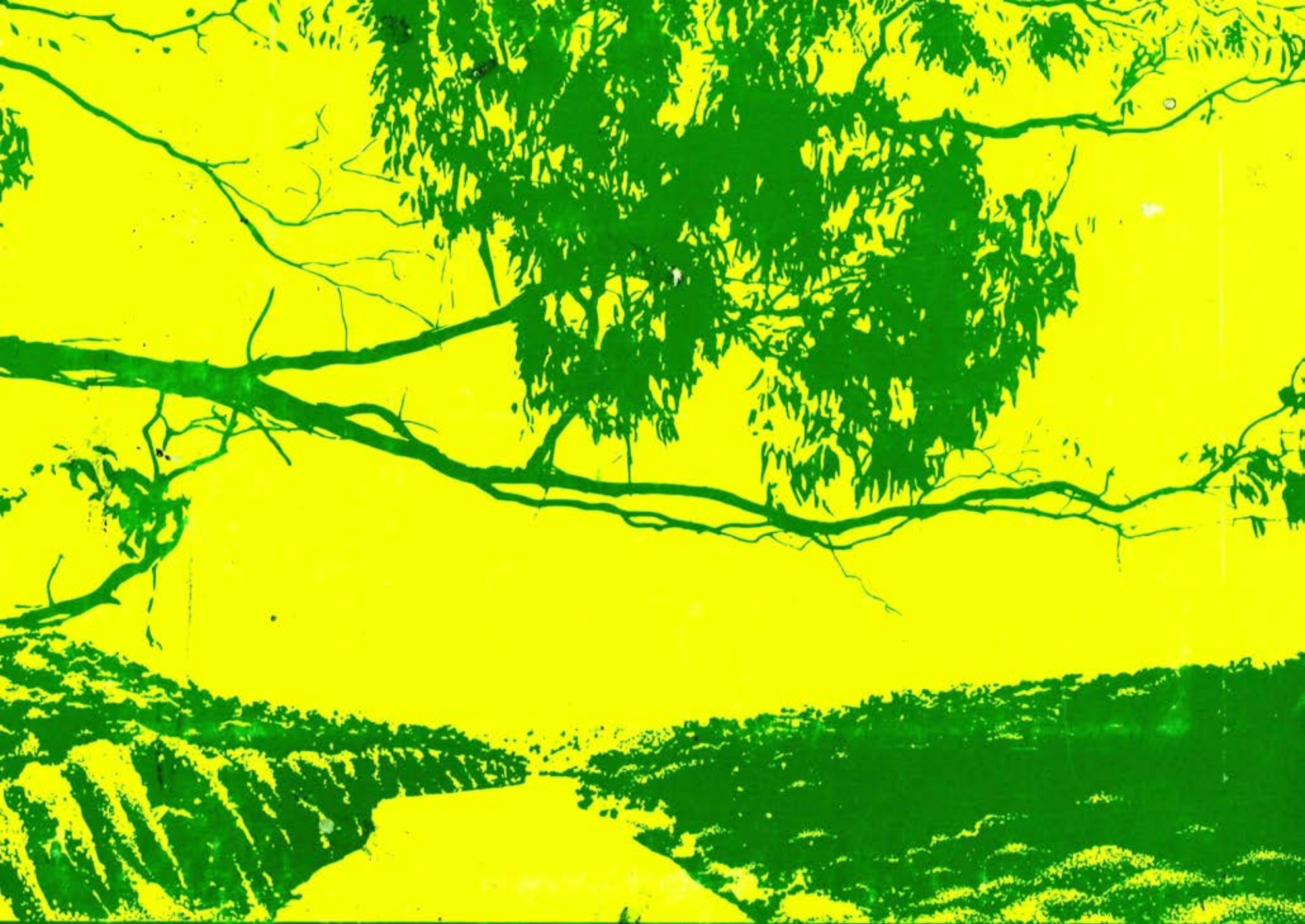

Land Conservation Council Victoria

East Gippsland Study Area

Price $3.00

REPORT

on the

EAST GIPPSLAND STUDY AREA

Land Conservation Council, Victoria
Melbourne: June, 1974.

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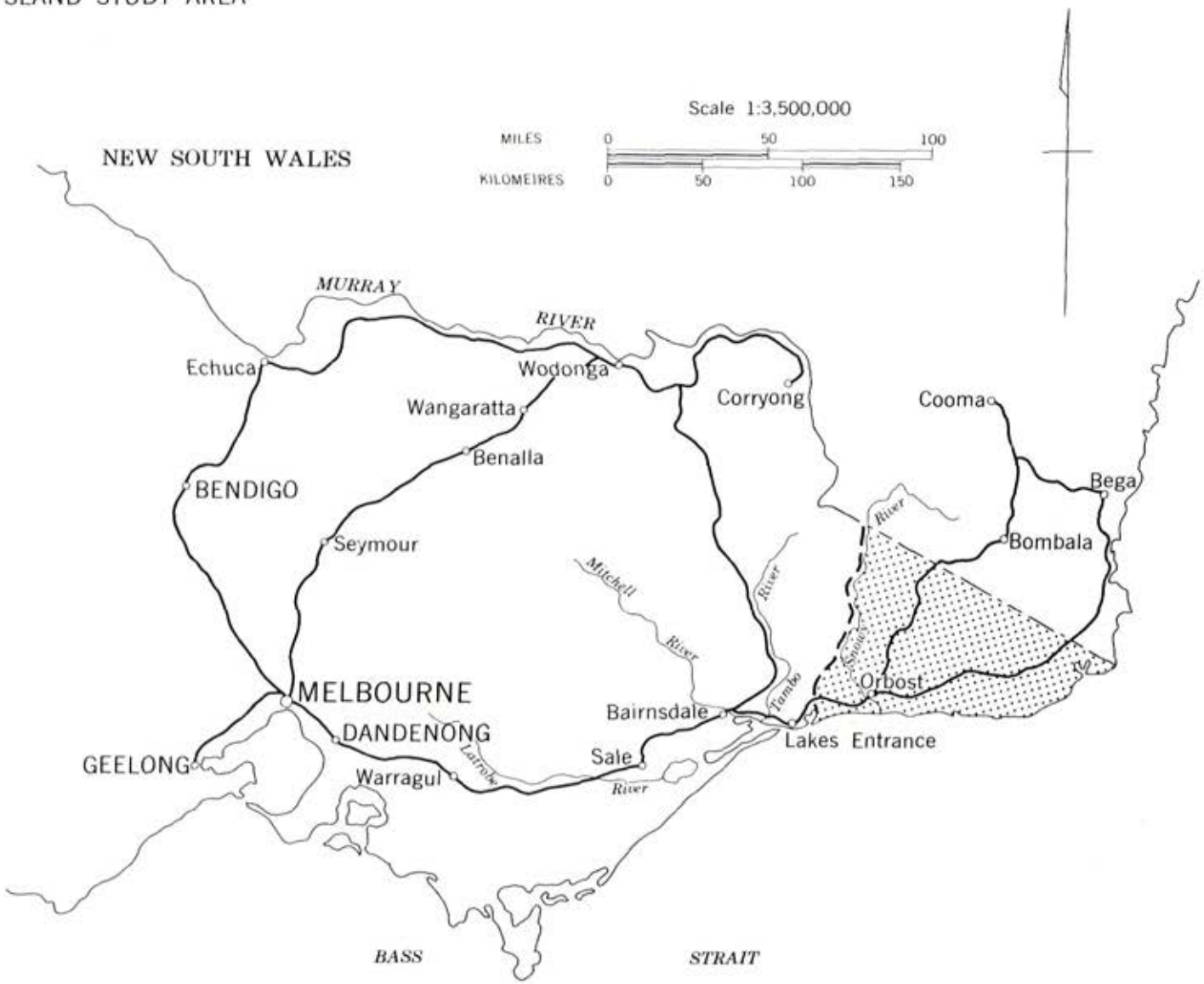
LAND CONSERVATION COUNCIL
VICTORIA
EAST GIPPSLAND STUDY AREA

LOCALITY PLAN



ERRATA–TIMBER PRODUCTION CHAPTER

Page 123	Footnote 1	*Read* ". . . . small-end diameter under bark divided . . . ."
Page 124	Line 21	*Read* "moist gully heads."
Page 129	Heading	*Read* "Sawlog supply"
Page 131	Line above photograph	*Read* "the remainder being burnt as waste."
Page 132	Line 8	*Read* "are unsuitable for sawlogs . . . ."

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FOREWORD

The *Land Conservation Act* 1970 established the Land Conservation Council whose function is to "carry out investigations and make recommendations to the Minister with respect to the use of public land in order to provide for the balanced use of land in Victoria."

This report sets out to describe and assess the natural resources of the public land in the East Gippsland area and provides a factual basis on which members of the community may base their submissions to the Council. It ensures that all those persons and bodies who have an interest in the future use of public land in this area can obtain and study the basic information, which the Council will itself study, and so make informed and constructive suggestions to the Council for its consideration.

In making this report available the Government hopes that all interested parties will be able to participate in an informed fashion in the process of considering how public lands should be used. It is hoped that in making submissions, members of the community will use as a basis the information provided by this study. The Council will make its recommendations only after due consideration of these submissions.

Demands for land for various purposes are many and varied, some of which are compatible and some conflicting or competitive. It is therefore important that decisions made are based on factual evidence, not on subjective criteria.

Submissions are now invited and should reach the Secretary of the Land Conservation Council within 60 days of the publication of this report, as notified in the Victorian Government Gazette.

S. G. McL. DIMMICK,
Chairman.

Land Conservation Council,
464 St. Kilda Road,
MELBOURNE, 3004.

LAND CONSERVATION ACT 1970

EXTRACT

Public Land

Section 2.

(1) "Public land" means -

(a) land which is not within a city, town or borough and is -

(i) unalienated land of the Crown including land permanently or temporarily reserved under section 14 of the *Land Act* 1958 and State forest;

(ii) vested in any public authority (other than a municipality or a sewerage authority within the meaning of the *Sewerage Districts Act* 1958); or

(iii) vested in the Melbourne and Metropolitan Board of Works; and

(b) any other land which the Governor in Council declares under sub-section (2) to be public land for the purposes of this Act.

"Reserved forest" and "State forest" have the same meanings as in section 3 of the *Forests Act* 1958.

(2) The Governor in Council may on the recommendation of the Minister made after consultation with -

(a) any Minister of the Crown in whom any land is vested; or

(b) the Minister responsible for a public authority in which any land is vested -

by proclamation published in the *Government Gazette* declare any such land to be public land for the purposes of this Act.

Functions of the Council

Section 5.

(1) The Council shall -

(a) carry out investigations and make recommendations to the Minister with respect to the use of public land in order to provide for the balanced use of land in Victoria;

(b) make recommendations to the Governor in Council as to the constitution and definition of water supply catchment areas under the *Soil Conservation and Land Utilization Act* 1958; and

(c) advise the Soil Conservation Authority concerning policy on the use of land (whether public land or any other land however vested) in any water supply catchment area.

(2) In making any recommendation the Council shall have regard to the present and future needs of the people of Victoria in relation to -

(a) the preservation of areas which are ecologically significant;

(b) the conservation of areas of natural interest beauty or of historical interest;

(c) the creation and preservation of areas of reserved forest;

(d) the creation and preservation of areas for national parks;

(e) the creation and preservation of areas for leisure and recreation, and in particular of areas close to cities and towns for bushland recreation reserves;

(f) the creation and preservation of reserves for the conservation of fish and wildlife;

(g) the preservation of species of native plants; and

(h) land required by government departments and public authorities in order to carry out their functions.

(3) Where the Council recommends the alienation of any land the recommendation shall include the Council's opinion as to the best method of alienating the land to ensure the most satisfactory use and management of the land in the public interest.

(4) Any person or body may make submissions to the Council as to how any public land can be better used to meet the needs of the people of Victoria and the Council shall consider any such submissions before making ary recommendation under paragraph (a) of sub-section (1).

Investigations, Notices and Reports

Section 9.

(1) The Council shall not make any recommendation under this Act in relation to any district or area without a prior investigation of the district or area.

(2) Before commencing any investigation under paragraph (a) of sub-section (1) of section 5 the Council shall publish a notice in the Government Gazette, in a newspaper circulating throughout the State and in a newspaper circulating particularly in or in the vicinity of the area or district to be investigated stating that an investigation of the district or area described in the notice is to be carried out for the purpose of this Act.

(3) On completing an investigation of a district or area under paragraph (a) of sub-section (1) of section 5 the Council shall -

(a) publish a report of the investigation;

(b) give notice in the Government Gazette of the publication of the report, the address where copies of the report may be obtained or inspected and stating that any submissions to the Council in relation to such report will be considered by the Council if they are made within 60 days of such notice; and

(c) publish notice in a newspaper circulating throughout the State and in a newspaper circulating particularly in or in the vicinity of the area or district investigated of the publication of the report, the address where copies of the report may be obtained or inspected and stating that submissions may be made to the Council and the date before which they should be made.

(4) The Council shall consider any submissions in relation to such report made by any person or body within 60 days of notice being given under paragraph (b) of sub-section (3).

Notice to be given to public departments and authorities in certain cases.

Section 10.

(1) Not earlier than 60 days after notice being given under paragraph (b) of sub-section (30 of section 9, the Council shall send a copy of its proposed recommendation to -

(a) the Council of any municipality in the municipal district to which the recommendation relates is situated;

(b) any other public authority or government department that in the opinion of the Council has an interest in the area of the proposed recommendation; and

(c) any person or body who made a submission under section 9 -

and shall consider any submission received within 60 days of the sending of such copy to the Council, authority, department, person or body or in the case of a public authority or government department within such longer period as may be agreed upon between the Minister and the Minister administering that department or responsible for that authority.

(2) Where any recommendation is made to the Minister under this Act it shall be accompanied by a copy of any submissions received from any person body department authority or council pursuant to the provisions of sub-section (4) of section 9 or sub-section (1) of this section.

(3) Where the Council has made a recommendation to the Minister under paragraph (a) of sub-section (1) of section 5 the Minister may, after he has given not less than fourteen days notice of his intention so to do to the Minister administering a government department or responsible for a public authority recommend to the Governor in Council that notice of the recommendation or that part of the recommendation that affects the government department or public authority concerned and where notice of that recommendation or part is so given by the Governor in Council it shall be the duty of the government department or public authority to use all diligence and dispatch to give effect to such recommendation so far as it affects any land vested in or controlled by it.

Copy of every recommendation and of Proposals to be tabled in Parliament.

Section 11.

A copy of every recommendation of the Council made under sub-section (1) of section 5 and of the proposals of the Council submitted to the Minister pursuant to section 7 shall be laid before both Houses of Parliament within fourteen days of the making thereof if Parliament is then sitting and if Parliament is not then sitting within fourteen days after the meeting of Parliament.

A copy of the *Land Conservation Act* 1970 can be obtained from the Government Printing Office, 7a Parliament Place, Melbourne, 3002.

ACKNOWLEDGEMENTS

This report covers so wide a field that its compilation would not have been possible without the generous assistance and co-operation of a great many individuals and organizations.

The Council acknowledges the assistance of the following organizations, which prepared basic information for maps and chapters of this report : Departments of Agriculture, Crown Lands and Survey, and Mines, the Fisheries and Wildlife Division of the Ministry for Conservation, the Forests Commission, the Soil Conservation Authority, the National Museum, the State Rivers and Water Supply Commission, and the Shire of Orbost.

Many others also readily supplied information, checked drafts, or contributed valuable discussion and advice. They include other Victorian and Australian Government bodies, universities, and many individuals with expert knowledge in fields such as physiography, botany, or zoology, or with special knowledge of particular localities. Their assistance is gratefully acknowledged.

Many individuals, two newspapers (The Age and the Bairnsdale Advertiser), and the Government bodies listed above kindly provided photographs for use in this report.

PART I

INTRODUCTION

AIMS AND METHODS

The aim of this report is to present factual information about the land and land use within the study area (comprising land in the Shire of Orbost). Its purpose is to enable members of the public, commercial enterprises, local government bodies, and government departments to consider future use of public land (which makes up about 88% of the study area), and to provide them with a readily available source of background information on which to base such considerations.

The report describes the nature of environmental features, together with the character and distribution of the various natural resources. It discusses forms of land use likely to make demands on public land, and assesses the suitability of the land for these uses. The probable impacts of the various types of land use are also discussed.

Much of the information has been collected from published reports, government departments, public authorities, private organizations, and individuals. Information already available has been supplemented by a number of surveys, but knowledge of the resources, the environment, and the interactions between land management practices and the environment is still far from complete.

The report is divided into four parts, the contents of which are outlined here.

Part I includes the aims of the report, discussion of conservation and ecological principles, a brief description of the study area, and a short account of its history, which is strongly oriented towards historical events affecting land use.

Part II includes descriptions of the main features of the environment and natural resources for the whole study area. The various chapters in this part describe climate, geology and physiography, soils, vegetation, fauna, water resources, and land systems. The text is supported by maps showing topography, annual rainfall, geology, vegetation types, and land systems.

Part III discusses the main forms of use of resources likely to make demands on public land. This involves discussion of the environmental hazards associated with existing land use, with emphasis on possible deterioration of land that may

follow changes in land use; this discussion is followed by commentary on the various types of resource use. The present level of activity in the area, likely future demand, and the capability of public land to meet such demand are considered for each resource use. Part III concludes with discussion of the relations between the various types of resource use. Maps showing the location of deposits of economic minerals and present forms of primary production are included.

Part IV describes the 14 blocks into which the area has been divided and then considers these individually. The discussion of individual blocks has a twofold benefit. Firstly, it brings together in a condensed form the information contained in different chapters in Parts II and III, and secondly it allows discussion in greater detail than is convenient in the general chapters. Most of the information in this part applies particularly to public land, since the aim of this report is to lead ultimately to decisions on the future use of public land. The description of each block concludes with an assessment of the land's potential for different forms of land use and associated hazards and conflicts. A map showing public land and descriptive blocks is included.

CONSERVATION

Conservation is concerned with Man's relation to his environment. It is often said to be the wise or balanced use of resources. Because "wisdom" and "balance" are not absolute terms, the principles set out here attempt to explain this concept.

Conservation can be considered as an endeavour to anticipate and resolve conflicts between the individual and society about the present and future use of resources, and between competing uses of the same resource. The conservationist is aware of long-term needs and recognizes that a community requires land for recreational, scientific, and aesthetic purposes as well as for the production of food, timber, and minerals, or for urban and industrial use.

Natural Resources

Two broad classes of natural resource may be distinguished, according to whether they are renewable.

Non-renewable resources

The quantity of these resources does not increase significantly with time, and use consumes them. In the last century the expansion of Victoria's economy was based on the exploitation of gold - a non-renewable resource. The oil and gas fields of Bass Strait provided another example of a non-renewable resource.

Conservation of such a resource requires the best techniques for exploration, recovery, and processing, and the efficient use of the end product.

Renewable resources

The quantity of a renewable resource such as timber may increase or decrease with time. Animal and plant communities and landscape fall within this category. Abuse of these resources may reduce them to such a poor condition that the practical opportunity to restore them to a desired state is lost for many generations.

Conservation of renewable resources requires a thorough understanding of ecological principles and development of sound management techniques based on those principles. An ecosystem typically contains many interrelated components. A change in any one of these will have

effects elsewhere in the system. In general, an ecosystem with a diverse range of species will be better able to adapt and absorb the impact of sudden change - such as that caused by fire, disease, or Man's activities - than a simple ecosystem with a few species.

Man is part of the ecosystem and, like every other organism, influences and is influenced by the other parts. The development of new techniques has increased his ability to modify the environment. Many new techniques have both advantages and disadvantages. Often the disadvantages are not obviously linked to the new techniques and only emerge in the long term - the use of insecticides can increase the production of food or fibre dramatically, but may also reduce the population of predatory birds and insects and so encourage the build-up of populations of other insect pests.

Relations Between Resource Uses

Many uses of a resource are compatible. They may be supplementary and add to each other, or complementary in that one use benefits from the other, but they may also be competitive when an increase in one leads to a decrease in the other.

For example, the relation between timber production and picnics within a forest may be complementary in the sense that picnickers gain access along tracks and use open spaces created during timber operations. It may become competitive if logging makes the forest an unsuitable picnic area, and at other times, picnickers may present a considerable fire risk. In general, decisions on land use will involve selecting major land uses for a particular area, and determining other uses compatible with these and the intensity of use above which they become imcompatible.

The Principles of Land Use

In the past our society has grown (and the economic welfare of the people improved) through mining, farming, timber production, and industrial development. These industries have been given prime importance, and the use of natural resources has often been decided in relation to short-term advantage when conflict arose. The deleterious effects of this type of development have been recognized, and there is now a popular demand for attention to the total long-term needs of the community.

The concept of balance involves equal consideration of the needs of all sections of society, on both regional and State bases, as well as the needs of this and future generations. These needs should be clearly stated as aims.

The intangible values of recreation, aesthetics, and preservation must not be ignored. In addition to actively providing land for these purposes, we must also consider the impact of other land

uses upon them. Outstanding natural features should be preserved.

Where several land uses are compatible, land should be available for the most beneficial combination of such uses. It may be necessary to define major aims amd to assess levels above which secondary uses are unacceptable.

Where land has been committed to a particular use, it should be managed so that its capability for that use is not impaired. Uncommitted land should be maintained in a condition that will allow the widest possible choice of future uses.

Policy measures should stimulate the best use of partly developed lands and discourage significant changes in natural areas.

Review and reassessmant of land will become necessary as society and technology change.

THE STUDY AREA

The area discussed in this report consists of land in the Shire of Orbost. It is bounded on the west by the Snowy River and the boundary between the Shires of Orbost and Tambo from the Snowy River to the sea, on the north-east by the Victoria-New South Wales border, and on the south by Bass Strait (see Topography map).

The total area is 970,000 ha (4.2% of the area of Victoria), of which approximately 850,000 ha (88%) is public land. About 70% of the privately owned land has been cleared for grazing or agriculture.

The topography of the area is quite varied, ranging from coastal cliffs and beaches through low hills to mountains, with lowland plains and elevated tablelands. Because of the great range in topography, climate also varies considerably. Temperatures near the coast are mild, being moderated by proximity to the sea; the elevated tablelands, however, are subject to severe frosts during winter. Average annual rainfall varies from below 700 mm in the upper Snowy River and Deddick River valleys to an estimated 2,000 mm on the Errindundra Plateau.

Vegetation on public land ranges from low coastal heaths to tall mountain forests and subtropical rainforest. The most extensive vegetation association is silvertop--stringybark forest, which occurs on the lowland hilly country up to an altitude of about 750 m. Other interesting vegetation types include bloodwood--angophora, which is characteristic of coastal New South Wales, and cypress pine--white box, which occurs mainly on dry rocky hillsides in inland New South Wales.

Soils range from undifferentiated dune sand or shallow rocky hill soils to deep friable reddish gradational soils.

Population

The population of the study area was 6,301 at the census of June, 1971. This population is sparsely distributed, averaging 0.66 persons per square kilometre, compared with the State average of 15.4 per sq. km. Population trends over the last 19 years are indicated by the data listed in Table 1.

The main town in the study area, Orbost, has a population of about 3,000. It is the only one with an extensive shopping

Table 1

POPULATION

Year	Whole Shire	Orbost Township
1954	5,492	2,214
1961	6,179	2,213
1966	6,430	2,797
1971	6,301	2,938

centre and industries other than sawmilling, having a butter factory, a powdered-milk factory, and several smaller industrial enterprises as well as seven sawmills. The only school in the area taking classes to Higher School Certificate is at Orbost.

About 3,300 people live in other parts of the study area, in the townships of Cann River (341 persons at June, 1971), Mallacoota (296), Marlo (207), Club Terrace, Bemm River, Bonang, and Bendoc, and on individual properties throughout the area. Mallacoota, Bemm River, and Marlo, all on the coast, are primarily tourist towns, catering mainly for campers but with some accomodation available in hotels, motels, and guest houses, and in rented houses and flats.

Employment

The Shire of Orbost depends on two major industries: hardwood timber production and agriculture. Hardwood timber sustains the most significant industry for the Shire, as some 25 sawmills are producing about 27% of the State's total hardwood output, employing 700 people. As it is estimated that these have about 2,100 dependents, some 44% of the total Shire population depends directly on production of hardwood timber. Many other persons, especially those engaged in tertiary activities, rely substan-

Cann River township, looking westwards

Public swimming pool, Orbost

The Shire Office, Orbost

tially on funds generated by the timber industry.

Agricultural pursuits include grazing of cattle, for meat and milk, and of sheep, with crop-growing on the fertile river flats. Agricultural activities are confined mainly to the 12% of the area that is freehold.

Mallacoota carries fishing and abalone industries. Smaller industries, either of a tourist nature or supporting the larger ones, are well established.

Access

The Princes Highway, which passes through the area, connects Melbourne and the Latrobe Valley with Sydney via the South Coast of New South Wales. The Cann Valley Highway leaves the Princes Highway at Cann River, and forms a link between East Gippsland and Cooma and Canberra. The Bonang Highway runs from Orbost to Cooma. Several lesser roads provide all-weather access to other parts of the area, but large blocks of country are accessible only by dry-weather roads or four-wheel-drive tracks.

In addition to the highway link with Melbourne, a railway line runs from Bairnsdale through Nowa Nowa to terminate at Orbost. At present this line only carries freight traffic, with two trains each weekday and one each

Saturday; however, a bus service links with passenger trains from Bairnsdale and two companies run buses to Melbourne. There are no scheduled air services, but Mallacoota has a good aerodrome.

Power

All the main population centres in the coastal area are now supplied with electricity from the State network. But Bendoc, Bonang, Tubbut, Deddick, and Goongerah receive electricty from the Monaro County Council, N.S.W.

Local government

The Shire of Orbost is the third largest of the 211 municipalities in Victoria, but it has the lowest proportion of rateable land. The wide distribution of the small proportion of freehold lands, and particularly of developing freehold areas, is the main reason why the Shire Council is in what the Local Government Department described as a "dangerous" financial position. The Council has continuously rated land at the maximum percentage allowable by law, yet at September 30, 1972, it owed more than $500,000 in respect of loans it had raised. Nearly 40% of present rate revenue is required to service interest on debts.

The Orbost Shire Council provides a wide range of services and facilities, such as roads, bridges, public buildings, and health and welfare services. These municipal services are used freely for the general public, and not just by the local rate-paying population. They are used by the timber industry throughout the year, and by tourists during the holiday season.

HISTORY

Aborigines

The county that comprises most of the area, "Croajingalong", takes its name from that of the Kruatungulung ("men of the east") clan of the Ben-Kurnai tribe. Headquarters of this small group was at Sydenham Inlet at the mouth of the Ben (Bemm) River. To the east, the territory of the Coast Murring peoples came down the coast to Mallagoota (Mallacoota Inlet). The country between these territories belonged to a small group called the Biduelli (scrub dwellers).

Discovery

The first European records concerning the area were of the first sighting of the east coast of Australia by those on board Captain James Cook's vessel *The Endeavour*. Cook wrote in his journal for Thursday, the nineteenth (nautical) day of April 1770: "At six, we saw land extending from N.E. to W. at a distance of five or six leagues." Cook named the land point Hicks "because Mr. Hicks, the First Lieutenant, was the man who discovered it."

Cook named another point Rame Head because of its resemblance to a point of that name at the entrance to Plymouth Sound, and also named Cape Howe.

The first white men to land on the coast were 17 crew members from a ship that has been wrecked on an island off Tasmania in 1797. They had set out for Sydney in a longboat, but landed in the proximity of Point Hicks. Three finally reached Sydney.

On December 21, 1797, George Bass and the crew of his whaleboat "landed at a little beach about a mile north of the Rame Head" near Wingan Inlet. Bass explored the vicinity, and recorded quite detailed observations on the physiography, soil and vegetation. On December 31, Bass continued his westward journey, describing the country in his journal.

Although it is likely that sealers and whalers used the bays and coves along the coast during the next 40 years, permanent settlement did not take place until the late 1830s, when pastoral runs were taken up.

Pioneers searching for fresh pastures for their stock were responsible for much of the early exploration of the region.

Agriculture

The first settlers in Gippsland came from the Monaro district of New South Wales, which has been opened up about 1823. Monaro squatters probably pastured cattle in the Bendoc-Bonang areas before George McKillop's exploratory journey from there to Omeo in 1835.

In 1835--36 Andrew Hutton and William Morris made an exploratory trip from Twofold Bay, but they were blocked by the Snowy River. In 1838 Andrew Hutton and five stockmen took 500 cattle from Nungatta down the Genoa River and thence along the coast to the entrance of Gippsland Lakes, where hostile Aborigines forced them to abandon the cattle.

Land in the area was first legally held as pastoral holdings or runs. Tubbut was licensed in the Monaro district in 1838 to T. M. Moore; John McLaughlin held Dellicknora from 1833 to 1867; William Bradley held Kirkenong (in the Bonang area) in 1841; Bendoc was first licensed in 1842 and Jingallala in 1854.

The first depasturing licence for a run in far-eastern Gippsland was for Wangarabell, issued to John Stevenson in November 1839. William Morris held Nungatta and Genoa about 1840, and in 1841 Robert Greig took up Maramingo and John Stevenson settled at Mallacoota. About 1841, Stevenson and James Allan attempted to run cattle at Cann River, but were forced away by the natives.

In 1842 Peter Imlay took 800 cattle to Orbost (from Monaro via Buchan), but later withdrew because of hostile natives. He later sold the Imlay brand to Norman and John Macleod, giving them all the cattle on the run, and they took out the first licences for runs in the Orbost vicinity (Newmerella and Orbost) respectively).

In 1850 the Ewing brothers took up a run (between Lakes Entrance and the Snowy River), which was sold in 1855 to Thomas Roadknight. In 1857 Thomas Stirling took over the Corringle run, extending from Lake Tyers to Bemm River.

In 1868 Hamilton Reed and John Lock took up a grazing area of about 60,000 acres at Goongerah and stocked it with cattle and horses.

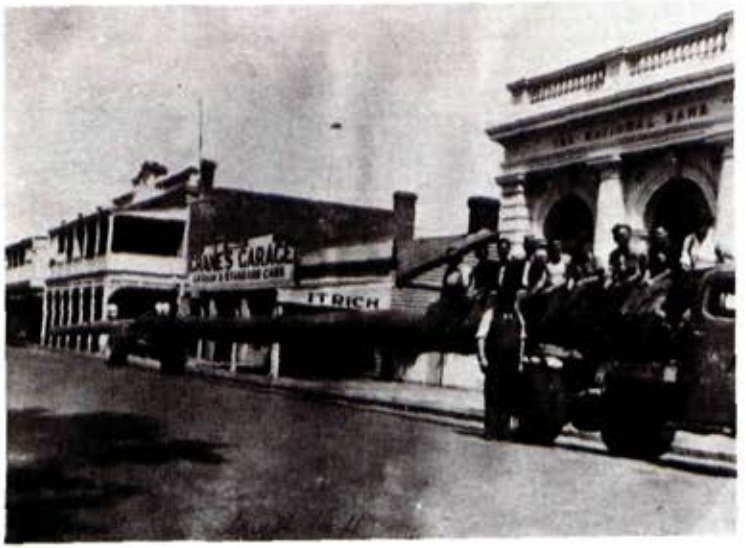
The beach at Wingan Inlet where George Bass sheltered from a storm in 1797

Further agricultural development followed gradually, centred mainly on the Snowy River and Cann River flats and in the Bendoc--Bonang area.

Attempts to use the Murrungowar--Glen Arte area for agriculture were largely unsuccessful, and many farms have been abandoned.

Mining

Gold also played a part in opening up the area, although finds were not as valuable as those further west in the State. The presence of gold in the Bendoc district was first suggested by Rev. W. B. Clarke in 1852. Alluvial gold was discovered there in 1855, and payable amounts were found in all streams flowing north from the Coast Range.



A yellow-stringybark pole, 34 m long, from East Gippsland (about 1940)

About 1862, many Chinese came to the Bendoc area searching for gold, and, for a time, a thriving Chinese community existed at Lower Bendoc. A number of gold-mines operated in the district between 1869 and 1910, and the Victoria Star mine was worked until about 1935.

Gold was also discovered in minor quantities at Club Terrace, Combienbar, and Mallacoota, but the direct effects of the gold discoveries were shortlived, although many ex-miners remained to select land for grazing and agriculture.

Other minerals were less important in the development of the area, but the copper and silver lodes in the Mount Deddick area attracted several mining ventures in the early Twentieth Century. Some are still active.

Forestry

Pit-sawing of timber at Bendoc, when gold-mining was in progress there in 1855, may have been the earliest commercial forest utilization in the region. Timber for the first hotel at Delegate was pit-sawn at Bendoc.

Samuel Richardson cut the first timber in the Orbost area in a mill at Tabbara, on the Brodribb River, in 1822. All early buildings at Orbost were built with timber from there.

In 1875 Charles Petterson, from Copenhagen, took a gang of about 40 men to the Snowy River to strip wattle bark for export to Europe. The bark was boated down to the mouth of the river and transferred to schooners.

The extension of the railway to Nowa Nowa (1914) and to Orbost (1916) opened up forests of "hardwood" eucalypt species acceptable for railway sleepers. Beams hewn from the species were also in demand for heavy wooden constructions, wharfs, bridges, etc. By 1920 the study area was producing some 60% of the State requirement of hewn beams and 25% of the sleepers, and the hewing industry became even more important following the depression of the 1930s.

Between 1950 and 1960, East Gippsland supplied up to half the State's requirements for railway sleepers, but the demand for, and production of, poles and sleepers has since declined.

In 1940 only three small sawmills were operating in the study area. The numbers and sizes of the mills increased until, by 1950, mill intake was 25 times the 1960 level. The area now produces more than one-quarter of the total State hardwood output.

Transport

Lack of transport restricted early development. Initially the only access to Orbost was by two very rough roads - one from Lakes Entrance via Ewings Marsh and the other from Bruthen via Nowa Nowa - and no roads ran to the north or east.

In 1878 Hamilton Reed and Nicholson blazed a trail from Goongerah to Orbost, but it was many years before this route became trafficable to drays.

About 1876 Charles Petterson had a steamer trading in and out of the Snowy River. A small company, the Orbost Shipping Company, was formed in 1880 with two vessels - the schooner *Orbost* built at Paynesville and the ketch *Endeavour* built by Samuel Richardson at Tabbara. Both were designed to draw only about 1.5 m of water, to enable them to negotiate the sand-bar at the Snowy River

Sawn timber on landing on Wallagaraugh River, awaiting shipment to Gabo Island and thence to Melbourne (about 1932)

entrance, and had a capacity of 250--300 bushel sacks of seed maize.

A landing was constructed 7 miles upstream from Marlo, and barges transported the bags of maize to the landing from as far upstream as Bete Bolong. In the very early days the barges were towed by paddlesteamers such as the *Curlip*, which was built at Tabbara in 1891.

Trade gradually deteriorated between 1910 and 1914, and the Orbost Shipping Company closed in 1915.

The railway was extended from Bairnsdale to Nowa Nowa in 1914 and to Orbost in 1916.

As suitable timber for hewing within waggon-reach of the railway became depleted, the sleeper-carters invested in motor lorries, and by 1935 the Forests Commission was assisting to establish roads to suitable stands.

It is only relatively recently that roads have been improved to good standard and the Princes Highway sealed for its full length. Improved access has led to the development of a new type of land use for the area - tourism and recreation. However, the importance of preservation of scenery has been recognized for many years. About 4,670 ha of land around Mallacoota Inlet and 1,940 ha around Wingan Inlet were reserved for National Parks in 1900. Land for Alfred National Park and Lind National Park was reserved in 1925-26. More recently, the Captain James Cook National Park was declared in 1969.

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PART II

NATURE OF THE LAND

CLIMATE

The climate of East Gippsland differs in many ways from that of the rest of the State; it is more similar to that of coastal New South Wales, being influenced by vigorous depressions off this coast and an inflow of warm, moist sub-tropical air from the Tasman Sea. Conditions resulting in low temperatures in other parts of Victoria may produce warm temperature in coastal East Gippsland.

There is a paucity of detailed information on the climate of this area due to the small number of meteorological recording stations. Temperature records have been taken at two stations (Gabo Island and Orbost) for more than 30 years, and at two others (Cann River and Nowa Nowa) for only a few years. Rainfall has been recorded at a greater number of places, but these are generally restricted to valleys and lowlands. Consequently the information is far from complete.

Rainfall

Rainfall is fairly evenly distributed month by month in most areas. For example, the maximum and minimum monthly rainfall averages for Marlo are 76 and 55 mm respectively. The corresponding data for Delegate River (near Bendoc) are 75 and 56 mm.

In addition to being evenly distributed, rainfall is reasonably plentiful. Very few parts of the study area have an average of less than 50 mm in any month (Table 2). However, median rainfall, which indicates the amount exceeded on 50% of occasions, is less than average rainfall. Total annual rainfall records range from 678 mm at Tubbut to 1,348 mm at Glen Arte. Greater amounts fall in elevated areas where long-term records do not exist - e.g. Errinundra Plateau. Districts of relatively low rainfall (less than 900 mm) are confined to the south-west part of the area and the rain-shadow areas along the Snowy River Valley and Deddick River Valley. The elevated areas north of Cabbage Tree and Club Terrace, and the upper Rodger River catchment, receive the greatest rainfall.

The reason for this pattern is the atmospheric situation that produces the rainfall, most of which is received from depressions centred off the east coast of Australia. These may have passed through Bass Strait and intensified near Gabo Island, but more commonly depress-

Table 2

MEAN RAINFALL (mm) AT SELECTED RECORDING STATIONS

(No. of years of record given in parenthisis for each station)

Month	Tubbut (26)	Bonang (83)	Marlo (45)	Glen Arte (9)	Genoa (53)	Combienbar (13)	Gabo I (111)	Orbost (89)
Jan	69	71	64	98	76	57	70	70
Feb	55	68	58	88	68	69	69	66
Mar	52	67	69	96	77	65	72	68
Apr	48	72	68	75	68	58	79	71
May	50	81	76	139	86	108	102	72
June	50	103	68	91	104	141	109	82
July	47	90	62	95	73	120	85	66
Aug	54	74	55	134	78	94	75	59
Sept	51	78	65	114	70	113	72	69
Oct	59	85	73	119	79	102	75	78
Nov	68	78	61	114	73	106	69	68
Dec	75	79	61	155	74	106	68	77
Year	678	944	780	1,348	927	1,142	945	840

Table 3

PERCENTAGE FREQUENCY OF OCCURRENCE OF RAINFALL EQUAL TO OR EXCEEDING THE "EFFECTIVE" AMOUNT

Month	Marlo	Orbost	Murrungowar	Bonang	Dellicknora	Bendoc	Noorinbee	Genoa	Gabo I
Jan	51	63	56	74	63	65	66	64	65
Feb	59	55	50	60	62	65	50	54	63
Mar	63	73	67	67	58	67	76	68	75
Apr	78	79	82	80	84	69	81	80	90
May	95	88	96	91	82	89	89	82	95
June	88	89	94	92	92	95	96	94	98
July	89	92	91	98	95	91	96	86	98
Aug	87	91	95	97	95	92	93	87	93
Sept	96	85	94	97	95	97	96	91	94
Oct	85	88	87	96	94	89	94	88	92
Nov	69	66	71	68	73	71	66	61	68
Dec	61	69	58	76	75	70	69	69	64

ions develop off the coast of New South Wales and move southwards. When the centre is just south-east of Gabo Island, a vigorous southerly airstream flows across East Gippsland. This air, which has originated over the Tasman Sea, is warm and moist, and produces very heavy rainfall over most of East Gippsland and particularly between Orbost and Cann River.

The frequency of 24-hour falls in excess of 76 mm is greater in East Gippsland than in other parts of Victoria. This rainfall frequently causes rapid rises in the short coastal streams such as the Brodribb, the Bemm, and the Cann. There is no seasonal trend in the occurence of east coast depressions.

Topography has a marked influence on rainfall, and in areas where it varies greatly the rainfall will be corresponding variable. In such cases data for nearby recording stations or general rainfall maps may give a poor indication of the actual amount received at a particular site.

Effective rainfall

In addition to rainfall, the amount of moisture in the soil available to plants depends on a number of factors, such as evaporation, slope of the ground, and the type of soil. Slope of the ground is a purely local factor; the importance of soil is discussed in Chapter 7. There is no evaporation recording station a the area, so theoretical evaporation has been estimated from saturation deficits. Evaporation varies throughout the year and throughout the area.

The calculated effective rainfall is a widely accepted measure of the availability of moisture to plants. This is the amount of rain necessary to start germination and to maintain growth above the wilting point. It has been calculated for each month for selected stations, together with the probability (based on long-term rainfall records), of receiving rainfall equal to or exceeding the effective amount. The relation is directly applicable to natural plant growth, but modifications of rainfall requirements result where special methods are used to conserve moisture.

Effective rainfall estimates provide a useful guide for crop and pasture growth, but are not ideal indicators of conditions affecting other plant species, particularly deep-rooted perennials.

Table 3 shows the monthly distribution of percentage frequencies of effective amounts of rainfall, indicating the normal seasonal trend for the stations listed. This reveals the remarkably long potential growing season throughout the area, even in the rain-shadow areas, which have been described previously as relatively dry. All these stations

receive the effective rainfall in any particular month in at least 50% of years. However, this does not mean droughts are never experienced, although they are less frequent, and generally of shorter duration, than elsewhere in the State.

At Orbost, two consecutive months of non-effective rainfall may be expected in about 50% of years, and three consecutive months of non-effective rainfall in 10% of years. Longer periods of non-effective rainfall occur only rarely.

Temperature

Temperature records are rather inadequate, with all recording stations in the area being situated in the coastal lowlands (Nowa Nowa, Orbost, Cann River) or, in the case of Gabo Island, just off the coast. To obtain an indication of temperatures on the tablelands, records for the nearest recording station (Bombala, N.S.W.) have been included in Table 4. Temperatures are highest in January-February, and lowest in July.

Temperatures in the narrow coastal belt are mild, with the moderating influence of the sea being an important factor. At lower elevations, maximum temperatures increase and minimum temperatures decrease with increasing distance from the sea. With increasing altitude, both maximum and minimum temperatures decrease. At Gabo Island the mean yearly maximum temperature is 17.7°C and the mean minimum is 11.9°C. The corresponding data for Cann River are 19.6 and 7.6°C, and for Bombala 18.3 and 4.7°C, respectively.

Winter temperatures in the lowlands are also moderated by the Fohn effect when northerly or north-westerly winds become warmer as they descend from the ranges. This sometimes results in East Gippsland being the warmest part of the State.

Summer temperatures are moderate, but winter temperatures may be low enough to restrict plant growth. This is particularly important at higher altitudes, but may also be significant in the coastal lowlands. If 10°C is taken as the mean monthly temperature below which plant growth is severely restricted, it can be seen that the months of June, July, and August would be considered too cold for plant growth at Orbost, Nowa Nowa, and Cann River, and at Bombala the cold period extends inclusively from May to September.

Frost

Light frosts (air temperatures less than 2.2°C) can occur at Orbost during the months April to September, with an average of 30 per year. The temperature rarely falls below 1°C at Orbost, but frequently does so in winter at Nowa Nowa and Cann River. The frequency and severity of frosts at Bombala are much greater than at the lowland stations.

Table 4

MEAN TEMPERATURES (°C)

(No. of years of record given in parenthesis for each station)

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
	Max	21.1	21.4	20.9	19.1	16.8	13.2	14.0	14.6	15.8	17.1	13.3	19.8	17.7
Gabo I	Min	15.5	16.0	15.3	13.3	10.9	7.8	8.0	8.4	9.6	11.0	12.5	14.2	11.9
(82)	Mean	18.3	18.7	18.1	16.2	13.9	10.5	11.0	11.5	12.7	14.1	15.4	17.0	14.8
	Max	25.1	24.9	23.6	20.5	17.3	14.9	14.4	15.5	17.5	19.4	21.2	23.3	19.8
Orbost	Min	12.6	13.1	11.7	9.0	6.7	4.9	3.9	4.5	5.9	8.0	9.8	11.4	8.5
(31)	Mean	18.9	19.0	17.7	14.8	12.0	9.9	9.2	10.0	11.7	13.7	15.5	17.4	14.2
	Max	25.4	24.7	24.1	20.5	17.3	14.5	14.8	15.8	18.6	20.3	21.4	24.4	20.1
Nowa Nowa	Min	11.3	12.4	11.1	7.8	5.9	3.8	2.0	2.6	4.2	6.9	8.5	10.3	7.2
(7)	Mean	18.4	18.6	17.6	14.2	11.6	9.2	8.4	9.2	11.4	13.6	15.0	17.3	13.7
	Max	25.9	24.5	24.5	20.1	16.3	13.7	13.5	14.4	17.9	19.6	20.0	24.3	19.6
Cann River	Min	12.1	12.8	11.4	7.8	5.7	4.3	2.3	2.9	4.9	7.5	8.8	10.8	7.6
(5)	Mean	19.0	18.7	18.0	14.0	11.0	9.0	7.9	8.7	11.4	13.6	14.9	17.6	13.6
	Max	24.8	25.0	22.6	18.0	14.4	11.2	10.8	12.5	15.7	19.0	21.5	24.0	18.3
Bombala	Min	9.6	10.3	8.4	5.2	1.7	-0.3	-1.1	-0.2	2.3	4.7	6.6	8.8	4.7
(29)	Mean	17.2	17.6	15.4	11.7	8.1	5.4	4.8	6.2	8.9	11.8	14.1	16.4	11.5

Short-term records indicate lower temperatures at Bendoc than at Bombala, and at Bendoc frosts can occur at almost any time of the year, the period with the temperature remaining above 2.2°C being only 2-4 weeks.

Snow

Snow rarely falls over the lower country. It has never been recorded at Orbost, but it has fallen several times at Cann River. Snow falls fairly frequently in winter at elevations above 600 m and sometimes blocks roads.

Summary

The general effect of climate is that, apart from the occasional periods of drought described, lack of rainfall imposes no limitation on the length of the growing season, as in no month is the mean monthly rainfall below the effective rainfall. Temperature, on the other hand, limits the length of the growing season to 9 months on the coastal lowlands, and to 7 months in the tablelands. There are wide year-by-year variations from the average climate conditions.

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GEOLOGY AND PHYSIOGRAPHY

The bedrock of the East Gippsland area is a thick sedimentary sequence regarded as Ordovician in age. It has been intruded by several major granitic bodies, around which metamorphism is generally minor.

Upper Palaeozoic (Devonian) volcanic complexes occur in the west, with slightly younger non-marine sediments preserved in downthrown blocks that form the valleys of several present-day streams.

Extensive sands and gravels, principally of non-marine origin, flank the southern part of the highlands. Older Tertiary limestones outcrop only between Lake Tyers and Newmerella, and Tertiary volcanic flows are isolated and of minor extent.

Quaternary dune systems are extensively developed along the coast, while large flats and swamps are a feature of the coastal plain and the foothills of the ranges.

The following tabulation lists the principal geological events from most recent to oldest:

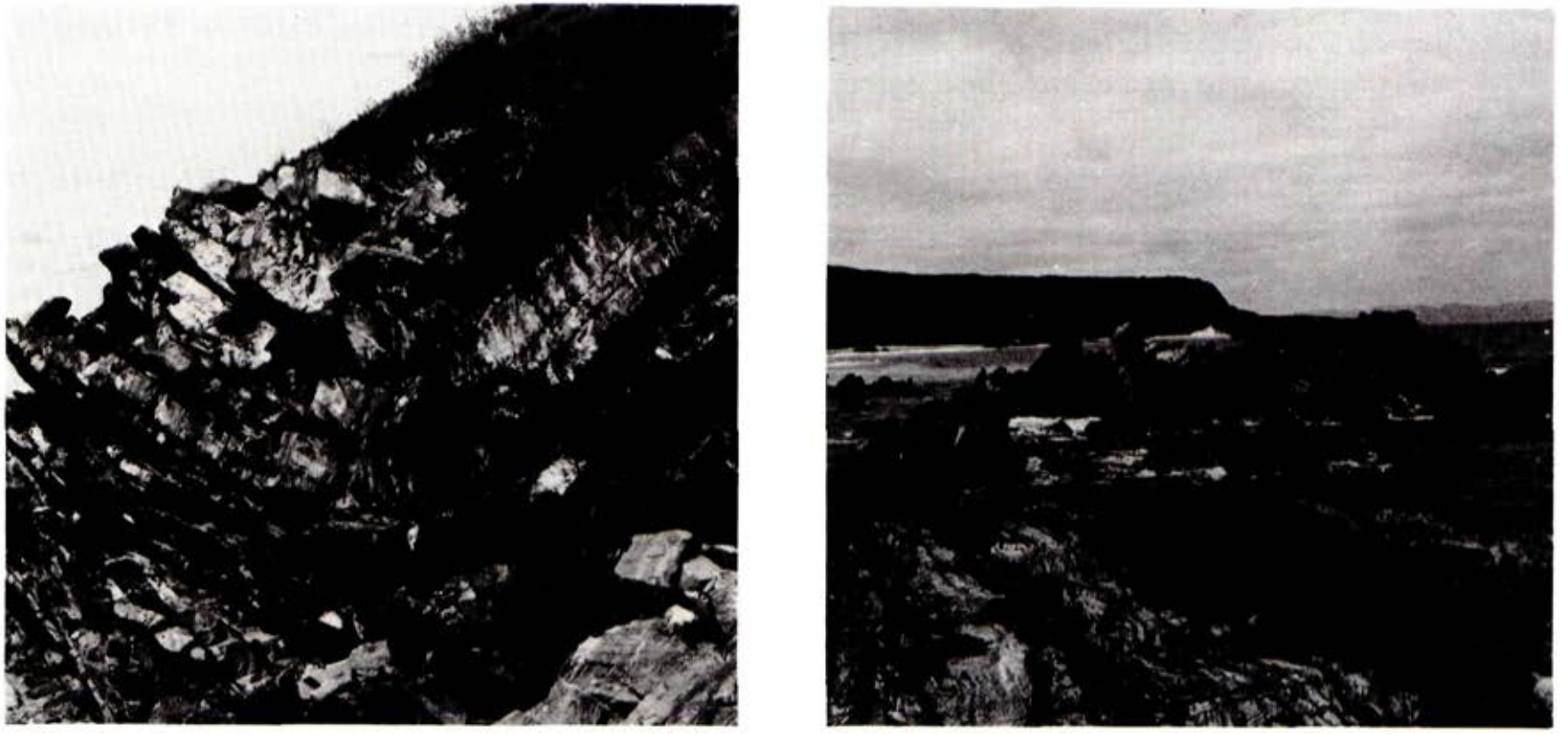
Quaternary sedimentation
Tertiary sedimentation and associated volcanic activity
Upper Devonian sedimentation
Granitic intrusion during Tabberabberan orogeny
Snowy River volcanic sequence - lower Devonian
Granitic intrusion during Benambran and Bowning orogenies
Ordovician sedimentation

Ordovician

The most widespread outcrop beds are regarded as Ordovician in age because graptolite fossils of Upper Ordovician age occur in the west. No graptolites have been recorded east of Cape Conran.

The sequence is many thousands of metres thick and the beds dip steeply. Talent (1969) noted that quartz sandstones are uncommon, with grain size generally in the range of clay to fine sand. In the Genoa district and upper Genoa River, however, they again become prominent.

Hawke (1972) described the sequence outcropping from Eden, N.S.W., south to Mallacoota Inlet - the Mallacoota beds.



Syncline in Ordovician sediments (left) and steeply dipping Ordovician sediments (right) near mouth of Seal Creek

These are well exposed along the coast to the south of the Inlet.

Much of the outcrop east of Cann River is masked by thin Tertiary cover, but faulting has exposed several prominent wedges and larger blocks.

A strongly metamorphosed belt runs south-west from the Ellery granodiorite through Murrungowar. This consists of dark, predominantly non-schistose metamorphics, with minor foliated rocks. Talent (1969) suggest that metamorphism took place in late Silurian or earliest Devonian times.

In unmetamorphosed areas the Ordovician bedrock often outcrops and carries a sparse forest. In elevated shaley areas

Granite tors (Devonian) on Mount Ellery

on protected slopes weathering is usually deep, and dense forest is present.

Silurian

Beds of this age have minor importance, A small outcrop area occurs between Martins Creek and Sardine Creek, and Talent (1959) noted sub-surface occurrences north of Nowa Nowa.

Devonian granites

Igneous massifs of Lower Devonian age intrude the Ordovician beds in the Genoa district, Mount Kaye--Mount Cann line, and Deddick River district. They are generally granodiorites or granites, with other rock types often prominent near the margins. Outcrops at Mount Raymond, Cape Conran, and elsewhere are outliers of these massifs. The age of the Genoa Peak granite has been estimated by potassium--argon isotope-dating methods to be 388±8 million years (i.e. Lower Devonian) and the other areas are regarded as similar.

A small area of dark, hornlende-rich rock 20 km north-west of Orbost is also regarded as Lower Devonian in age.

Two major granitic massifs regarded as Upper Devonian in age occur in the east and west. These are the Ellery granodiorite around Mount Ellery, and the Gabo Island granite. The latter outcrops prominently at Gabo Island and forms the spine of the Howe Range; its pink

orthoclase makes it particularly easy to distinguish, although part of the Genoa Peak massif, for example at Wingan Inlet, also contains pink orthoclase.

Isolated, yet sometimes extensive tor areas with light tree cover are a feature of the granites. Weathering of the less-dissected outcrop produces extensive gravels of homogeneous siliceous sands, sometimes difficult to separate from well-graded Tertiary deposits that, in many cases, flank or cap the granitic exposures.

Devonian sediments and lavas

Along the western margin of the study area, rhyodacites, tuffs, and subordinate rhyolites, andesites, and basalts represent the Snowy River volcanics complex, best exposed a little further west. Ar Errinundra a downfaulted remnant is interbedded with marine limestones.

Non-marine Upper Devonian beds occur in the Cann, Combienbar, Bemm, and Genoa River Valleys. They all appear to lie in downfaulted blocks, and are mainly flat dipping sandstones, with shales or "redbeds" and conglomerates prominent but much less extensive. Minor beds of this age occur in the Cape Howe and Maramingo districts as outliers of the Merrimbula formation in New South Wales.

West of the Genoa River much of the Upper Devonian beds are cleared for agriculture, perhaps because of their association with alluvial deposits rather than a result of any intrinsic agricultural worth.

In 1972 the Genoa River beds became known as the location of fossil footprints, which Warren and Wakefield (1972) regarded as among the oldest in the world. Fossil plants have also been recorded from nearby localities.

Tertiary basalts and sediments

Remnants of the igneous activity known as the "older basalts" occur east of Club Terrace,and are of minor importance. Much more extensive are Tertiary

Granite boulders, eastern shore of Wingan Inlet

sands, gravels, and semi-lateritic ironstones, conglomerates, and grey billy.

Fringing the coastal plain in the west, and extending to the highlands in the east, the Tertiary beds are often represented by little more than relic sandy soils, but also survive in pockets of well bedded gravels and sand. Along the Princes Highway east of Genoa, and south of Wangarabell, the beds often contain fragments and logs of silicified wood. Marine beds are not known in this district, but limestones of Miocene age (Tambo River formation, Gippsland limestone) form the cliffs on the west side of the Snowy River flats at Orbost and underlie the younger Tertiary sands and gravels to the west.

An inter-montane basin - Errinundra

Quaternary deposits

Silts, sands, gravels, and minor peaty beds are present along the major river valleys as mentioned above, and all major settlements except Mallacoota are located on such sites. Extensive swampy and peaty flats - with reed, sedge, and grass-tree cover - occur in the foothills and on the coastal plain, often along major faults.

Older Quaternary, consolidated, and semi-consolidated dune systems are prominent in some coastal areas, and in the Cape Howe area Recent dunes persist for 2--3 km from the sea.

Physiography

Four major physiographical units are represented in the area. These correspond to the land zones shown on Map 4 - Land Zones and Land Systems.

The elevated tablelands (Bonang Land Zone) are an extension of the Monaro Tablelands in New South Wales, which continue southwards onto the Errinundra Plateau and which also occur as a few isolated areas. These tablelands are

characterized by poorly pronounced relief, with wide shallow valleys. Their development is largely an expression of the erosion of certain rock types.

The dissected ridges (Coopracambra Land Zone) cover most of the study area. The topography is moderately sloping ridges in a complex pattern of dissection. Scattered through this zone are a number of small intermontane basins, such as Combienbar and Buldah, formed by downfaulting or differential erosion. The geology of this zone is varied, and erosion of the different geological types results in characteristic physiographic patterns. Areas on Ordovician bedrock tend to be deeply dissected by numerous streams, while areas on igneous rock tend to be more even, with a less well-developed drainage system.

The plains (Bralak Land Zone) are mainly on Tertiary sediments, although they also include other rock types. Relief is generally poorly to moderately pronounced, the least development being on the Quaternary alluvial deposits. On the Tertiary sediments, the land surface is generally fairly flat, with incised valleys. This physiographical unit on Quaternary alluvial deposits also includes areas that are almost flat, apart from some terracing.

The coastal unit (Tabbara Land Zone) is confined almost entirely to Quaternary deposits along the coast. The land is mainly sand dunes formed parallel to the prevailing winds, but the unit also includes areas of coastal swamps on low-lying flat land (such as Ewings Marsh).

Point Hicks, showing parallel sand dunes formed along direction of prevailing wind

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SOILS

The classification and naming of soils are based on properties that are easily recognizable in the field. Primary profile forms derived from Rowe (1972) and based on those of Northcote (1960) provide the framework for the classification, and are as follows:

- Organic soils - profiles dominated by plant remains
- Uniform soils - profiles dominated by the mineral fraction, the soils having only small differences in texture throughout
- Gradational soils - profiles dominated by the mineral fraction, the soils gradually becoming finer-textured with increasing depth
- Duplex soils - profiles dominated by the mineral fraction, the soils having pronounced and clearly defined contrast in texture between the A and B horizons

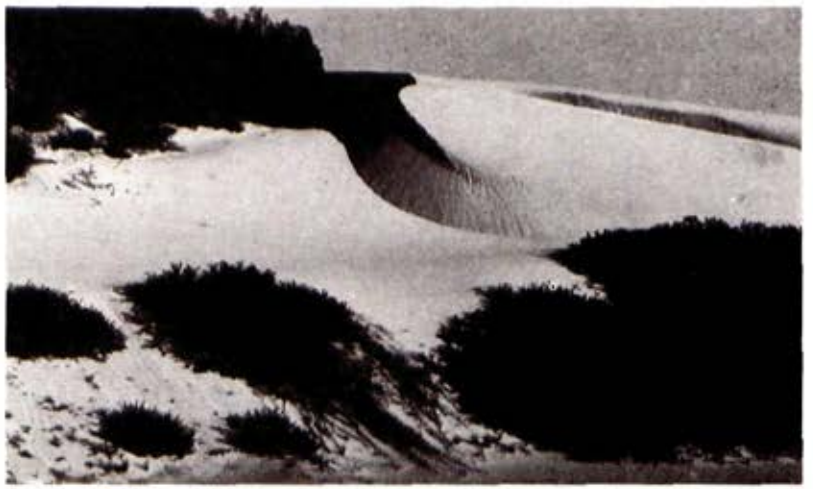
The classification scheme used in this study is set out in Table 5, in which soil nomenclature is compared with that from other classifications.

Description of Soils

Apart from some very fertile river flats, such as the Snowy River flats at Orbost, most of the soils of the coastal plains and adjoining foothills have low natural fertility. All are deficient in phosphorus, most sandy and gravelly soils lack copper and molybdenum, and most have low potassium reserves. The soils of the extensive grass-tree plains that occur east of Marlo are exceptionally low in fertility.

In the mountains, soil features mainly reflect differences in altitude linked with climatic change, whereas on the plains soil changes are fairly closely correlated with the geomorphology.

Soils with gradational profiles are typical for most of the area. They are shallow and stony on the steeper slopes, and increase in organic content with elevation. Subsoil texture is usually lighter than clay except on the gentler slopes of the foothills and the high plateaux. Duplex soils occur on the lower-rainfall hills north of Orbost and in parts of the Deddick and Genoa River catchments.



Undifferentiated and weakly differentiated aeolian sands

On the plains, friable gradational soils predominate on weathered granodiorite. Duplex profiles occur on Tertiary fluviatile deposits and uniform soils where the parent materials are sandy or loamy.

The features of the soil groups are discussed below.

Organic Soils

Peats

Occurring on low-lying, permanently wet sites above about 900 m altitude on the high plateaux, peats comprise largely or partly decomposed plant remains, usually containing more than 20% organic carbon. They are rich in nitrogen and phosphorus although these nutrients are not readily available. Water-holding capacity is very great.

Peat accumulates because of the slow breakdown of organic matter in the high swamps - mainly owing to lack of oxygen, but also because of the low temperature.

Uniform Soils

Undifferentiated aeolian sands

These largely bare yellowish brown sands form the toe of the frontal dunes of the Ninety Mile Beach. They are calcareous, containing shell fragments, and are largely subject to inundation by very high tides. They are very impoverished of plant nutrients.

Weakly differentiated aeolian sands

Except for surface darkening by organic matter, these sands show no differentiation. They occur on the recent dunes beside the Ninety Mile Beach. The first one to three dunes are calcareous, those further inland acidic. Very high tides sometimes undercut the frontal dune.

Leached sands

Leached sands have darkened humic surfaces. Their horizons, with iron and humus accumulation, may be soft or strongly cemented. They are fairly strongly acid (pH 4.5-5.5), and impoverished of most nutrients. Despite low

Table 5

SOIL GROUPS IN THE EAST GIPPSLAND STUDY AREA

Soil Groups		*Equivalent names*
Organic	Peats	peats
Uniform	Undifferentiated aeolian sands	regosols
	Weakly differentiated aeolian sands	regosols
	Leached sands	podzolic sands, nomo podzols, groundwater podzols
	Undifferentiated alluvial sands, silts, loams, and gravels	regosols, alluvial soils
	Undifferentiated stony loams	lithosols, skeletal soils
	Gravelly reddish and brownish loam	red earth
	Brown loams on alluvium	alluvial brown earths
	Saline soils	solonchaks, saline soils
	Dark brown and black friable clayey soils	prairie soils, chocolate soils
Gradational	Yellowish brown gradational soils on alluvium	alluvial brown soils
	Earthy brown or yellowish brown gradational soils on alluvium	alluvial brown soils
	Massive yellowish brown gradational soils	cryptopodzols, leptopodzols
	Yellowish brown gradational soils	leptopodzols, cryptopodzols
	Reddish and brownish gradational soils	leptopodzols, minimal podzolic soils
	Friable reddish and brownish gradational soils	amphipodzols
	Friable yellowish or reddish gradational soils on deeply weathered granodiorite	amphipodzols
Duplex	Massive brown duplex soils	brown podzolic
	Yellowish brown or reddish brown duplex soils	red podzolic, red solodic, brown podzolic

water-holding capacities, they may often be waterlogged due to high water tables.

They occur on ancient dunes and swamps of the coastal plains and, in pockets, on Tertiary fluviatile deposits and weathered granodiorite.

Undifferentiated alluvial sands, silts, loams, and gravels

These show no soil development apart from some darkening by organic matter to shallow depth. Changes in texture, where they occur, are due to changes in the original stream deposits, such as alternating silt, sand, or gravel layers.

Such soils occur mainly along the courses of streams, but also (less commonly) in alluvial fans, where the textures are generally clayey.

Undifferentiated stony loams

Occurring on steep slopes and exposed crests, these soils, which are usually shallow and brown in colour, have rock fragments as their major constituent. The small proportion of soil, with its limited water-holding capacity, will usually only sustain deep-rooted shrubs and trees, which can tap moisture in underground rock crevices.

Gravelly reddish and brownish loams

These loams (often very deep) are formed on colluvial deposits, commonly at the bases of long, steep slopes. Because of the mixture of much gravel with some binding fine material, they are valuable for road-making materials. The gravel is set within a porous matrix of loam or clay loam.

Brownish loams on alluvium

Very dark and strongly structured in the surface 30-60 cm, these become paler and weakly structured with depth. They occur beside streams and are most extensive on the Snowy River flats between Bete Bolong and Marlo. Textures grade from sandy loams in the upper reaches to silty loams further downstream.

Gully eroded in black friable clay in the Deddick area

Saline soils

Saline soils of various textures, but mainly silty loams and sands, occur on the margins of estuarine inlets, such as Lake Tyers and Mallacoota Inlet, and near the mouths of rivers.

Dark brown and black friable clayey soils

These have a strong fine structure in the upper 10-50 cm. They occur in very small, scattered pockets on Tertiary basalt and Miocene limestone, and in the drainage lines of the mountains (notably on the high plateaux).

Gradational Soils

Yellowish brown gradational soils on alluvium

Yellowish sandy loam surfaces overlie strongly structured yellow-brown clays. They are confined to narrow remnants of the highest terraces bordering the major river valleys.

Earthy brown or yellowish brown gradational soils on alluvium

Brownish black loam, clay loam, and silty clay loam surfaces grade to earthy, coarse, moderately structured, brown or yellow-brown clays. They occur on the intermediate terraces and, except for the Snowy River flats and narrow strips along the banks of other streams, occupy most of the broader river flats.

Massive yellowish brown gradational soils

Coarse, weakly structured, brown or yellow-brown loam or sandy loam A horizons grade to clay loams and (on gentler slopes) to coarse, weakly structured, earthy clays; profiles are usually stony throughout. These soils occur in the mountains, mainly in the 700-1,000 mm mean annual rainfall range and most frequently on granodiorite or quartzite.

Yellowish brown gradational soils

Brownish sandy loam surfaces cover moderately to strongly structured, yellowish brown clays. On Devonian granodiorite they predominate below about 750 m altitude and occur on ridges up to 900 m.

On Ordovician sediments, schists, and gneisses, they occur below 900 m and predominate on footslopes. They are also the main soils on moist footslopes overlying Devonian sediments and rhyodacite.

Reddish and brownish gradational soils

Brownish and reddish brown loam surfaces cover moderately to strongly structured reddish brown clays, with the profiles usually stony throughout. These soils predominate on Devonian sediments and rhyodacite, and on well-drained ridges

overlying Ordovician sediments, schists, and gneisses up to about 600 m elevation.

Friable reddish and brownish gradational soils

Friable loamy surfaces grade to strongly structured, friable clay loams and clays. They are the most common soils of the high plateaux - on Devonian granodiorite above about 750 m, and on steeper higher Ordovician sediments. Subsoils are usually red-brown, but below 900 m altitude (particularly on metamorphic rocks) may be yellow-brown.

Friable yellowish or reddish soils on deeply weathered granodiorite

Coarse brown or yellowish brown sandy loam surfaces overlie deep, strongly structured clays, which are light brown, reddish yellow, or (in better-drained situations) reddish brown. Below the subsoils lie highly weathered, mottled clays.

Duplex Soils

Massive brown duplex soils

Massive, yellowish brown, fine sandy loam surface horizons to about 25 cm overlie weakly structured, very coarse, earthy, brown clay. These soils occur on dry ridges underlain by Devonian sandstones in the upper Genoa River catchment.

Yellowish brown or reddish brown duplex soils

In lower-rainfall areas, yellowish brown sandy loam A horizons cover moderate to strongly structured yellowish brown or reddish brown clays. The reddish brown duplex soils occur on steeper slopes of the Deddick River catchment on Ordovician hills north of Orbost, and on better-drained Tertiary fluviatile deposits; the yellowish brown duplex soils occur on gentler-sloping granodiorite of the upper Deddick River, and on poorer-drained Tertiary deposits.

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VEGETATION

This chapter discusses vegetation structure and floristics and describes the native vegetation of the study area. This should be considered in conjunction with the vegetation map (two sheets) in a pocket in the back of this report.

Vegetation Structure and Floristics

The structure of a plant community is defined in terms of three components:

* vertical arrangement of the species into strata
* horizontal arrangement or spacing of plants
* abundance of each species

The study of floristics includes the grouping of associated plant species into more or less homogeneous units. One method of doing this is to collect data from carefully set out plots (or quadrats), and process the data statistically. This method delineates associated groups of species, which form useful units for defining habitats and indicating site conditions.

However, the method has two disadvantages: collection of data is a slow and painstaking process, and the characteristic species in any grouping may be small plants that would be difficult to map. It is impracticable for mapping and describing the vegetation on the extensive areas of public land in the study area. However, the Botany Department of Monash University used this method for surveys in the area, and it proved valuable for identifying the component associations of the heath complex and for listing the common understorey species from most of the coastal forest and woodland associations. Appendix I gives examples of the results of one of these surveys.

This report uses an alternative method of classification, in which groupings are determined subjectively according to uniformity in structure and qualitatively uniform floristic composition of the dominant stratum (the one that exerts a controlling influence on other plants, usually the tallest stratum).

The Study Area

The vegetation of the East Gippsland study area is remarkably varied. The combination of topography and climate, which is more typical of the coast of New South Wales than of the rest of

Victoria, results in a complex pattern of vegetation types (or plant communities). Some of these, being restricted to the east coast of Australia, are found within Victoria only in the study area, and this applies to a large number of the plant species growing here. Although East Gippsland comprises only about 4% of the total area of the State, more than one-third of the plant species recorded in Victoria occur within it. The Land Conservation Council holds lists of plant species from many localities within the study area, and these are available for inspection.

Clearing for agriculture has been restricted, and logging has involved only a small proportion of forested areas. Consequently, much of the vegetation is in a similar state to that existing before the arrival of the white man. However, changes in the fire regime since settlement, and bush grazing, have no doubt resulted in some changes.

Mapping and classification

The basis of classification is a system developed by Specht (1970) for use in the International Biological Program, modified to better suit the vegetation of the study area and the availability of data, and to conform with published data for other areas.

The classification defines closed forest as vegetation of which the tallest stratum comprises trees with projective foliage cover exceeding 70%. In open forest and woodland, the tallest strata of trees have projective foliage covers of 30-70% and 10-30% respectively. These divisions are further subdivided by height classes using the following criteria:

Height class	I	Trees 5-15m
	II	Trees 15-28m
	III	Trees 28-40m
	IV	Trees >40m

The class termed "heath" comprises plant communities in which the tallest stratum consists of shrubs (including monocotyledons) generally less than 2 m high. The broad vegetation types described above (except closed forest) have been mapped for the area, and an interesting relation between distribution of the different classes and topography is clearly seen. (Closed forest was not mapped because of the small areas occupied.) The main environmental factors that caused this distribution pattern are soil properties and climatic conditions.

These vegetation types are all heterogeneous when their component species are considered, so have been subdivided into species associations. Each association is typifies by one or more dominant species, but a variety of others also occur in each association, and occasionally these minor species may predominate in a particular stand. It is important to remember that this classification of species associations, although more

detailed than division by structural characteristics, is still a generalization of the yet more complex situation that occurs in reality.

The heath type also contains a number of distinct species associations, but these have not been mapped individually because of the great complexity of their arrangement.

It should be emphasized that plant communities exist under specific environmental conditions. The species composition of the community at any site will change if the environment changes. For example, closed forest may replace open forest after a prolonged period without fire or disturbance.

Vegetation Associations

Montane closed forest II

This association is generally confined to the wetter gullies above about 600 m altitude, but it also occurs on some south-facing hill sides, particularly on the Coast Range. It develops in the shelter of surrounding forest, and is very sensitive to fire.

The dominant tree species is frequently sassafras (*Atherosperma moschatum*), with blackwood (*Acacia melanoxylon*) or wattle (*A. frigescens*) and black oliveberry (*Elaeocarpus holopetalus*) are less important tree species, but blackwood or wattle are sometimes dominant. Common

Montane closed forest of sassafras and tree ferns

shrubs include blanket-leaf (*Bedfordia salicina*), mint bush (*Prostanthera* spp.), mountain pepper (*Drimys lanceolata*), and Gippsland waratah (*Telopea oreades*) - which in Victoria is restricted to the study area.

Tree-ferns (particularly soft tree-fern (*Dicksonia antartica*), and smaller ferns such as mother shield-fern (*Polystichum*

Lowland closed forest

proliferum), bat's-wing fern *(Histiopteris incisa)*, mother spleenwort *(Asplenium bulbiferum)*, hard water-fern *(Blechnum procerum)*, and ray water-fern *(B. fluviatile)*, are common, and mosses are very conspicuous on trunks, logs, and rocks.

An interesting variant of this association occurs on the Goonmirk Range, where mountain plum pine *(Podocarpus lawrencei)* grows in tree form up to 10-12 m high, with mountain pepper, Gippsland waratah, Victorian christmas-bush *(Prostanthera lasianthos)*, banyalla *(Pittosporum bicolor)*, tree lomatia *(Lomatia fraseri)*, sub-alpine beard-heath *(Leucopogon maccraei)*, and mock-olive *(Notelaea ligustrina)* in the understorey.

Mountain plum pine usually occurs in sub-alpine areas as a prostrate shrub on rock screes and in exposed positions - its habitat and its form at Goonmirk Range are exceptional.

Lowland closed forest II

The lowland closed forest (better known as "jungle") is the southern extension of subtropical rainforest. It is confined to moist but well-drained sites, occurring along many streams and in moist gullies, and on some steep south-facing hillsides. This association depends for its development and survival on the protection of the surrounding forest and on the exclusion of fire.

The most common tree is lilly-pilly *(Eugenia smithii)*, which may reach 30 m in height. It is associated with kanooka *(Tristania laurina)* and blackwood along streams, and with other trees such as sallow wattle *(Acacia longifolia)*, mutton-wood *(Rapaenea howittiana)*, yellow-wood *(Acronychia oblongfolia)*, black oliveberry, and blue oliveberry *(Elaeocarpus reticulatus)*.

Blanket-leaf, sweet pittosporum *(Pittosporum undulatum)*, and prickly currant-bush *(Coprosma quadrifida)*, are sometimes common shrubs.

Ferns usually grow prolifically, and up to five species of tree-fern sometimes occur in a single stand. Epiphytic ferns are often common and mosses abound locally.

A conspicuous feature of this association is the abundance of epiphytic lianes, of which 17 species grow in the study area. Jungle grape *(Cissus hypoglauca)*, is the most prominent, and may have a stem diameter of up to about 17 cm. Austral sarsaparilla *(Smilax australis)*, milk-vine *(Marsdenia rostrata)*, and pearl vine *(Sarcopetalum harveyanum)* are other common climbers.

On Cabbage Tree Creek and Brodribb River, a few small patches of lowland closed forest contain the cabbage fan-palm *(Livistona australis)*, which is separated from its main areas in New South Wales by some 300 km.

Shining gum open forest IV

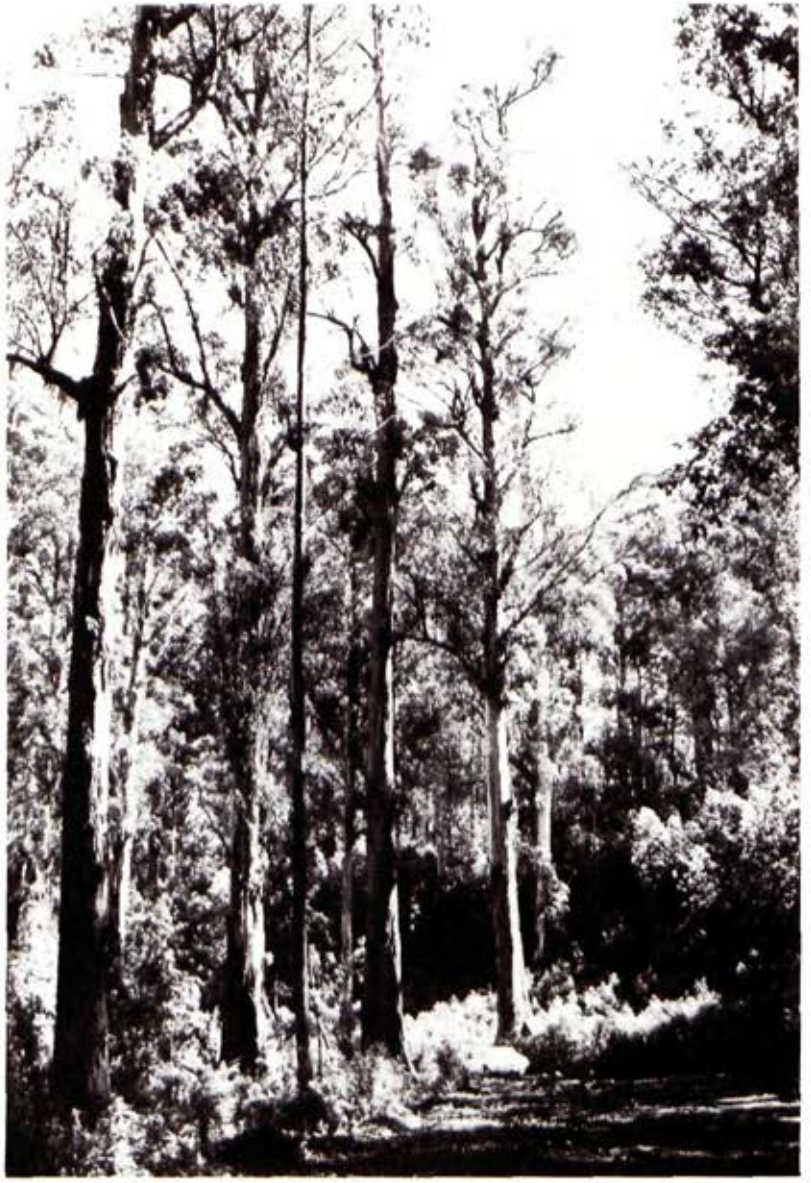
This type occurs mainly on the Errinundra Plateau on the moistest elevated sites, generally with southerly or easterly aspect. Shining gum *(Eucalyptus nitens)* often occurs pure, but usually is mixed with other eucalypt species, particularly brown-barrel *(E. fastigata)* - locally known as cut-tail.

In addition to sassafras and wattle, silver wattle *(Acacia dealbata)* may occur as an intermediate stratum beneath shining gum.

The understorey contains most of the montane closed forest species. Complete exclusion of fire probably leads to the development of pure montane closed forest. Mountain pepper, Gippsland waratah, forest starwort *(Stellaria flaccida)*, bats-wing fern, mother shield-fern, hard water-fern, and soft tree-fern are common in the understorey. Black oliverberry, mock-olive, milk-vine, twining silk-pod *(Parsonsia brownii)*, Australian clematis *(Clematis aristata* austral mulberry *(Hedycarya angustifolia)*, elderberry panax *(Tieghemopanax sambucifolius)*, sub-alpine beard-heath, and dusty daisy-bush *(Olearia phlogopappa)* are common understorey species in some stands.

Mountain ash open forest IV

This association occurs mainly in moist sheltered positions in the elevated



Mountain ash open forest; upper Rodger River area

country between Goongerah and the Snowy River, but also on the Coast Range. Mountain ash (*Eucalyptus regnans*) usually occurs in pure stands.

Common understorey species include hazel pomaderris (*Pomaderris aspera*), blanket-leaf, silver wattle, Victorian christmas-bush, musk daisy-bush (*Olearia argophylla*), and snowy daisy-bush (*O. lirata*), bootlace bush (*Pimelea axiflora*), fireweed groundsel (*Senecio linearifolius*), hop goodenia (*Goodenia ovata*), ivy-leaf violet (*Viola hederacea*), austral sarsaparilla, cane holy grass (*Hierochloe rariflora*), soft tree-fern, mother shield-fern, and hard waterfern.

Raspwort (*Haloragis teucrioides*), black wood, varnish wattle (*Acacia vernicaflua*), rusty dodder-laurel (*Cassytha phaeolasia*), austral mulberry, mountain correa (*Correa lawrenciana*), and bats-wing fern are also locally common.

Small stands of mountain ash on the Coast Range represent the eastern limit of distribution of this species.

Alpine ash open forest IV

Alpine ash (*Eucalyptus delegatensis*) generally occurs in pure stands, but may occasionally be mixed with shining gum. This association is found at elevations above about 1,000 m on the Errinundra Plateau and upper portions of the Yalmy River. Alpine ash also occurs as much

smaller trees on exposed ridges and peaks at high elevations.

The understorey commonly contains silver wattle, forest starwort, Gippsland waratah, Victorian christmas-bush, mountain pepper, forest geebung *(Persoonia silvatica)*, tussock grass *(Poa sp.)*, tasman flax-lily *(Dianella tasmanica)*, soft tree-fern, and mother shield-fern. Locally common species include dusty daisy-bush, rough coprosma *(Coprosma hirtella)*, elderberry panax, fireweed groundsel, tree lomatia, wattle, shiny cassinia *(Cassinia longifolia)*, blackwood, mountain cotula *(Cotula filicula)*, common lagenophora *(Lagenophora stipitata)*, and bats-wing fern.

Brown barrel open forest IV

Brown barrel grows on moist slopes at elevations between about 200 m and 1,000 m; at lower elevations it is restricted mainly to sheltered southern slopes of the foothills. It may be mixed with messmate *(Eucalyptus obliqua)* and mountain grey gum *(E. cypellocarpa)*, and occasionally with shining gum.

Common understorey species include daisy-bush, hazel pomaderris, blanket-leaf, austral sarsaparilla, and forest wire-grass *(Tetrarrhena juncea)*. Others common on some sites include prickly currant-bush, fireweed groundsel, silver wattle, shiny cassinia, common cassinia, *(Cassinia aculeata)*, bootlace bush, hop goodenia, common raspwort *(Haloragis tetragyna)*, Victorian christmas-bush, tall oxylobium *(Oxylobium arborescens)*, mountain correa, elderberry panax, Australian clematis, ivy-leaf violet, rough tree-fern *(Cyathea australis)*, soft tree-fern, austral bracken *(Pteridium esculentum)*, mother shield-fern, and gristle fern *(Blechnum cartilagineum)*.

Messmate--gum open forest IV

The trees generally comprise a mixture of messmate and mountain grey gum, but shining gum or Gippsland blue gum *(Eucalyptus pseudoglobulus)* may replace mountain grey gum, and brown-barrel may be mixed with messmate. This very extensive association occurs throughout the study area on suitable sites. At higher elevations it appears extensively on northern and western exposed sites in conjunction with brown-barrel open forest IV, but is restricted to the protected slopes at lower elevations.

Common understorey species include Gippsland waratah, black oliverberry, sassafras, Victorian christmas-bush, hazel pomaderris, mountain pepper, tall oxylobium, silver wattle, forest wire-grass, soft tree-fern, mother shield-fern, and bats-wing fern.

The following species are locally common: wattle, blackwood, musk daisy-bush, Australian clematis, twining silk-pod, mountain correa, forest geebung, elderberry panax, mock-olive, tasman flax-lily, and rough tree-fern.

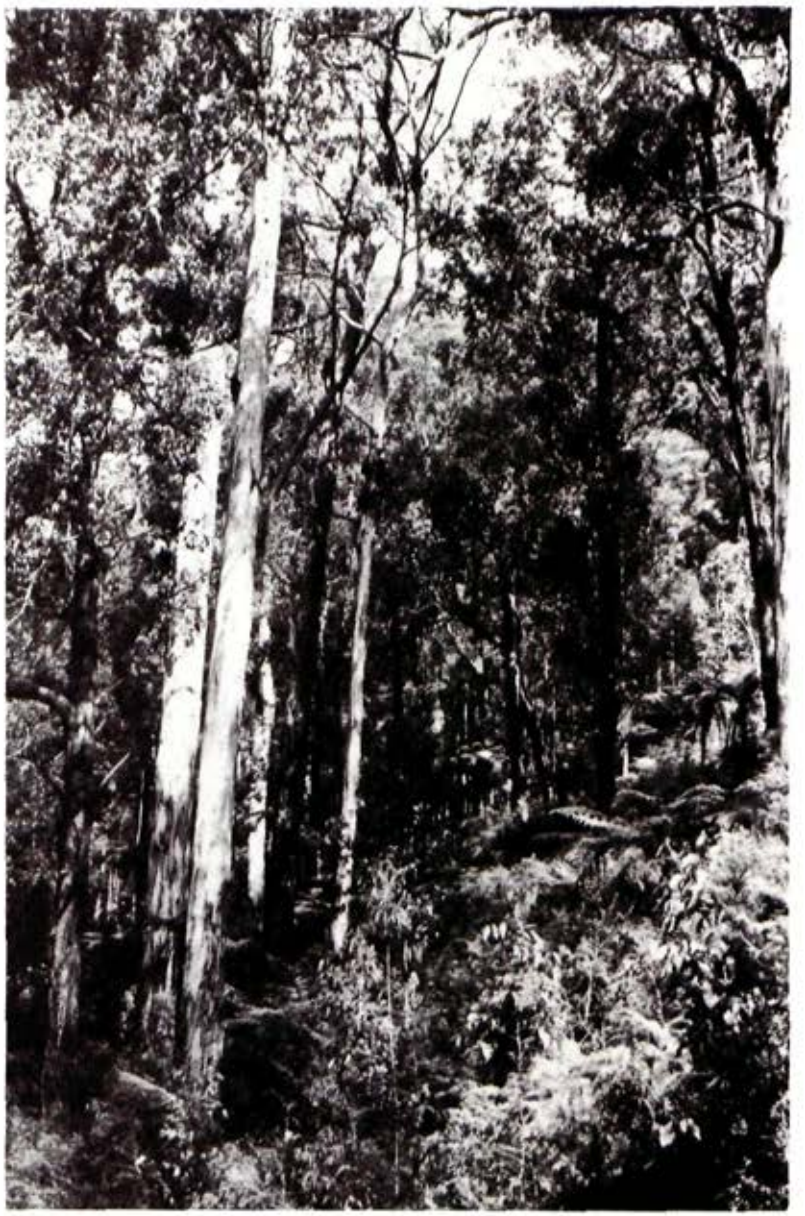
Messmate--gum open forest III

This association occurs extensively in low-elevation gullies and also on moist slopes. Major tree species are messmate and mountain grey gum, but Gippsland blue gum, yellow stringybark *(Eucalyptus muellerana)*, river peppermint *(E. elata)*, and narrow-leaf peppermint *(E. radiata)* may be locally important.

Common understorey species include blackwood, hazel pomaderris, blanket-leaf, dwarf nertera *(Nertera reptans)*, common lagenophora, soft tree-fern, and fishbone water-fern *(Blechnum nudum)*. This association sometimes extends onto drier sites, when the following understorey species may be common: narrow-leaf wattle *(Acacia mucronata)*, prickly bush-pea *(Pultenaea juniperina)*, guinea flower *(Hibbertia astrotricha)*, blue dampiera *(Dampiera stricta)*, raspwort, lance beard-heath *(Leucopogon lanceolatus)*. common heath *(Epacris impressa)*, holly lomatia *(Lomatia ilicifolia)*, pink-bells *(Tetratheca ciliata)*, prickly currant-bush, golden-tip *(Goodia lotifolia)*, stinking pennywort *(Hydrocotyle laxiflora)*, ivy-leaf violet, spiny-headed mat-rush *(Lomandra longifolia)*, tasman flax-lily, cane holy grass, forest wire-grass, red-fruit saw-sedge *(Gahnia sieberana)*, and austral bracken.

Peppermint--gum open forest III

The main species of this association are narrow-leaf peppermint, broad-leaf



Messmate-gum open forest III

peppermint (*Eucalyptus dives*), and mountain grey gum, but other gums such as candlebark (*E. rubida*) and manna gum (*E. viminalis*) and messmate also occur in some stands. The association occurs mainly at altitudes above 800 m on sites of intermediate moisture status in the Bendoc--Bonang--Bowen Range area.

Common understorey species include silver wattle, bootlace bush, ivy-leaf violet, Gippsland waratah, common lagenophora, cane holy grass, and austral bracken.

Other understorey species common at some sites include varnish wattle, narrow-leaf wattle, mountain hickory wattle (*Acacia obliquinervia*), dusty coral-pea (*Kennedia rubicunda*), stinking pennywort, mountain beard-heath (*Leucopogon suaveolens*), blanket-leaf, snowy daisy-bush, heath pink-bells (*Tetratheca ericifolia*), common bird-orchid (*Chiloglottis gunnii*), and tasman flax-lily.

Silvertop--stringybark open forest III

This comprises two associations, widespread in the lowland hills, reaching an upper altitudinal limit at about 700 m. The dominant tree species are silvertop (*Eucalyptus sieberi*) - pure in one of them - and white stringybark (*E. globidea*), but many other eucalypt species occur in association with these.

Understorey tree species include sunshine wattle (*Acacia botrycephala*), black she-oak (*Casuarina littoralis*), hairpin banksia (*Banksia spinulosa*), and saw banksia (*B. serrata*) on sandy soils.

The following smaller understorey species occur commonly: handsome flat-pea (*Platylobium formosum*), guinea-flower, blue dampiera, bush needlewood (*Hakea sericea*), raspwort, lance beard-heath, wedding bush (*Ricinocarpus pinifolium*) common correa (*Correa reflexa*), pink-bells, common heath, common aotus (*Aotus ericoides*), prickly tea-tree (*Leptospermum juniperinum*), broad sword-sedge (*L. laterale*), and austral bracken.

This type of open forest III extends up to 80 km inland, where gorse bitter-pea (*Daviesia ulicifolia*), mountain hickory wattle, tall oxylobium, prickly oxylobium (*Oxylobium ilicifolium*), cluster-flower geebung (*Persoonia confertiflora*), and broom spurge (*Amperea xiphoclada*) as well as raspwort, forest wire-grass, and austral bracken may be common.

Bloodwood--silvertop open forest III

This association occurs only in one part of the area, extending eastwards from just west of Wingan Inlet. The main tree species are red bloodwood (*Eucalyptus gummifera*) and silvertop, with white stringybark, yellow stringybark, brown stringybark (*E. baxteri*), yertchuk (*E. consideniana*), and rough-barked apple (*Angophora floribunda*), sometimes occurring in mixture.

Common understorey species include saw banksia, sunshine wattle, wedding bush, pink-bells, common correa, handsome flat-pea, common heath, raspwort, broom spurge, forest wire-grass, sandhill sword-sedge, spiny-headed mat-rush, leafy purple-flag *(Patersonia glabrata)*, and austral bracken..

Coast grey box open forest III

Coast grey box or Gippsland grey box *(Eucalyptus bosistoana)* occurs in several localities on gently sloping sites

Red bloodwood--silvertop open forest

within 40 km of the coast, either in pure stands, or mixed with other eucalypts such as but-but *(E. bridgesiana)*. Many of the sites that once carried this association have been cleared for agriculture, particularly at Cann River, Noorinbee, and Genoa.

Common understorey species include slender lagenophora *(Lagenophora gracilis)*, common rice-flower *(Pimelea humilis)*, creeping bossiaea *(Bossiaea prostrata)*, black wattle *(Acacia mearnsii)*, austral bears ear *(Cymbonotus preissianus)*, showy violet *(Viola betonicifolia)*, pennywort *(Hydrocotyle foveolata)*, (Australian buttercup *(Ranunculus lappaceus)*, small grass-tree *(Xanthorrhoea minor)*, thatch saw-sedge *(Gahnia radula)*, wattle mat-rush *(Lomandra filiformis)*, together with spiny-headed mat-rush, kangaroo grass *(Themeda australis)*, broad sword-sedge, early nancy *(Anguillaria dioica)*, and austral adder's tongue *(Ophioglossum coriaceum)*.

Peppermint--red stringybark--gum open forest II

A mixture of broad-leaf peppermint, red stringybark *(Eucalyptus macrorhyncha)*, and brittle gum *(E. mannifera)* or candlebark dominates this association. It occurs on dry hillsides at elevations above 700 m in the north of the study area (Bendoc--Bonang area).

Common understorey species include silver wattle, sharp beard-heath *(Leuco-*

pogon stuartii), twin-flower beard-heath *(L. biflorus)*, daphne heath *(Brachyloma daphnoides)*, blunt-leaf guinea flower *(Hibbertia obtusifolia)*, common raspwort, heath pink-bells, and creamy stackhousia *(Stackhousia monogyna)*. Many other species are common in individual stands, including the orchids pink fingers *(Caladenia carnea)*, musky caladenia *(C. angustata)*, and honey caladenia *(C. testacea*, var. *hildae)*.

Stringybark--silvertop--red box open forest II

This association occurs throughout the study area on dry hillsides below about 600 m. The dominant tree species are red box.*(Eucalyptus polyanthemos)*, red or sometimes white stringybark, and occasionally silvertop. Common understorey species include hop bitter-pea *(Daviesia latiflora)*, common raspwort, prickly broom-heath *(Monotoca scoparia)* errienellam *(Drosera auriculata)*, blue dampiera, shrubby platysace *(Platysace lanceolata)*, heath pink-bells, blunt-leaf guinea flower, broad sword-sedge, thatch saw-sedge, spiny-headed mat-rush, and wax-lip orchid *(Glossodia major)*. Hairy beard-heath *(Leucopogon pilibundus)*, lance beard-heath, common cassinia, shiny cassinia, tiger orchid *(Diuris sulphurea)*, and pink fingers are locally common.

Bloodwood--apple open forest II

This association is confined to the ex-

Open forest of rough-barked apple

treme east of the study area, as rough-barked apple extends westwards only a few miles beyond Genoa. White stringybark, brown stringybark, and yertchuk are sometimes associated with the major species.

Common understorey species include saw banksia, sweet wattle *(Acacia suaveolens)*, spike wattle *(A. oxycedrus)*, common heath, wedding-bush, broom spurge, raspwort, sword bossiaea *(Bossiaea ensata)*, smooth parrot-pea *(Dillwynia glaberrima)*, prickly broom-heath, paperbark tea-tree *(Leptospermum attenuatum)*, shrubby platysace, austral grass-tree *(Xanthorrhoea australis)*, spear grass-tree, *(X. resinosa)*, tassel rope-rush *(Hypolaena fastigiata)*, sandhill sword-sedge, and swamp selaginella *(Selaginella uliginosa)*.

White sallee open forest I

Occurring mainly at high altitudes (above 1,200 m), this association generally has white sallee *(Eucalyptus pauciflora)* - locally known as snow gum - as its dominant tree species, but on the Bowen Range spinning gum *(E. perriniana)* occurs in mixture.

Common understorey species include prickly starwort *(Stellaria pungens)*, mountain hickory wattle, alpine oxylobium *(Oxylobium alpestre)*, gorse bitter-pea, everlasting *(Helichrysum rutidolepis)*, snow grass *(Poa* sp.*)*, with small flax-lily, field woodrush *(Luzula cam-*

White sallee open forest, Mount Delegate

pestris), and small mat-rush *(Lomandra micrantha* var. *sororia)* or spiny-headed mat rush *(L. longifolia)*.

A variant of this association occurs in low-lying areas of the elevated tablelands, where cold-air drainage creates frost hollows. In such locations, white sallee is generally mixed with candlebark, which sometimes occurs in pure stands. Common understorey species in this variant include heath pink-bells,

mountain beard-heath, sharp beard-heath, tree lomatia, blunt-leaf guinea flower, everlasting, common wedge-pea *(Gompholobium huegelii)*, leafy bossiaea *(Bossiaea foliosa)*, grass trigger-plant (*Stylidium graminifolium)*, and sieber grass *(Poa sieberana)*.

Cypress pine woodland II

White cypress pine *(Callitris columellaris)* and black cypress pine *(C. endlicheri)* dominate this association. It occurs on dry rocky slopes in the lower Deddick River valley and northern part of the Snowy River valley.

It usually contains white box *(Eucalyptus albens)* in mixture. The understorey is relatively sparse, but commonly contains twin-flower beard-heath, sieber crassula *(Crassula sieberana)*, tall bluebell *(Wahlenbergia stricta)*, pink purslane *(Calandrinia calyptrata)*, rough bedstraw *(Galium gaudichaudii)*,hares foot clover *(Trifolium arvense-* an introduced species), sieber grass, kangaroo grass, variable spear grass *(Stipa variabilis)*, sedge *(Carex brevilculmis)*, pale vanilla-lily *(Arthropodium milleflorum)*, rock-fern *(Cheilanthes tenuifolia)*, and bristly cloak-fern *(C. distans)*.

White box woodland II

This woodland is dominated by white box or bundy *(Eucalyptus goniocalyx* - locally known as long-leaved box*)*, but

Cypress pine woodland, Deddick

sometimes white cypress pine and black cypress pine occur as isolated trees. It occurs on dry slopes in the lower Deddick River valley and northern part of the Snowy River valley.

Common understorey species include small-leaf clematis *(Clematis microphylla)*, two flower beard-heath, tall bluebell, stinking pennywort, kidney weed *(Dichondra repens)*,hares-foot clover,

black wattle, kangaroo grass, sieber grass, and rock-fern.

Red stringybark--yertchuk woodland II

Red stringybark and yertchuk, which sometimes occur in pure stands, are dominant. The association is found on poor soils on exposed steep rocky slopes of inland hills (mainly along the Snowy and Rodger Rivers), up to a maximum elevation of about 600 m.

Woodland of yertchuk and red bloodwood, with saw banksia and moderately dense understorey

Common understorey species include blunt-leaf guinea flower, hop bitter-pea, shrubby platysace, shiny buttons *(Leptorhynchos linearis)*, button everlasting *(Helichrysum scorpioides)*, hairy pink-bells *(Tetratheca pilosa)*, trailing oxylobium *(Oxylobium procumbens)*, handsome flat-pea, common rice-flower, blue dampiera, thatch saw-sedge, spiny-headed mat-rush, wax-lip orchid, dotted sun-orchid *(Thelymitra ixioides)*, and bird-orchid *(Chiloglottis* sp.*)*.

Yertchuk woodland II

Occurring throughout the coastal part of the study area, this is generally assocoated with patches of heath. The main tree species, yertchuk, usually has other eucalypt species present in mixture - southern mahogany *(Eucalyptus botryoides)* in the west and central parts, red bloodwood and rough-barked apple in the east, and brown stringybark and white stringybark throughout.

Common understorey species include saw banksia, spike wattle, common heath, wedding bush, raspwort, smooth parrot pea, paperbark tea-tree, prickly tea-tree, common aotus, pink-bells, woolly xanthosia *(Xanthosia pilosa)*, spiny-headed mat-rush, small grass-tree, slender dodder-laurel *(Cassytha glabella)*, screw-fern *(Lindsaya linearis)*, and swamp selaginella.

Stringybark--silvertop--mahogany woodland II

This association occurs along the coastal belt of the study area, frequently on sandy soils. Various mixtures of brown stringybark, southern mahogany, white stringybark, silvertop, red bloodwood, and saw banksia dominate the tallest stratum.

The following understorey species are common in this association: sunshine wattle, wedding bush, shrubby platysace, tree broom-heath *(Monotoca elliptica)*, common heath, handsome flat-pea, prickly tea-tree, blue dampiera, raspwort, spiny-headed mat-rush, sandhill sword-sedge and austral bracken.

Heath

Many different species associations have been combined for mapping as heath. These often occur in complex arrangement in areas too small to be mapped at the scale used for this report.

The heath association including scrub she-oak *(Casuarina paludosa)*, occurs on slopes and plains exposed to winds and salt spray close to the coast, such as the coastal plain west of Mallacoota. This association generally only reaches about 0.5 m in height. The common species include scrub she-oak, slender dodder-laurel, pink swamp heath *(Sprengelia incarnata)*, scented paperbark *(Melaleuca squarrosa)*, prickly tea-tree,

Banksia--brown stringybark woodland with heath understorey

blunt-leaf heath *(Epacris obtusifolia)* blue dampiera, raspwort, yellow-eye *(Xyris* sp.*)*, slender twine-rush *(Leptocarpus tenax)*, flat cord-rush *(Restio complanatus)*, spreading rope-rush *(Calorophus lateriflorus)*, zig-zag bog-rush *(Schoenus brevifolius)*, hairy rice-grass *(Tetrarrhena distichophylla)*, common rapier-sedge *(Lepidosperma filiforme)*, austral grass-tree, spear grass-tree, and swamp selaginella.

Spear grass-tree heath with stunted saw banksia near Seal Creek

A second heath association occurring generally in more protected positions, has several distinct sub-associations, which occupy different habitats. Species common in at least some of these are pink swamp-heath, blunt-leaf heath, common heath, smooth parrot-pea, blue dampiera, scented paperbark, prickly tea-tree, raspwort, slender dodder-laurel, austral grass-tree, spear grass-tree, slender twine-rush, flat cord-rush, spreading rope-rush, leafy bog-rush *(Schoenus maschalinus)*, or (inland from Wingan Inlet) black bog-rush *(S. melanostachys)*, yellow-eye, and swamp selaginella. An inland variety of this association often has an open tree layer of silver-leaf stringybark *(Eucalyptus cephalocarpa)*, as well as the additional ground flora heath milkwort *(Comesperma ericinum)*, woolly-style heath *(Epacris lanuginosa)*, and button-grass *(Gymnoschoenus sphaerocephalus)*.

One component of the heath system, apparently confined to low-lying areas, is dominated by swamp paperbark and zig-zag bog-rush with prickly tea-tree and scented paperbark also being common.

Another, commonly found at the edge of forest or as isolated swamps at stream heads in the forested hills away from the coast, is dominated by scented paperbark, with a dense entangled skein of wiry bauera *(Bauera rubioides)* and spreading rope-rush between the shrubs. Other common species here include common heath, prickly tea-tree, slender dodder-laurel, and paroo lily *(Dianella caerulea)*.

In association on exposed recent sand-hills along the coast, coast tea-tree *(Leptospermum laevigatum)* dominates with very few other species. Of these few, tree broom-heath, coast banksia *(Banksia integrifolia)*, saw banksia, and austral bracken are the most common.

Exposed rocky headlands (such as Sandpatch Point and Rame Head) may carry an

association in which giant honey-myrtle *(Melaleuca armillaris)*, dominates, commonly accompanied by common heath, hop goodenia, grey everlasting *(Helichrysum obcordatum)*, bush-pea *(Pultenaea* sp.), tree broom-heath, common aotus, coast tea-tree, and spiny-headed mat-rush.

Ewing Marsh is an extensive swampy area behind the fore-dune between Lake Corringle and Lake Tyers. Common species include wing pennywort *(Hydrocotyle pterocarpa)*, water-milfoil *(Myriophyllum propinquum)*, fireweed *(Senecio minimus)*, Australian lilaeopsis *(Lilaeopsis polyantha)*, slender knotweed *(Polygonum minus)*, marsh yellow-cress *(Rorippa islandica)*, scrub nettle *(Urtica incisa)*, small river buttercup *(Ranunculus rivularis)*, centella *(Centella cordifolia)*, running marsh-flower *(Villarsia reniformis)*, water woodruff *(Asperula subsimplex)*, streaked arrow-grass *(Triglochin striata)*, water ribbons *(T. procera)*, jointed rush *(Juncus articularis* - an introduced species), tall spike-rush *(Eleocharis sphacelata)*, tall sedge *(Carex appressa)*, swamp club-rush *(Scirpus inundatus)*, blown grass *(Agrostis avenacea)*, Australian sweet-grass *(Glyceria australis)*, floating pondweed *(Potamogeton tricarinatus)*, and common reed *(Phragmites australis)*. Swamp paperbark *(Melaleuca ericifolia)* forms dense thickets around the margins.

A number of open areas in swamps at high elevations, particularly along the Delegate River, sometimes contain mountain swamp gum *(Eucalyptus camphora)*. Other common species include woolly tea-tree *(Leptospermum langigerum)*, myrtle tea-tree *(L. myrtifolium)*, coral heath *(Epacris microphylla)*, swamp heath *(E. paludosa)*, mountain baeckia *(Baeckia utilis)*, small-fruit hakea *(Hakea microcarpa)*, wing pennywort, creeping rasp-

Ewing Marsh, with burnt swamp paperbark (foreground), ribbon weed and tall spike-rush (middle distance), and coast tea-tree on dunes

Complex of coastal swamp and dune communities

wort *(Haloragis micrantha)*, spreading rope-rush, leafy flat sedge *(Cyperus lucidus)* and rush *(Juncus* sp.*)*.

Species Important for Preservation

Because East Gippsland is the southern limit of the distribution of many plant species native to the east coast of Australia, many species occurring there are not found elsewhere in the State and may be classed as rare within Victoria (J.H. Willis, 1971; A.C. Beauglehole, personal communication). However, many of them are common in New South Wales, and so their preservation is less urgent than that of other species that occur more extensively within Victoria, but are rare or uncommon throughout their range.

About 45 species in East Gippsland may be considered rare generally, at least in southern Australia, and are described below. The East Gippsland species that are rare in Victoria but that the National Herbarium of New South Wales considers to be reasonably common in southern New South Wales are discussed in the block descriptions.

A wattle *(Acacia subporosa)* is known in Victoria only from the Harrisons Creek area of the Howe Ranges - it occurs also in New South Wales, where it is rare or restricted.

Black stem *(Adiantum formosum)* is extremely localized in Victoria, being known only from Pipeclay Creek near Orbost, the Cann River near Noorinbee, and Buttercup Creek near Wroxam, where it grows on moist rich soil of river-flat jungles. It also occurs in New South Wales (rarely), Queensland, and New Zealand.

Rare bent-grass *(Deyeuxia microseta)* is known in Victoria only from Combienbar - it is otherwise restricted to the Blue Mountains in New South Wales.

Broad-leaf hop-bush *(Dodonaea rhombifolia)* occurs in East Gippsland along the Snowy River, but also at Pine Mountain, on the upper Murray River, and in New South Wales, where it is uncommon, particularly in the south of the State.

Wax-flower *(Eriostemon virgatus)* is known from Mount Kaye within Victoria, but also occurs in Tasmania.

Eastern leatherwood *(Eucryphia moorei)* grows in the Howe Ranges and also in New South Wales (south of Wollongong).

Lanky fescue *(Festuca eripoda)* occurs in East Gippsland at Maramingo Creek - other Victorian occurrences are at Mount Cope and Limestone Creek (east of Benambra) and it is also found in New South Wales.

Shrubby raspwort *(Haloragis racemosa)* is known in Victoria from Mount Tingaringy and Suggan Buggan - it also grows in New South Wales, and is relatively common in Western Australia.

Guinea flower *(Hibbertia rufa)* occurs in East Gippsland at Reedy Creek (near Cann River) and Genoa Creek - it is also found in New South Wales.

Rusty velvet-bush *(Lasiopetalum ferrugineum)* has been recorded in Victoria in the Genoa River gorge. It is otherwise not known south of Picton, near Sydney, but is very common in northern New South Wales.

Scale rush *(Lepyrodia anarthria)* is confined within Victoria to a few localities in East Gippsland (e.g. upper Genoa River), but also occurs in New South Wales.

River beard-heath *(Leucopogon riparius)* is an endemic Victorian species known only from the gorge of the Snowy River north of the Museum Spur.

Cabbage fan-palm *(Livistona australis)* is rare and localized in Victoria,where it is known only from three colonies on Cabbage Tree Creek, Caleys Creek, and the lower Brodribb River; it also occurs in New South Wales and Queensland.

Tiny logania *(Logania pusilla)* is recorded in Victoria only from the mouths of the Betka River and Seal Creek, but is also found in New South Wales and Queensland.

Bog clubmoss *(Lycopodium serpentinum)* is known in Victoria only from the Grampians, French Island, and Maramingo Creek in East Gippsland - it occurs also in other States, but is generally rare.

Long clubmoss *(Lycopodium varium)* has been found in Victoria in the Victoria Range (Grampians), Calder River (Otways), Sealers Creek,(Wilsons Promontory), and at Mount Kaye and Genoa Peak (East Gippsland) - it also occurs in other eastern Australian States and in New Zealand.

Loosestrife *(Lysimachia salicifolia)* is only known in Victoria from a single collection made at the mouth of the Snowy River by F. Mueller in 1855 - it is now presumed to be extinct at that locality, but occurs in New South Wales.

Promontory daisy-bush *(Olearia allenderae)* is an endemic Victorian species, known only from Wilson's Promontory and from betweeen the Mueller and Wingan Rivers in East Gippsland.

Red passion-flower *(Passiflora cinnabarina)*, a plant of the lowland closed forest, has limited distribution in Victoria.

Myrtle geebung *(Persoonia myrtilloides* var. *brevifolia)* is extremely localized and rare in Victoria, being confined to Yambulla Creek near its junction with the Genoa River near the New South Wales border. It also occurs in the far south-east of New South Wales.

Hookers grass *(Poa hookeri)* is a very rare species, recorded in Victoria only from Mount Tingaringy and recorded only once or twice in New South Wales.

An unnamed grass *(Poa* sp.*)* has been recorded only from the Mallacoota and Wingan areas.

Pomaderris *(Pomaderris costata)* is known in Victoria only from East Gippsland (e.g. Brodribb River) - it is also very rare in New South Wales.

Pomaderris *(Pomaderris cotoneaster)* has been recorded in Victoria only from the upper Genoa River - it also occurs rarely in New South Wales.

Pomaderris *(Pomaderris sericea)*, like the preceding species, is known in Victoria only from the upper Genoa River, and is very rare in New South Wales.

Leek orchid *(Prasophyllum appendiculatum)* may be endemic in East Gippsland, where it grows on damp sandy ground of the near-coastal "grass-tree plains". The type locality is at Genoa Creek. It possibly extends into far southern New South Wales, but has not yet been recorded there.

Green midge-orchid *(Prasophyllum viride)* is known in Victoria mainly from East Gippsland (Mallacoota, Seal Creek, Little Rame Head, Buldah Road), but has also been recorded at French Island, and occurs (though rarely) in New South Wales and Queensland.

Tangled pseudanthus *(Pseudanthus divaricatissimus)* is uncommon in Victoria and New South Wales, and occurs in East Gippsland (e.g. Howe Range).

Bush-pea *(Pultenaea altissima)* is known in Victoria only from the upper Genoa River. It also occurs in New South Wales, but is rare.

Austral sage *(Salvia plebeia)*, extremely rare in Victoria, has been recorded

from the Snowy and Deddick Rivers, as well as the Tambo and Buchan. It is locally common from southern Queensland south to about Bathurst, N.S.W., but is not known in southern New South Wales.

Sandalwood *(Santalum obtusifolium)* is known in Victoria only from the Genoa River near Genoa - it occurs also in New South Wales and Queensland, but is rather restricted, especially in southern New South Wales.

Floating bog-rush *(Schoenus fluitans)* is rare in Victoria, and apart from a record at Barracoota Lake (east of Mallacoota Inlet) is known only west of Melbourne. It occurs also in South Australia and Tasmania.

Bog-rush *(Schoenus turbinatus)* is known in Victoria from the Grampians, Anglesea, and the Howe Range. It also occurs in New South Wales and Tasmania.

Club-rush *(Scirpus gunnii)* is known in Victoria only from the Bogong High Plains and Mount Kaye in East Gippsland. It also occurs in Tasmania.

Club-rush *(Scirpus forsythii)* is restricted in Victoria to the Genoa River near Genoa - it also occurs in New South Wales (though rarely).

Tiny spyridium *(Spyridium cinereum)* is endemic in Victoria, recorded only from coastal heaths at Mallacoota aerodrome and from the Grampians.

Giant trigger plant *(Stylidium laricifolium)* is recorded in Victoria only from Wingan Inlet. It also occurs in New South Wales and Queensland.

Rare veined sun-orchid *(Thelymitra cyanea)* is known in Victoria only from subalpine heath along the upper Delegate River, and near sea-level at Maramingo Creek north-east of Genoa. It also occurs in Tasmania and New Zealand.

Sun orchid *(Thelymitra retecta)* is known in Victoria only from Noojee, Healesville, Seal Creek, and the upper Delegate River. It also occurs near Launceston, Tas.

Another species of sun orchid *(Thelymitra* sp.*)*, known from the Genoa--Mallacoota area, is apparently undescribed.

Rush fringe-lily *(Thysanotus juncifolius)* is restricted in Victoria to near-coastal damp heaths at Reedy Creek, Mallacoota, Genoa, and Maramingo Creek. It also occurs in New South Wales from the north coast to just south of Sydney.

Oval fork-fern *(Tmesipteris ovata)* is rare, growing on the trunks of tree-ferns at Mount Drummer and Howe Range; there is also a single record from the Dandenong Ranges. This species extends through New South Wales (where rare or restricted) to Queensland.

Snowy River westringia *(Westringia cremnophila)* is apparently endemic in

Victoria, being known only from the gorge of the Snowy River.

Dwarf yellow-eye *(Xyris juncea)* is known in Victoria only from a swampy heath at Maramingo Creek (north-east of Genoa) - it also occurs in New South Wales and Queensland, though it is rather restricted in New South Wales, especially in the south.

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FAUNA

East Gippsland is an important area for fauna because its public land carries a large area of native vegetation that has great diversity. A number of species are endemic, others are not found elsewhere in Victoria but occur in other States, and some widespread but rare species occur in the study area.

In this chapter, an introductory section on habitats is followed by a brief outline of the distribution of major fauna groups within the study area. The species most characteristic of each type of habitat are discussed, but no attempt has been made to list all species that may occur in any habitat. Species of special significance are discussed at the end of the chapter.

Chapter 8 classified the vegetation in terms of structure and variations in floristics within each structural class described. These major vegetation types can also be utilized for analysing the distribution of animals. It should be recognized that this type of habitat classification has shortcomings, but based on present data it is considered to be the best available approach. The discussion also includes a few habitats such as ocean, estuary, etc. that have not been described in terms of vegetation.

Much of the information used here was obtained in exploratory fauna surveys conducted by the Zoology Department, Monash University. These surveys provided information on mammals, birds, reptiles, and amphibians.

Study of mammals included systematic trapping for small ground-dwelling animals, using wire-cage and Elliott box-traps baited with a mixture of peanut butter and rolled oats. Traps in excess of the expected number of captures were set along surveyed lines, each of which consisted of 12 trap-sites 25 m apart. Thus quantitive estimates of abundance of each species could be obtained - the results are summarized in Appendix 2.

It is important to recognize that these surveys were exploratory and that interpretation of the results is limited by their short duration, seasonal bias, and coincidence with a drought, and to some degree by the sampling method adopted. For example, some surveys were undertaken at times in the life history of the *Antechinus* species during which activity, age, and sex-structure of the

Brown antechinus

population differed markedly from those at other times of the year.

Supplementary surveys were also conducted in the study area by the Fisheries and Wildlife Division. The National Museum (Victoria) supplied information on specimens lodged in the Museum. Both institutions provided comments on various sections in the chapter.

Habitats

The following discussion attempts to indicate general relations between particular habitats and their associated fauna, mainly on the basis of vegetation formations. The habitats selected for the most part correspond with the vegetation types described in detail in chapter 8 (see Appendix 2) and are:

General forest habitat
Wet forest
Dry open forest
Inland woodland
Coastal woodland
Dense heath
Open heath
Sub-alpine complex
Wetlands
Littoral habitat
Estuary
Ocean
Agricultural land

General forest habitat

Open forest and woodland cover most of the public land in the study area and support a diverse fauna. Many of the animal species are widely distributed and have no known affinity for particular types of forest. A few species occur in specific forest types.

Many forest-inhabiting species use particular niches within the forest structure for breeding and feeding purposes, and are therefore closely associated with specific plant layers within the forest community.

Wet forest

Open forest IV and closed forest II can be conviently grouped as one

habitat type. The tall trees, dense understorey, and ferny gullies provide a variety of niches resulting in a relatively diverse fauna.

Dry open forest

Open forest II and III can be conviently grouped as a drier type of forest habitat for animals. It is characterized by shorter trees, a lower and more open understorey, and a sparse litter layer. On poor sites this forest often approaches woodland.

Inland woodland

This habitat does not support a large variety of animals where the understorey is sparse; but where the understorey is dense the variety and abundance of fauna is much greater.

Coastal woodland

In coastal areas woodland frequently occurs as a transitory zone between forest and heath and beach; in such situations the fauna may be particularly rich.

Dense heath

Although it has no tree stratum, the vegetation is fairly dense and provides continuous cover for ground-dwelling mammals, which are relatively abundant. This habitat is normally associated with permanently wet soil.

Open heath

Vegetation is less dense, offering little cover, and conditions are generally drier. Faunal populations differ from those of dense heath, most mammals usually being less abundant.

Sub-alpine complex

The sub-alpine lands (including white sallee open forest I and sub-alpine swamps) are not a favourable habitat for most animals because of the relatively harsh climate. A number of species use the area as feeding and breeding grounds during summer, but most descend to warmer elevations for the winter months.

Wetlands

Wetlands - land areas seasonally or permanently inundated by fresh water - include swamps, reservoirs, earth tanks, and streams. A number of habitat zones can be defined,and these are correlated with water quality, water levels, and the duration of inundation.

Europeans have considerably altered some wetland habitats in the area. They have drained swamps such as the Snowy, Delegate, and Brodribb River flats for agricultural purposes.

Littoral habitat

This habitat includes land subject to tidal influences. Coastal beaches,

shores of estuaries (including associated sandflats and mudflats), and salt marshes are all components of the littoral zone.

These areas provide important sources of food for many fish and waterbirds, and nest sites for a number of bird species.

Estuary

The waters of estuaries such as Mallacoota Inlet and Wingan Inlet support a wealth of biological activity. The shallow waters provide spawning and nursery grounds for many marine fish, as well as having their own typical fish species. The variations in salinity from fresh to salt water are important in the ecology of the estuaries.

Ocean

Decisions on land use within the study area itself may affect the adjacent ocean and the diverse fauna occurring there. Many species from the study area (particularly birds) depend on the ocean for food.

Agricultural lands

Some of the land in the study area (especially the river flats) has been considerably modified to produce domestic crops and stock to meet Man's specific needs for food and fibre. Management usually involves the suppression of competition by other plants and animals. Many of the original species have been reduced in these areas, but some (especially birds) have been able to accomodate to the new habitat, which usually has a woodland or grassland nature.

Mammals

General forest habitat

Insectivorous bats are common in the study area throughout all woodland and forest habitats. All small bats require secluded sites for roosting during daylight, and most can be classified as either forest bats (which roost in hollow limbs of trees) or cave bats (which

Sugar glider

seek tunnels, caves, and mine shafts). The lesser long-eared bat, greater long-eared bat, bent-winged bat, Gould wattled bat, and little bat have been recorded in the study area, and probably also occur there. The grey-headed fruit-bat and the red fruit bat from northern Australia visit southern Victoria in most years, being seen frequently in the Genoa--Mallacoota area.

Five possum species are widely distributed in most forest areas. All are nocturnal and nest in tree hollows. The availability of suitable nest sites may determine their occurrence. The brush-tailed possum feeds on the leaves, buds, and fruit of various trees and shrubs. The common ringtail lives in hollow trees where available, but may build characteristic dreys in small trees. It is most common in coastal woodland. The sugar glider has a well-developed social system, which appears to be based on family groups. It feeds on insects and possibly also buds and blossoms. The feather-tailed glider, although widespread, is rarely observed under natural conditions. It is insectivorous but also feeds on nectar. The yellow-bellied glider - also widespread - feeds mainly on insects, but also on sap from the trunks of some species of eucalypt.

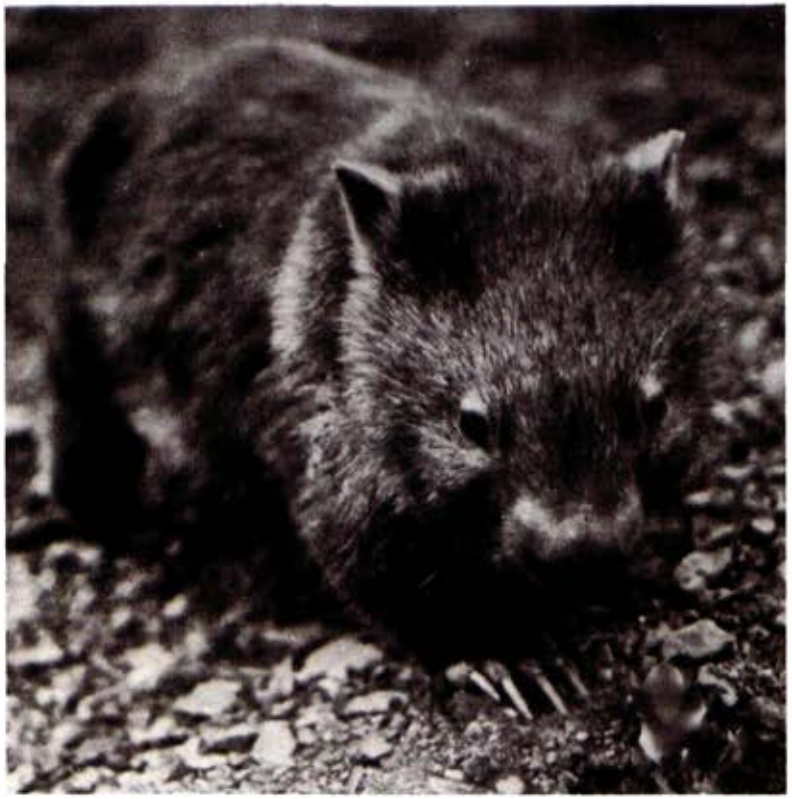
Although widely distributed through all forest types and heath, the black wallaby reaches its highest density in wet forests. It browses on low shrubs and grasses.

Tiger cat

The tiger-cat, the largest marsupial carnivore on the mainland, is found occasionally in forests in East Gippsland. Factors influencing its distribution are not well known.

The bush rat is omnivorous, with invertebrates forming the major food during spring and summer, and fungi and fibrous plant material during the winter. It nests in burrows and hollow logs.

Another carnivore, the brown antechinus, feeds largely on arthropods living in trees and in litter on the forest floor, and nests in the hollows of trees or fallen logs. The Swainson antechinus is widespread, and is most common in moist forest gullies, although less abundant



Wombat

than the bush rat and brown antechinus.

The wombat, which is a powerful burrower, feeds on roots and other vegetable matter.

Feral cats are widespread in forest, but are not common except on the Errinundra Plateau.

Dingoes and feral dogs are relatively common in all forest types.

Wet forest

The greater glider, an herbivorous species, occurs in the wet open forest and appears more common inland than in coastal areas. A combination of suitable feed trees (such as narrow-leaf peppermint) and suitable nest sites (often located in messmate or gums) can result in large numbers of this species inhabiting relatively small areas. The bobuck is also common in wet forests where suitable den trees occur; it has a very varied diet.

The taxonomy of potoroos is at present confused, but at least two species of potoroo occur in the study area. One of these is normally found in wet forest.

Dry open forest

Great grey kangaroos are frequently encountered in dry open forest. The echidna is also characteristic of this habitat type. The red-necked wallaby occurs in areas of dry open forest, especially in some coastal districts.

Inland woodland

This habitat frequently has a sparse understorey, so small ground-dwelling animals are uncommon. However, the white-footed dunnart, a small carnivorous marsupial known from only a few localities in Victoria, occurs in this type. Great grey kangaroos are fairly common.

Coastal woodland

This habitat has a diverse mammal fauna with relatively dense populations. It commonly contains the eastern pigmy possum, swamp rat, and great grey kangaroo, and also a species of potoroo west of Sydenham Inlet. The long-nosed bandicoot and smokey mouse have both been found in coastal woodland.

Dense heath

The most common mammal species are the bush rat and the swamp rat. The Swainson antechinus also occurs in this habitat, and the potoroo has been recorded around the margins of dense heath where it abuts coastal woodland.

Open heath

The brown antechinus is the most common mammal species, but the bush rat and swamp rat also occur, although less abundantly than in dense heath. The short-nosed bandicoot is found occasionally in open heath. The black wallaby occurs in both heath types.

Sub-alpine complex

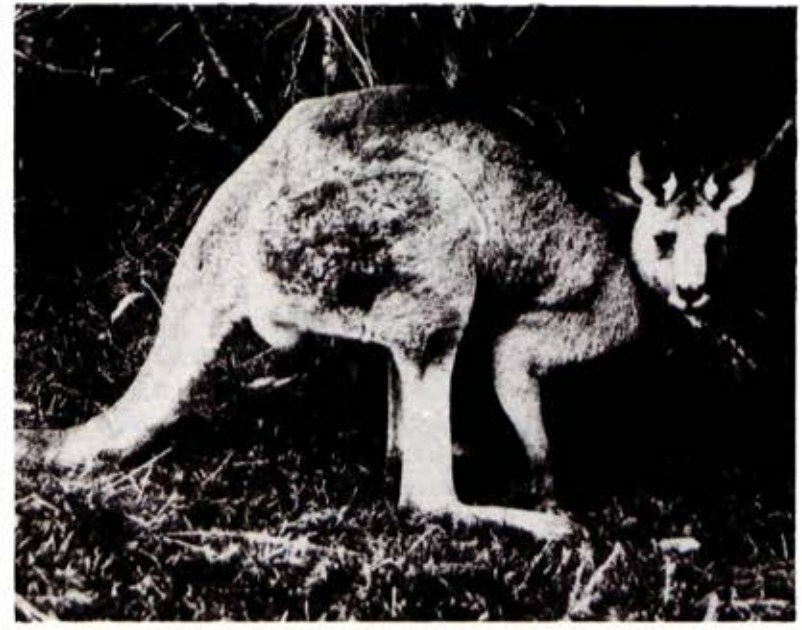
The great grey kangaroo, black wallaby, and wombat occur in this habitat. Some possum species occur in the white sallee--alpine ash forests, which are included here rather than with other forest types, and the bush rat and brown antechinus are also common.

Wetland

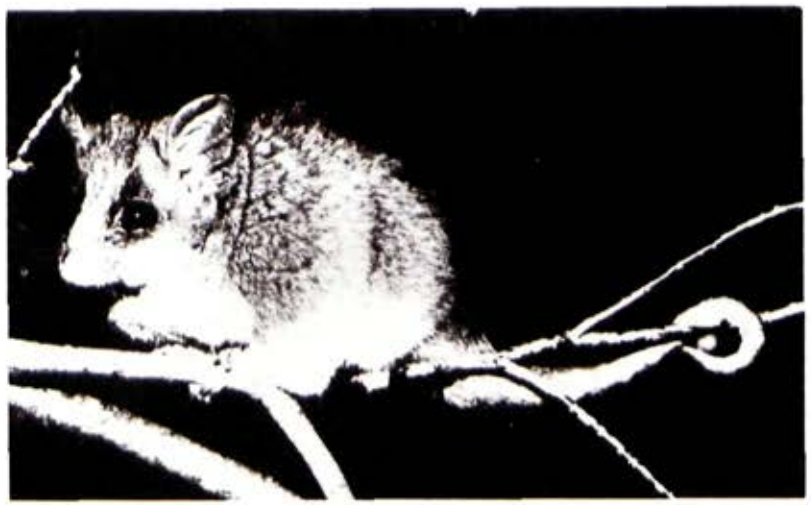
The platypus is common in Victoria, but its habits make observation difficult, as it digs burrows in soft friable river banks and shelters in these during the day. It feeds on aquatic invertebrates such as molluscs, worms, and yabbies obtained by sifting through bottom sediments. The eastern water rat occurs in the study area, probably along all rivers and inlets.

Ocean

The Skerries, offshore from Wingan Inlet, carry a colony of the Australian



Great grey kangaroo



Eastern pigmy possum

fur seal. Whales and dolphins commonly occur in the waters of Bass Strait.

Agricultural land

Most of the wild animals in agricultural areas are introduced species. They include the rabbit, hare, house mouse, black rat, sewer rat, fox, dog, and cat. The common ringtail and brush-tailed possum and a few bat species are native mammals frequently found in areas where adequate tree cover remains.

Birds

General forest habitat

Many bird species are widespread in forested areas. Among these, the red wattle-bird, rainbow lorikeet, gang-gang cockatoo, white-naped honeyeater, yellow-faced honeyeater, striated thornbill, and spotted pardalote feed among the crowns of the trees and of the understorey; the shrike-tit and white-throated tree-creeper feed in branches and along trunks of trees; the grey fantail feeds in the air beneath the tree canopy; the brown thornbill feeds in crowns of the understorey; and the superb blue wren and white-browed scrub-wren feed in the shrubby ground cover. Other species that frequent forest habitats are the boobook owl, yellow-tailed black cockatoo, satin bower-bird, crimson rosella, and laughing kookaburra (all of which nest in hollows in trees), the golden whistler, southern yellow robin, and grey shrike-thrush, the peregrine falcon, Australian goshawk, white-eared honeyeater, grey-breasted silvereye, eastern spinebill, common bronzewing, and Australian raven. The bell miner and yellow-tufted honeyeater live in colonies in vegetation along streams.

Wet forest

Bird species inhabiting this forest include the superb lyrebird and pilot-bird (both of which nest close to the ground). the wonga pigeon (which feeds upon fallen fruits and seeds), the red-browed tree-creeper (which forages in the upper trunk and branches of trees), the sooty owl, the large-billed scrub-wren, the eastern whipbird, the king

parrot, and the Lewin honeyeater. Other species characteristic of these forests are the olive whistler, rufous fantail, pied currawong, Australian ground-thrush, crescent honeyeater, pink robin, rose robin, and common bronzewing.

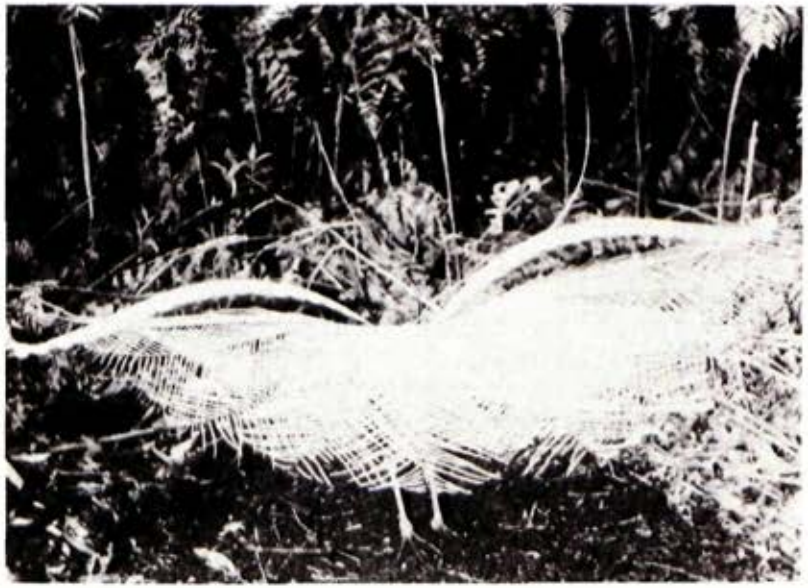
Several species are characteristic of low-land closed forest (jungle). These include the black-faced flycatcher, brown warbler, scarlet honeyeater, and brush cuckoo.

Dry open forest

The more open understorey and tussock grass ground cover of the drier forests provides ideal habitat for the spotted quail thrush and buff-rumped thornbill, which both frequently utilize the grass tussocks for nesting. Other characteristic species are the grey currawong (which feeds on insects, fruits, and the eggs of other birds), the white-winged chough (which lives in family groups with a well-organised social structure), and the scarlet robin (which tends to move out of the forest to more open areas at lower elevations over the winter months).

Inland woodland

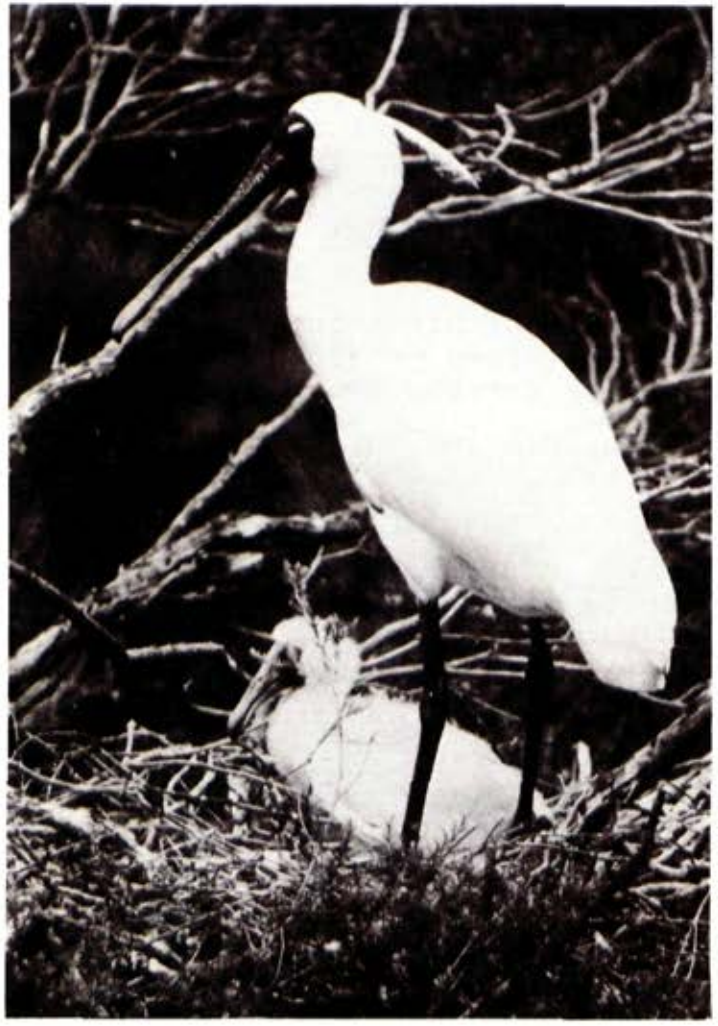
A wide range of birds inhabit these areas. The trees provide nectar, pollen, and insects for the brown-headed



A male superb lyrebird, during display

Gang-gang cockatoos

honeyeater, the musk and little lorikeets, and the striated pardalote. Orange-winged sittellas forage for insects on the trunks and branches of the trees, while the brown tree-creeper forages on the trunks and on fallen timber. The buff-rumped thornbill inhabits the low bushes and ground cover. The Horsefield bronze cuckoo and the pallid cuckoo occur in the study area during summer. Other common species are the jacky winter, rufous whistler, and Australian raven. Emus are widespread in these woodlands.



Female royal spoonbill with chick

Coastal woodland

Honeyeaters - such as the New Holland honeyeater, little wattle-bird, and eastern spinebill - abound in coastal woodland when banksias are in flower. Other species of coastal woodland include the crimson rosella, yellow-tailed black cockatoo, little grass-bird, and the brush bronzewing.

Dense heath

The southern emu-wren, tawny-crowned honeyeater, and field wren are found throughout areas of heath. The white-browed scrub-wren, superb blue wren, and brown thornbill are most common in dense heath. The eastern bristlebird also inhabits dense heath, particularly tea-tree thickets.

Open heath

In addition to species found in heath generally, the heath wren and brown quail occur frequently in areas of open heath. The ground parrot is a rare species found only in such areas.

Sub-alpine complex

Some birds of the grassland and open forest habitats are also found in sub-alpine areas. The common species are the Australian pipit, brown hawk, nankeen kestrel, black-faced cuckoo-shrike, grey shrike-thrush, and little raven. Pied currawongs are plentiful during the summer, but descend to lower areas in the winter.

Wetland

Wetlands are inhabited by the dusky moor-hen, eastern swamp hen, coot, and little grass-bird. The black swan, mountain duck, and black duck sometimes frequent inland water bodies.

Littoral habitat

The hooded dotterel and red-capped dotterel are common on beaches. Sheltered mudbanks provide resting areas for many water birds, and fringes of tall reeds and low scrublands provide nesting sites for some species. Silver gull and crested tern are common in this habitat. The pied oyster-catcher occurs on sandy shores, and the sooty oyster-catcher inhabits rocky shores. The reef heron also occurs in this habitat. The white-breasted sea eagle, which is fairly rare elsewhere in Victoria, may frequently be seen flying above ocean beaches.

A number of wading birds have been recorded in the study area. Waders, as a group, are highly specialized, having adapted to feeding from shallow waters, mudflats, beaches, and under mangroves. Many are of international significance because they migrate from their summer breeding grounds in the northern hemi sphere to feeding grounds along the coasts of southern continents. Among the species visiting the study area are the eastern curlew, greenshank, sharp-tailed sandpiper, red-necked stint, and bar-tailed godwit.

Spur-winged plovers, silver gulls, and dabbling ducks such as grey teal frequent areas of salt marsh, which also support the red-capped dotterel.

Estuary

Birds that feed on fish and aquatic invertebrates utilize open waters deeper than a metre. These birds include the Australian pelican, little pied cormorant, little black cormorant, and hoary headed grebe. Shallow waters between 15 cm and 1 m in depth are the feeding habitat of black duck and black swan. These shallow margins also support the white-faced heron, white egret, and royal spoonbill. The azure kingfisher also inhabits estuaries, where the white-breasted sea eagle is common in East Gippsland.

Ocean

The open waters of Bass Strait are the feeding grounds for large numbers of

Short-tailed shearwater

The pied currawong

seabirds. Common species are the black-browed albatross, Australian gannet, short-tailed shearwater, giant petrel, and white-faced storm-petrel. The little penguin breeds on Gabo Island and Tullaberga Island.

Agricultural land

Many native bird species obtain food in agricultural areas, although some have to depend on adjoining forest for breeding areas. The Australian pipit (which nests on the ground), the yellow-rumped thornbill (which nests in small shrubs), the predatory nankeen kestrel and brown hawk, the white-backed magpie, willy wagtail, magpie lark, eastern rosella, and Australian raven are all widespread. Stubble quail live in areas of tall grass or crops. The barn owl and black-shouldered kite, both predators of

insects and small vertebrates, vary greatly in number due to seasonal availability of food. Other common species are the spur-winged plover, grey shrike-thrush, pied currawong, white-winged chough, and galah. Among introduced species, the starling is common, while the goldfinch is established in some areas.

Reptiles

General forest areas

The garden skink is probably the only reptile species that can be considered a general forest inhabitant. It forages in bark, twigs, and other litter in all areas except white sallee woodland, where temperatures become too low. Although heliothermic, this species is small and consequently requires only small areas of sunlight for temperature regulation.

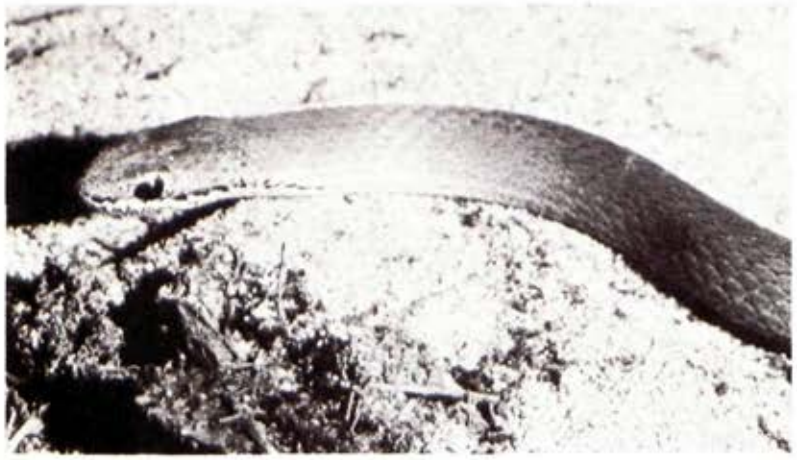
Wet forest

Lower temperatures and dense foliage cover make this forest type less suitable for reptiles than drier, more open forest types. The Spencer skink is almost wholly arboreal and is especially common where dead trees extend beyond the scrub canopy, providing open basking sites. Water skinks are also common in wet forest. The copperhead snake, which feeds mainly on frogs and small reptiles, is found in most parts of this habitat.

Dry open forest

The distribution of the reptile species recorded in this habitat is determined largely by the presence of suitable microhabitats. The Cunningham skink occurs only where rocky outcrops are available for basking sites, whereas the delicate skink and garden skink live among the litter on the forest floor. Variations in altitude also influence species distribution within this broad habitat type. For example, the Cunningham skink is replaced by the black rock skink where forests occur at higher altitudes. The copperhead snake and brown snake are common. The tree goanna commonly occurs in this habitat, sometimes reaching 220 cm in height.

Whites skink



White-lipped snake

Inland woodland

The brown snake and tree goanna are common in this habitat.

Coastal woodland

The tree dragon, common blue-tongue, Whites skink, black rock skink, and the tree goanna are common in coastal woodland. Common snakes are the red-bellied black snake and white-lipped snake.

Open heath

The tree dragon occurs in open heath.

Dense heath

The mourning skink, formerly thought to be rare, was found to be very common in dense heath. Other common species are the water skink and red-bellied black snake.

Sub-alpine complex

Grass meadows are ideal for grass skinks and white-lipped snakes. Copperhead snakes and water skinks are found in swampy areas. Rocky exposures provide suitable microhabitat for the Spencer skink.

Wetlands

The snake-necked tortoise occurs in rivers and swamps. This species needs sandy river banks for successful egg-laying. The tiger, red-bellied black, and copperhead snakes are also associated with streams and swamps within their respective ranges. They feed mainly on frogs. Eastern water dragons and the water skink are associated with streams.

Amphibians

The distribution of amphibians is greatly influenced by the presence or absence of free surface water or high humidity, which are necessary for survival and reproduction. The breeding habitat of most frogs is restricted to shallow waters and adjoining moist vegetation, although a few species reproduce in moist litter. Adult frogs can move away from waterholes into other habitats, but the following discussion refers to frogs only under wetland.

Wetland

The brown froglet, Ewing frog, and Victorian froglet are common amphibians occurring throughout the study area. The brown froglet is very common, particularly in shallow flooded situations. The Ewing frog is frequently found on reeds and low vegetation around dams and streams. Other species occurring in all but the high-elevation wet forest areas are the bullfrog (which breeds on temporary or permanent water), the spotted marsh frog and striped marsh frog (which live in shallow swampy areas and breed in still water), the golden bell frog (which generally breeds in the open water of dams and ponds), and the Verreaux tree frog (which is often found on low vegetation fringing permanent water). The Rocky River frog occurs in shallow rocky streams, and the giant burrowing frog breeds in dams and streams with earthy banks. Several species of toadlet occur in the area - during the breeding season they construct small tunnels under the moist litter.

Other amphibain species occurring in the study area include the Jervis Bay tree-frog, Peron tree-frog, leaf-green tree-frog, Blue Mountains tree-frog, Haswell froglet, and the barred frog.

Ewing frog

Rocky River frog

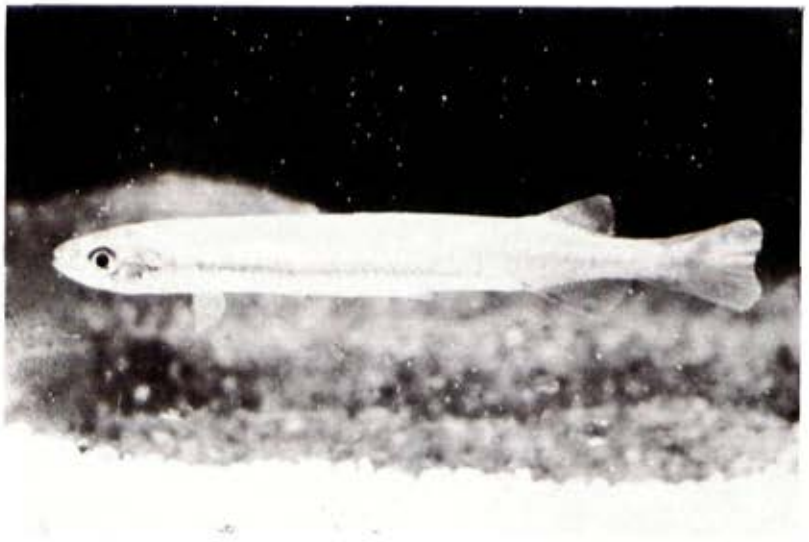
Fishes

Wetlands

The small fish that inhabit the streams of the area include galaxiids, smelt, gudgeons, larval lampreys, and mosquito fish. These provide forage for larger species and for waterbirds. The river blackfish has been recorded in the area and also the Australian grayling (in the Combienbar River). The introduced brown trout and rainbow trout are common in the streams.

Estuary

Because of their variable salinity, estuaries can support fish ranging from freshwater to marine species. Large estuaries permanently open to the sea support a greater number and range of species than small estuaries closed for prolonged periods. Many fish inhabiting the estuaries are marine species that enter them periodically or occasionally, but seldom remain in them for long periods, rarely or never move into the freshwater reaches of the system.



A minnow (galaxiid)

These include sea garfish and Australian salmon (which enter the estuaries to feed), school shark and snapper (which use the estuaries for spawning), and King George whiting, yellow-eye mullet, and ruff (which use estuaries as nursery areas and for adult feeding, although probably spawning elsewhere).

Another group of fish - including the flounders, flatheads, and cobbler - usually live entirely in marine waters, but some may use estuaries as a permanent habitat and spawning area.

Black bream and river garfish are examples of fish that permanently inhabit and spawn in inlets and are only rarely found in the sea.

Species confined to estuaries and the lower reaches of freshwater rivers and lakes include Australian bass and estuary perch.

Several other fish species, including eels, pass through the estuaries when migrating between rivers and the sea.

Ocean

The marine fishes generally have a wide distribution around Australia's coastline, and those of the study area coast are important to the local industry.

Invertebrates

East Gippsland has a particularly unusual invertebrate fauna for Victoria. This has many unique features brought about by the geographic position and climatic conditions, and also has many close affinities with the Australian East coast (and even subtropical) faunas that are totally absent from other areas of the State.

Terrestrial invertebrates

The study area is the only part of Victoria where so many typically northern species have been found. Some of these, butterflies and moths, have been listed by D. F. Crosby and A. N. Burns in *Victorian Naturalist*, volumes 68 and 77-80. Many other insect species of tropical origin have been observed, but the evaluation of the fauna is far from complete.

Interesting endemic species of ants, bees, dragonflies, stoneflies, and caddis-flies have been described. Other species endemic to the area or the near vicinity include several species of land snails, earthworms, and land planarians.

The largest land snail species in Victoria, *Pygmipanda kershawi*, is most prevalent in East Gippsland, although it also occurs outside the area.

Aquatic invertebrates

The freshwater invertebrate fauna of East Gippsland is typical for south-eastern Australia. However, the aquatic invertebrate fauna of Mallacoota and the lower parts of the Genoa and Wallagaraugh Rivera is particularly interesting and has several unique features. Of special note are the bivalve--ascidian dominated fauna of the Top Lake area, the jelly fish *Catostylus mosaicus*, which breeds in the area, and large populations of an undescribed species of bubble-shell, as well as several other species of opisthobranch molluscs that are undescribed or not recorded elsewhere in Victoria.

Endemic and Endangered Species

The area contains no known endemic vertebrate, but a number of endemic vertebrate species. These include ants, bees, dragonflies, stoneflies, caddisflies, land snails, land planarians, and earthworms.

One of two mammal species endemic to Victoria, the smokey mouse, has been recorded in small colonies in heathy woodland near Bemm River. It has a discontinuous distribution in Victoria and is considered as an endangered species.

The smokey mouse

The Australian grayling is found in the Combienbar River. It is one of the four Australian freshwater fish species considered to be seriously threatened (Lake, 1971). During the mid Nineteenth Century it was abundant in Victorian streams; by 1910 it was reported to be fast disappearing, and is now very rare. The reason for the decline is not known.

The river blackfish, another species listed by Lake as seriously threatened, also occurs in streams in the area.

Rare Species

A number of animal species in the study area are recognized as rare, although not in immediate danger of extinction.

The white-footed dunnart is rarely observed in Victoria and occurs in small colonies in yertchuk woodland along the Mooresford Track, in the west of the study area.

Apart from a colony in the Grampians, the brushtailed rock wallaby is confined to the east of the State, although it also occurs in New South Wales. One of the largest colonies in Victoria is believed to exist along the Snowy River gorge, on both sides of the river. Evidence of another colony in the study area has been found in the Bowen Range south of Deddick.

The wallaroo is another marsupial species rare in Victoria but more common in New South Wales. It has been recorded in the north-west corner of the study area.

The ground parrot inhabits coastal and montane heathland (mainly open heath) in a very discontinuous distribution from Noosa in Queensland to south-western Western Australia, including Bass Strait islands and Tasmania; it occurs in the eastern part of the study area.

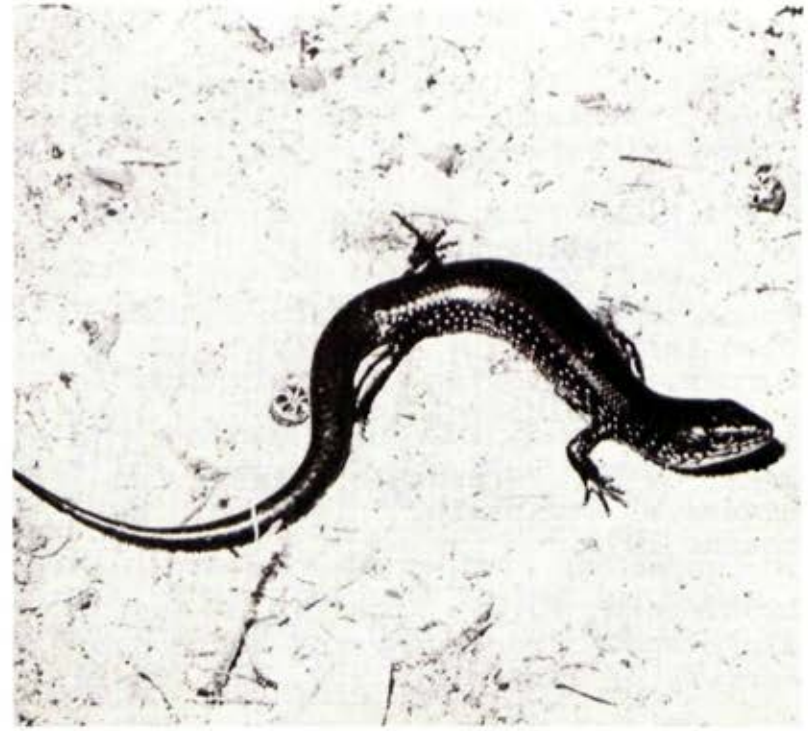
The glossy black cockatoo occurs in coastal and near-coastal areas from Rockhampton to Mallacoota, with an isolated population on Kangaroo Island, inhabiting a range of forest types from closed forest to woodland. It is quite uncommon in central and southern New South Wales and Victoria.

The eastern bristlebird is rare throughout its discontinuous distribution from Cunninghams Gap (Qld) to Marlo (in the study area). It inhabits dense low heath and adjoining scrub in coastal and some montane localities.

The sooty owl occurs from New Guinea south through the Great Dividing Range to the Dandenongs. It is apparently rare throughout its range, but this may be because it is difficult to observe. It occurs in the study area.

The beautiful firetail is found from Newcastle to Kangaroo Island and in Tasmania, and is widespread in coastal parts of East Gippsland. This species

The white-footed dunnart



Mourning skink

seems to have declined rapidly in recent years and is now considered rare, but has been observed recently in the study area.

The mourning skink is a reptile species normally considered rare, but appears common in dense coastal heath in the study area.

The diamond python, which is not known elsewhere in Victoria, occurs in the far east of the study area.

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WATER RESOURCES

Character of the catchments

Most of the streams in the area have their catchments entirely within the boundaries of the study area; the Snowy, Genoa, and Wallagaraugh Rivers are exceptions. The Snowy River is nearly 500 km long, but the other streams in the area are relatively short; all of them flow southwards into the sea.

Because the catchments are comparatively narrow and their sides usually steep, heavy general rains quickly produce large floods. Owing to the generally steep gradient of the river beds, these floods travel rapidly, and because the rivers flow in deep valleys or gorges throughout much of their length, no ponding occurs over flats, and therefore very high peak flows may develop.

Serious flooding has occurred only in the lower reaches of the Snowy, Cann, and Genoa Rivers; although the flood waters recede fairly rapidly, they may cause considerable damage.

The stream catchments are predominantly forested, and except for tracks around their boundaries in the upper reaches, some are free of clearing and roads.

Stream-flow records

Table 6 shows stream-flow data for selected gauging stations. There are only two long-term records included, both of which were recorded on the Snowy River - at Jarrahmond and near Buchan. These records do not represent the present conditions in the catchment areas, as they contain data from before the Snowy Mountains Hydro-Electric Authority commenced to store and divert water from the Upper Snowy River area. The Snowy Mountains Project affects only 14% of the total 1.4 million ha above Orbost, but it has been estimated that about half the annual flow of the river came from this area. The yield of the rest of the catchment, being partly in rain-shadow, is rather poor except when general rains occur. However, the amount of water diverted from the Snowy River in the Snowy Mountains is relatively insignificant.

Due to the great variability of stream-flow, short-term records are usually unreliable indicators of normal or

Table 6

Stream-flow Data for Selected Gauging Stations

Stream	Gauging point	Years recorded	Annual discharge (Ml)			Minimum monthly discharge (Ml)	Peak Flow * (Ml/day)
			Maximum	Minimum	Mean		
Snowy	McKillops Br	5	979,500	268,000	535,300	1,419	(a) 109,100 (b) 660,600
	Near Buchan	34	4,647,500	280,000	1,750,300	2,220	(a) 489,300 (b) 636,100
	Jarrahmond	33	4,014,100	388,000	1,804,600	1,665	(a) 599,400 (b) 650,800
Deddick	Deddick	6	136,300	20,900	57,900	234	(a) 18,500 (b) 78,800
Bemm	Bemm River	3	304,000	105,200	172,200	3,293	(a) 38,300 (b) 84,500
Cann (West Branch)	Weeragua	13	115,900	12,300	56,600	493	(a) 4,600 (b) 53,800
Genoa	Wangarabell	10	190,500	14,100	96,400	173	(a) 59,900 (b) 225,100

* (a) to April 1970

(b) on 6 February 1971

The Snowy River at Orbost

average conditions. Even the relatively long-term records may be significantly changed by later information.

In addition to those listed in Table 6, stream-gauging stations are in operation on the Brodribb, Rocky, Errinundra, Thurra, and Cann (East Branch) Rivers.

Rainfall

The incidence of rainfall in the area is affected by monsoonal influence from the north and also by cyclonic disturbances, mostly from the east. In many ways the climate is governed by different factors from those affecting the rest of Victoria. While the amount of rainfall varies widely throughout the area, the monthly precipitation is fairly uniform. Consequently most streams maintain reasonable flows. Droughts sometimes occur, but they seldom last longer than 3-4 months.

Salinity

Regular salinity observations are being carried out on the more important streams in the area and salinity records are available for the Snowy, Brodribb, Rocky, Deddick, Bemm, Cann, Errinundra, Genoa, Thurra, and Betka Rivers. The average amounts of total dissolved solids in these rivers range from 65 to 170 p.p.m.; these amounts increase slightly during the seawards passage of the rivers.

In March 1968 during a drought, salinity of all flowing streams in the area and of pools originating from these streams was tested, and even at those very low stages the highest salinity observed was only 365 p.p.m.

Groundwater

Because there has been little need to exploit underground water, little exploratory work has been done. However, it is probable, from geological considerations, that there are reserves of groundwater beneath many of the Tertiary and Quaternary alluvial deposits.

LAND SYSTEMS

The preceding chapters have discussed individually the various environmental factors - climate, geology, physiography, soils, vegetation, and fauna. However, no one factor alone determines land use; it is their combined effect that controls the uses to which the land may be put. The mapping of land systems is an attempt to consider the different environmental factors in combination.

The fundamental land unit (or component) may be regarded as an area in which the environmental factors do not vary enough to significantly influence any of the likely forms of use such as agriculture or forestry. Such a component may be, for example, a section of a ridgetop. Because these components are frequently small (say 5 - 20 ha), it is practical to define land units as combinations of components - for management purposes and as an aid to mapping. In the land unit, such as a shallow basin of the order of 100 ha or more, the fundamental components show a predictable pattern.

As an aid to mapping and general description, these land units may be further grouped into mapping units, termed land systems. Similar land systems may be combined into land zones.

The land systems and land zones of the study area have been described and mapped by B.M. Nicholson (see Map 4). Land systems are recognized on geomorphic grounds and thus have characteristic patterns of land forms. These patterns were delineated on 1:80,000 aerial photographs and transferred to a 1:250,000 base map. The land systems were visited in the field, noting climate, geology, topography, vegetation, soils, land use, and their inter-relations.

In the mountains land system boundaries are generally sharp, but on the plains the subdued relief and occurrence of similar leached sands in adjacent land systems makes some boundaries - particularly those between the Wooyoot, Waygara, and Barga Land Systems - more difficult to map.

Table 7 lists the characteristics of the land systems.

TABLE 7

LAND SYSTEMS OF THE EAST GIPPSLAND STUDY AREA

Land System	Map Symbol	Area ha	Area % of total	Mean Annual Rainfall	Parent Material	Land Forms	Soils	Native Vegetation	Land Use Capabilities
Errinundra	E	58300	7%	900-->1300mm	Ordovician sandstones & claystones (mainly) & Devonian granodiorite	High plateaux with rolling landscape	Friable reddish & brownish gradational soils	Open forest of shining gum, brown-barrel, and alpine ash above 900m; broad-leaved peppermint, narrow-leafed peppermint and candlebark below 900m	Water conservation of prime importance because of high precipitation and absorbtive soils; hardwood production very valuable and nature conservation important. Some areas are cleared for grazing, which has further potential in forested land below about 1000m elevation.
Kirkenong	Kg	14600	2%	700--900mm	Ordovician sandstones & claystones (mainly) & Devonian granodiorite	Undulating, gently sloping high plateaux	Friable brownish gradational soils	Open forest of white sallee, broad-leafed peppermint, and narrow-leafed peppermint	Important for water conservation, and nature conservation. Most of the area is used for grazing (improved pasture), but there is some potential for timber production.
Cabanandra	C	9600	1%	750--1000mm	Ordovician sandstones & claystones	Low hills with rounded ridges	Friable reddish & brownish gradational soils	Open forest of white sallee, candlebark, and broad-leafed peppermint	Water conservation is important, as is timber production in the taller forests. The limited gentler slopes and deeper soils can support high-quality improved pastures.
Moonkan	M	15200	2%	900-->1300mm	Palaeozoic quartzites, claystones, and sandstones	High rounded ridges & peaks with deep dissection	Friable reddish & brownish stony gradational soils	Open forest of candlebark, broad-leafed peppermint, messmate, and alpine ash above 1,100m	Soils of this land system are prone to erosion if disturbed. Important for water conservation, hardwood production, and (because it is rich botanically and has spectacular scenery) nature conservation and recreation. Too steep for agriculture.
Tubbut	T	15400	2%	650--900mm	Devonian granodiorite	Moderately steep, deeply dissected valleys	Yellowish-brown duplex soils	White box woodland westwards of Tubbut; red stringybark open forest eastwards	The erosion hazard is fairly high. About one-fifth of the area is under pasture for beef cattle and wool, and these have further potential. There is limited scope for hardwood production and nature conservation.
Jingallala	J	17900	2%	600--900mm	Devonian granodiorite	Steep hill with long narrow ridges & V-shaped valleys	Brown gravelly loams with reddish-brown duplex soils on gentler footslopes	Red stringybark open forest above 600m; woodland of white box or white cypress pine below 600m	The erosion hazard is high. Low potential for agriculture because of the short growing season, steep slopes, and poor access. Timber is generally of poor quality and stands are of low density and relatively inaccessible. The rugged landscape favours nature conservation and recreation.
Wyangil	Wl	27900	3%	600--900mm	Ordovician sandstones & claystones	Long narrow ridges & deep V-shaped valleys; slopes greater than 15°	Friable reddish & brownish gradational soils, & (lower elevations) reddish & brownish gradational soils	Mainly open forest of red stringybark with woodlands of white sallee on exposed ridges above 1,100m; open forest of candlebark and broad-leafed peppermint in wetter areas between 750 and 1,400m altitude	Erosion hazard is high, and damage to the native plant cover should be minimized to protect the Deddick and Snowy Rivers. Hardwood production is important in the taller forest. Spectacular scenery and interesting vegetation make this land system valuable for nature conservation and recreation
Bullamalk	Bk	109200	13%	1000--1300mm	Ordovician sandstones & claystones	Long, narrow ridges & deep shaped valleys; slopes greater than 20°	Friable reddish & brownish gradational soils, above 700m reddish & brownish gradational soils below 700m	Open forest of messmate, mountain grey gum, and broad-leafed peppermint above 700m; silvertop below 700m	Important for water conservation, hardwood production, nature conservation and recreation.
Weeragua	We	67100	7%	900--1000mm	Ordovician sandstones and claystones	Moderately long, narrow ridges & deep V-shaped valleys; sloped greater than 20°	Reddish & brownish gradational soils	Open forest of silvertop (mainly), with red stringybark open forest on northerly aspects	As for Bullamalk land system.
Wat Wat	Wt	36700	4%	1000-->1300mm	Devonian granodiorite	Long, broad, steep ridges; rectangular drainage pattern	Friable reddish & brownish gradational soils above 750m; yellowish-brown gradtionsl soils below 750m	At altitudes greater than 750m, open forest of candlebark, brown-barrel, alpine ash (above 1100m), shining gum (above 900m), mountain grey gum, and messmate; at elevations below 750m, silvertop open forest	As for Bullamalk land system.
Kowat	Kt	50500	6%	850--1000mm	Devonian granodiorite	Moderate steep, broad ridges, wide valley, rectangular drainage pattern	Stony friable reddish & brownish gradational soils above 850m; yellowish brown gradational soils below 850m	Open forest of messmate, brown barrel and mountain grey gum above 600m; silvertop below 850m	Erosion hazard is high. Important for water conservation timber production, and (mainly because of its precipitous peaks) nature conservation and recreation.
Yalmy	Y	11100	1%	750--900mm	Devonian Snowy River volcanics	Broad steep ridges, often with gorge-like valleys	Reddish & brownish gradational soils	Open forest of silvertop above 500m altitude; open forest of white stringybark below 500m	Potential for hardwood limited, for agriculture very limited. The gorges, with grand scenery and (often) unique flora, are valuable for nature conservation and recreation.
Koola	Ka	10300	1%	850--1150mm	Devonian sandstones, siltstones and conglomerates	Dissected land form with moderately steep, rounded ridges & narrow, often gorge-like valleys	Reddish & brownish gradational soils	Open forest of silvertop or, where mean annual rainfall is less than about 1,000m and aspect dry, red stringybark	Erosion hazard is very high where rainfall is less than 1,000m annually. Important for water conservation, timber production (in the taller forest), and nature conservation and recreation (especially in the gorges).
Pinnak	P	93300	10%	800--1150mm	Ordovician sandstones & claystones	Hilly with short narrow ridges & valleys	North of Princes Hwy. stony reddish & brownish reddish gradational soils; S. of Princes Hwy. yellowish-brown gradational soils	Open forest of silvertop and (lower slopes) white stringybark, with red stringybark on drier sites	Most of the land is used for hardwood production with some bush grazing. There is potential for improved pastures on the gentler slopes, water supply catchments, and nature conservation.
Wurrin	Wn	72200	8%	800--1000mm	Devonian granodiorite	Hilly to undulating; short, broad, rounded ridges; rectangular drainage pattern	Yellowish-brown gradational soils	On moist well-drained sites, open forest of silvertop (upper slopes) or white stringybark (lower slopes); white stringybark open forest on drier aspects and steeper slopes	Used mainly for hardwood production, with some bush grazing. May have potential for further agricultural development. Limited value for nature conservation and recreation.
Wooyoot	Wo	170500	19%	900--1000mm	Devonian granodiorite & Tertiary deposits	Dissected plains, scarps, and depressions	Friable yellowish or reddsih gradational soils; leached sands	Open forest of silvertop and (lower slopes) white stringybark; and heaths of scrub she-oak and spear grass-tree	Hardwood production is important. The Betka River catchment supplies Mallacoota and an increasing additional demand for conservation of water for town supply is likely. Hardly any land has been cleared although the gradational soils have agricultural value. There is potential for extensive nature conservation reserves.
Waygara	Wa	56200	6%	750--900mm	Tertiary fluviatile deposits	Dissected plains	Reddish-brown or yellowish-brown duplex soils; leached sands	Open forest or woodland of silvertop; woodland of white stringybark	Hardwood production is important. The duplex soils have agricultural potential, although costs of development are high. There are valuable (although limited) areas for nature conservation and recreation.
Noorinbee	N	21300	2%	750--1000mm	Quaternary fluviatile deposits	Riverine terraces	Earthy brown or yellowish brown gradational soils; brown loams	Open forest of coast grey box; heath of scrub she-oak or spear grass-tree; closed forest of lilly-pilly, vines, ferns, and epiphytes	Most of the land has been cleared for agriculture. The public land is particularly important for the conservation of closed forest.
Wau Wauka	WW	3800	1%	800--1000mm	Recent estuarine deposits	Low terraces	Leached sands; saline soils	Woodland of swamp gum *Eucalyptus ovata* on leached sands, scrubs of swamp paper-bark and giant honey-myrtle, and various heath associations	Limited potential for agriculture. Much of the land has been periodically grazed after burning. Most of the land system is important for nature conservation and recreation, providing feed and shelter for wildlife.
Barga	Ba	16800	2%	750--1000mm	Quaternary marine sand	Longitudinal dunes	Leached sands	Woodland yellow stringybark southern mahogany, brown stringybark, and white stringybark; heaths of spear grass-tree and scented paper-bark	Low potential for timber production and agriculture. Some land particularly adjacent to the ocean or inlets, is valuable for nature conservation and recreation.
Boole Poole	Bp	7500	1%	750--1000mm	Recent marine sand	Longitudinal dunes	Weakly differentiated calcareous sands; weakly differentiated acid sands	Heath of coast wattle or coast tea-tree; woodland of coast banksia (east of Sydenham Inlet); woodland of southern mahogany and coast banksia (west of Sydenham Inlet)	Very prone to wind erosion following disturbance. Damaged by tourists and cattle (and associated burning). Valuable for nature conservation and recreation.

PART III

LAND USE

HAZARDS

Physical Hazards

A hazard in the use of land is anything that threatens to reduce its ability to serve chosen purposes.

Because of interdependence of the various environmental factors, a change in one usually produces changes in others until a new stable relation, which may be more or less productive, is attained. Complete understanding of the interrelations between environmental variables would enable us to predict those changes that are likely to cause a decline in productivity. However, much of our present knowledge of land use hazards comes only from experience. Consequently a knowledge of the present condition of the land in relation to the way it is used has great value.

Soil erosion

In East Gippsland, erosion resulting from soil disturbance by Man's activities (such as clearing, burning, cultivating, grazing, timber extraction, earth moving, track construction, or trampling) is generally mitigated by a long growing season. Once the native vegetation is removed, severe water erosion can occur quickly because of the high and often intensive rainfall. Fortunately, soil wash is usually checked by rapid regrowth of vegetation. The water erosion hazard is greatest in the largely uncleared mountainous two-thirds of the area because of the steep slopes. It is also severe on the higher country, in the drier north-west, where the growing season is shorter. Apart from the limited areas already suffering water erosion and the wind-eroded stretches of the coastal dunes, soil loss is generally an important potential hazard rather that a present problem.

Water erosion affects not only the productivity and aesthetic appeal of the land but also the flow rates of the streams and the quality of the water used for urban and farm supplies. In addition, it causes siltation in the reservoirs and increased flood damage. Wind erosion along the coast, apart from making conditions unpleasant for visitors, results in the destruction of unique vegetation, and the sanding-up of buildings, roads, and channels.

The most extensive water erosion in the study area probably originates from rilled bush tracks on grades that are

Eroded track

Dunes above the Ninety-mile Beach breached by "blow-out" after partial destruction of the protective cover of coast tea-tree

too steep or where inadequate provision has been made for run-offs, or both. Silt is often deposited on the Snowy River flats and, in the occasional major floods, the banks of the Snowy River can suffer severe scouring.

Gully and sheet erosion is limited mainly to where the mean annual rainfall is about 750 mm or less, on dry aspects where the steep slopes have been overgrazed by stock and rabbits. Examples may be seen in the north-west on Devonian granodiorite (Tubbut and Jingallala Land Systems), in the west on Snowy River volcanics (Yalmy Land System), and in the south-west on Tertiary fluviatile deposits (Waygara Land System). Sheet erosion, sometimes followed by gully erosion, also occurs in the wetter areas after ground cover has been reduced by "hot" bushfires. In the mountains the better-structured, porous soils of higher elevations, particularly those on

Ordovician sediments, are usually less prone to these hazards.

Wind erosion of coastal sand dunes, although widespread, is generally moderate rather than serious. Frequent burning by lessees over many years and, more recently, by visitors can be blamed for most of it. However, the explanation of some of the most extensive areas of bare dunes in the study area, notably at Tamboon Inlet and north of Point Hicks and Lake Barracoota, remains obscure. Some other dunes near the mouths of rivers (e.g. the Snowy River) became denuded very recently when the rivers shifted their entrances to the ocean.

Fire

The genus *Eucalyptus* and many of the understorey species that dominate Victoria's forests have adapted to survive in an environment renowned for the severity and frequency of fires. Before European settlement, fires were started by lightning or by the Aborigines, but after settlement the pattern changed greatly as the incidence of fires caused by Man increased. Fires for land clearing were not always confined to the intended area, and fire was used to promote the growth of fresh palatable grass on forested grazing areas. Severe fires were encouraged and allowed to rage unchecked.

Sand dune spilling into Thurra River, north of Point Hicks

After considerable areas had already been cleared for agriculture and when the timber industry began to develop, it was realised that forested land was not an unlimited resource that could be maltreated and neglected. On the contrary, it must be managed and protected from fires if its benefits are to be obtained.

In East Gippsland only about 8% of the total area has been cleared for agriculture, and thus large tracts of forest land remain. Several small settlements occur throughout the forested area and these are often threatened by forest fires. The inhabitants of these settlements usually depend on the forests for part of their existence.

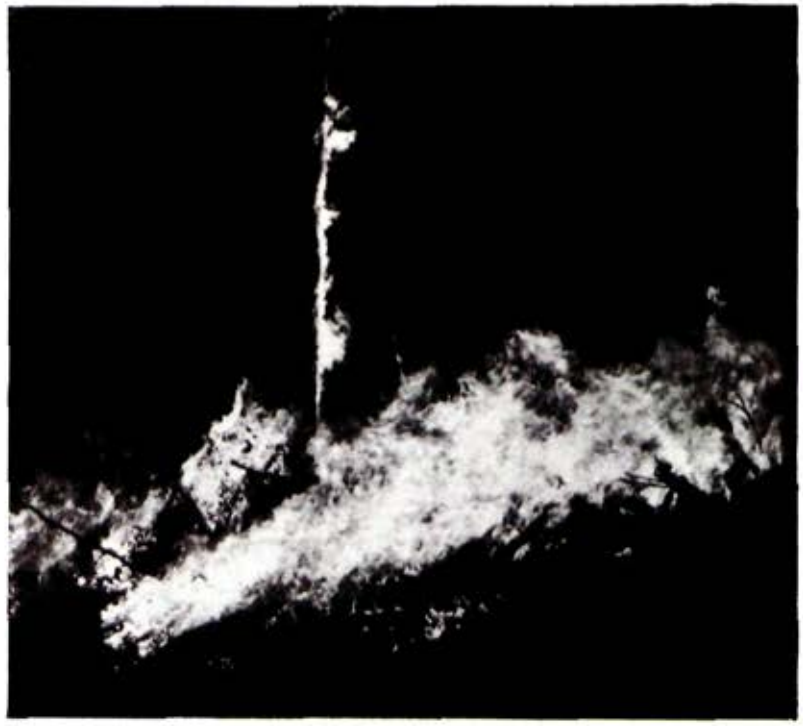
On the basis of fire hazard, three broad forest types are recognizable in East Gippsland: mountain and plateau; coastal and foothill; and rain-shadow.

Mobile sand invading burnt stand of coast tea-tree

Mountain and plateau areas have a high rainfall that is reasonably well distributed throughout the year; soils are deep and conducive to fast-growing vegetation. Here the fire hazard is much lower than for other types of forest because the moist sheltered gullies only rarely dry out during summer.

Coastal and foothill country is flat and undulating, with a dense distribution of fuels that dry out quickly and uniformly over the entire zone. Since these areas remain dry for 6-7 months each year, the fire hazard is very great.

Rain-shadow country receives little rainfall and the terrain is very rugged and inaccessible. The sparse vegetation dries out quickly and stays dry for long periods of the year. The fire hazard in this type of forest is moderate. Lightning starts most of the fires, as 'dry' thunderstorms are prevalent during summer months.



Fire in coastal forest

Each of these forest types generally presents its own special problem in fire-protection but, because of the long fire season and the high concentrations of flammable fuels, East Gippsland is recognized as one of the worst fire-risk areas in Victoria.

The numbers and extent of fires that have occurred in the Fire Protected Area between 1963 and 1973 are listed in Table 8. It is known or suspected that lightning caused approximately 20% of these fires (accounting for 0.9% of the area burnt). A further 30% (burning 63% of the total area burnt) are believed to have been deliberately lit. The remaining fires were started accidentally. Thus, the most serious fire threat is from people, who, in one way or another, started approximately 80% of the fires, which accounted for 99% of the total area burnt.

Fire prevention is carried out in the form of extensive fuel-reduction burning with low-intensity fires during the autumn and spring. The technique is a most important activity in reducing the fire hazard around settlements, on private property, along roads, and around tourist spots. Broad-acre fuel-reduction burning is also employed, using both ground crews and aircraft. Aerial ignition of fuel-reduction fires over wide areas produces a patchwork or mosaic that has a general effect of reducing fuel quantities without removing all cover and sources of food

White stringybark forest after severe fire

TABLE 8

FIRE STATISTICS FOR THE FIRE-PROTECTED AREA OF THE EAST GIPPSLAND STUDY AREA

Year	Causes - known or suspected													
	Escapes from other fires		Deliberate		Tourists		Lightning		Other**		Unknown		Total	
	No.	Area*	No.	Area*	No.	Area*	No.	Area*	No.	Area*	No.	Area*	No.	Area*
1963/64	3	600	13	600	4	200	10	40	5	-	3	-	38	1,400
1964/65	4	200	14	800	5	-	13	400	7	600	4	40	47	2,000
1965/66	3	-	8	500	4	400	11	40	7	-	3	-	36	900
1966/67	3	-	3	-	2	-	5	-	7	-	-	-	19	-
1967/68	27	32,000	43	73,000	6	100	4	300	13	-	1	100	94	106,000
1968/69	13	700	16	300	1	-	8	40	9	40	2	-	49	14,100
1969/70	-	-	-	-	-	-	4	-	8	-	-	-	12	-
1970/71	5	200	-	-	1	-	3	-	2	-	-	-	11	200
1971/72	9	500	20	6,100	1	-	12	100	9	-	-	-	51	6,700
1972/73	27	10,500	19	16,600	5	40	20	500	8	700	5	8,700	84	37,000
Total	94	44,700	135	98,600	29	600	90	1,400	75	1,700	18	8,900	442	156,000
%	21.3	28.7	30.6	63.2	6.6	0.4	20.4	0.9	17.0	1.1	4.1	5.7	100.0	100.0

* area in hectares

** includes house, car, and tip fires.

required for wildlife. The area planned to be burnt in this manner is 100,00 ha annually.

Studies have shown that, because fire has always been a feature of the environment, exclusion of fire may cause a marked change in the species composition of the plant community.

Protection of both public and private assets in the area depends on efficient communications, good access, regulation of forest fuels, sufficient equipment, and an adequate work force of trained experienced personnel.

Floods

Much of the land at present developed for agriculture is low-lying and adjacent to rivers, on the rich alluvial flats. Under natural conditions, large areas of these flats were subject to flooding and were poorly drained. Erosion in the catchment of the Snowy has added to the flooding problem because of deposition of large quantities of sand and gravel in the lower reaches, thus reducing the flood-carrying capacity of the stream. As mentioned in Chapter 5, rainfall in East Gippsland may be particularly heavy, leading to rapid rises in the streams.

Some flood-control work has been carried out on the Snowy, Brodribb, and Cann Rivers. This has included the removal of snags and obstructions from the river beds, protection of eroded banks, and construction of levee banks. Dams constructed as part of the Snowy Mountains Hydro-Electric and Irrigation Scheme in the headwaters of the Snowy allow minimal control over the flow of this river.

The probability of flooding is increased when the natural vegetation of the stream catchment is destroyed.

Snowy River flats near Orbost during the flood of 1971. The railway station is near the centre of the picture

Biological Hazards

Pest plants and animals

The majority of problems associated with pest plants and animals in the area occur on or near privately owned land, and along the river systems. Although blackberry and rabbits are being controlled in most areas, these pests demand constant attention and pose a threat to any area that Man has disturbed.

Dingoes and feral dogs are fairly prevalent in undisturbed Crown Land and grazing leases. Under the present system of trapping, these animals are causing little harm to domestic stock in agricultural land. Pest animals frequently live around the margins of uncleared land and move onto cleared land to feed.

Dingoes and feral dogs occur in most of the timbered areas. Their diet consists mainly of native mammals (particularly wallabies and wombats), rabbits, birds, and reptiles. They carry hydatids, which could present a problem if the populations were not controlled.

Foxes in the area feed mainly on native mammals, rabbits, herbage, and insects. Feral cats were widespread, feeding on small mammals, lizards, and insects. The importance of predation on native animal populations by foxes and cats is unknown.

Rabbits occur mainly on freehold properties and on the margins of Crown land. They rarely penetrate more than about one kilometre into virgin forests and heathland.

Wombats damage the boundary fences of farms in some areas but the costs of repairs are not great.

A survey carried out in 1970 revealed 22 species of noxious weeds in the area. Of these only blackberry, great mullein, and thorn apple are of much importance. These weeds occur mainly in areas where the native vegetation has been disturbed or cleared including roadsides. Blackberry encumbers the banks of many streams, where its impenetrable thickets create serious problems for trout fishermen, graziers, and others.

The other weeds, although of minor importance on public land, could spread rapidly if existing control measures were relaxed. As weeds are distributed by the river systems, new infestations appear frequently near the streams after floods. These infestations warrant close attention to prevent their spread onto adjacent land.

Cinnamon fungus

The cinnamon fungus *(Phytophthora cinnamomi)* is widely distributed in the coastal forest of East Gippsland, where it is consistently associated with severe mortality, die-back, and deca-

dence of eucalypt forests, especially on poorly drained sites. The hazard posed by this organism is related to the depth of soil overlying the impervious sandy-clay hard pan, and to soil temperature.

The fungus is scattered in the low foothill forests, but in the high-altitude forests it is found only in some isolated spots where Man has been active.

Biological evidence tends to suggest that cinnamon fungus was introduced into this region recently, and many of the native species have little resistance to the root rot produced by this organism. The infection is of long duration and, because the fungus cannot be economically eradicated from the soil, such an infection causes a change in the species composition of the area.

The phenomenon is well documented in other parts of Victoria and Australia. Infection considerably decreases the number of ways the area can be used.

A considerable amount of information has been amassed by the Forests Commission and other organizations that have conducted research on the distribution, biology, and ecological impact of the cinnamon fungus and on land use following infection by the organism. Systems of land management of infected areas are being developed. These include reforestation with introduced disease-tolerant eucalypts, use of plantation methods, and land sanitation.

Area infected by cinnamon fungus

Man

Many of the land use hazards mentioned above are caused or aggravated by the activities of Man. In addition, Man may also cause environmental harm by vandalism, depositon of rubbish, and the misuse of chemicals.

Chemicals are widely used in agriculture and are now becoming increasingly important in forestry. Pesticides may spread

beyond the area being treated, particularly if applied from the air. Insecticides also affect birds and animals that feed on poisoned insects. Fertilizers are less obviously an environmental hazard but, by changing the nutrient status of the soil or water, they cause changes in the species and number of individuals present.

Waste is an inevitable by-product of human activity. The disposal of domestic and industrial wastes must be carefully controlled and planned to minimize environmental harm. Discharge of sewage into lakes and inlets could quickly result in pollution problems.

Careless disposal of rubbish results in despoilment of the scenic values that are such an important attribute of land. The hazard is greatest along roads and at viewing points, picnic areas, and camp sites.

NATURE CONSERVATION

Conservation is concerned with Man's relation to his environment. It was described in Chapter 2 as being the wise or balanced use of resources to provide for his physical and spiritual needs, both now and in the future. This chapter discusses those aspects of conservation concerned with the native species, communities, and landscapes of the area, which are commonly grouped under the collective heading "nature conservation". The following chapters consider other aspects related to the production of food, fibre, and minerals. In some cases these activities also depend upon native species.

Ecology

Irrespective of their particular interest, all conservationists are basically concerned with environments and their use. The environment has both aesthetic attributes, such as inspiring landscapes and remoteness, and physical attributes such as topography, timber, and minerals. Its character is due to the combined effect of all its individual features, such as climate, soil, and vegetation, which have been discussed in the preceding chapters. Knowledge and understanding of these and of their interactions are essential for conservation.

Ecologists have developed terms and concepts that, although only convenient working abstractions, clarify our thinking and enable us to describe and discuss the otherwise incredibly complex web of interactions.

The ecosystem - the unit of study - is applicable on many scales: the whole world may be regarded as an ecosystem, as can a lake, a forest, or a small part of the soil beneath the floor of the forest. Each ecosystem contains four interacting parts: the inorganic materials, producers (green plants), consumers (chiefly animals), and decomposers.

Biological communities

Biological community is the term given to any naturally occurring group of different organisms whose members inhabit a common environment, interact either directly or indirectly with each other (especially through food chains), and are relatively independent of other groups. Some communities form more readily recognizable entities than

others, for example the flora and fauna of a pond, but in fact no community is ever a closed system, as interactions, movement of animals, and transfers of energy continuously take place across any arbitrarily defined boundary.

Stability

Each community has evolved within its particular environment, and so together the species form a dynamic but stable system. Undisturbed, the community represents the best combination and relative abundance of the available plant and animal species that can continue to live and compete with each other in the prevailing soil, topographic, hydrological, and climatic conditions.

Different systems have varying degrees of stability. The more stable tend to be those containing the greatest variety. In some of the most vulnerable, stability depends on some particular set of circumstances such as specialized vegetation; others may have inherent topographic, soil, or hydrological weaknesses.

Undisturbed coastal scenery, an outstanding natural feature of the study area

The Influence of Man

Man is part, and to us a very important part, of any world ecosystem. Although he is only one of many species, his dense and rapidly growing centres of population and his ability to manipulate other species, and parts of his physical environment, make him a very significant and influential one. He has affected, either directly or indirectly, all parts of the study area. Pressure of grazing by rabbits and domestic stock and invasion of exotic weeds have changed the original pastures. Man's activities have changed for generations - and perhaps for ever - the pristine nature of much of the land. A network of access tracks covers the area, and so few, if any, parts of it are further than 5 km from the nearest vehicle track.

Despite this pervading effect, it is convenient and generally accepted to arbitrarily distinguish between artificial systems (such as urban areas and farms) in which Man's influence is obvious, and "natural" ones (such as eucalypt forests) in which it is not obvious, even though it may still be present in the form of logging, exotic weeds, and feral animals. Much of the East Gippsland study area remains much closer to its original natural condition than "natural" areas elsewhere in the State.

Man must provide himself with adequate supplies of food and fibre, many of which he can best obtain from artificial systems such as cropping and grazing enterprises. He must manage such systems in a way that permits the combination of introduced plants and species to maintain general stability within the soil, topographic, hydrologic, and climatic systems, just as the original natural combination did.

Certain other of Man's needs can best be provided by natural systems. Awareness of this is causing a rapidly growing demand, here as elsewhere, for land to be set aside and managed specifically to preserve the natural or native fauna, flora, and landscapes.

Conservation Needs

Some of the types of land required to satisfy the needs of nature conservation are discussed below. Each has value for our edification, inspiration, and recreation; each requires different levels of management and manipulation. Their naturalness can vary considerably, being greatest in large areas used for reference and least in those intensively managed to preserve some endangered species, or the remnant of a former landscape, and in areas that people are encouraged to visit for education and recreation.

None necessarily requires a monopoly of the land. Often they are compatible with each other or with commercially productive uses.

Areas for reference

Viable and relatively undisturbed examples of all types (differing in land forms, soils, or communities) need to be set aside as reference areas to which those concerned with changing and managing land for either productive or aesthetic uses can refer when trying to solve the resultant problems. As with references and standards used in other fields, these areas must not be tampered with, and natural processes should be allowed to continue undisturbed. Access should be restricted to competent observers carrying out approved work, and no experimental manipulation should be permitted.

Continued studies of natural features and their dynamics increase our knowledge of the ecological laws and processes on which Man's survival may ultimately depend. Reference areas act as standards against which the progress and effect of human alteration and utilization of the land can be measured. They will also provide a valuable gene pool of wildlife species. Such material is already being used, and will be increasingly used, to produce genetically strong domesticated species. Although all land types need to be represented in reference areas, the need is most urgent in those that have been extensively developed for uses such as agriculture.

Few, if any, areas suitable for reference remain in some land types, such as the river flats of the Snowy and other streams and other land types of limited extent in grazing areas. Conscious effort must be made to retain reference areas of other land types currently being developed, for example some of the open forest types being increasingly utilized for recreation and hardwood timber.

Park areas

Other examples of each of the major land types and their biological communities are also required for the less restrictive inspirational, educational, cultural, and recreational purposes.

Several categories of park are needed. Large parks containing outstanding natural features and diverse land types are of nation-wide significance. These have visitor density restricted to a generally low level in order to impair their naturalness as little as possible (although limited areas such as information centres may be intensively used). They may contain areas of wilderness suitable for solitude, inspiration, and primitive unconfined forms of recreation.

On the other hand, smaller parks are of particular importance to regional populations. Higher densities of visitors are permitted and so their naturalness correspondingly declines. However, they still provide opportunities for contact between Man and nature, and serve the

important function of reducing the pressure of visitors on more restricted parks.

Education areas

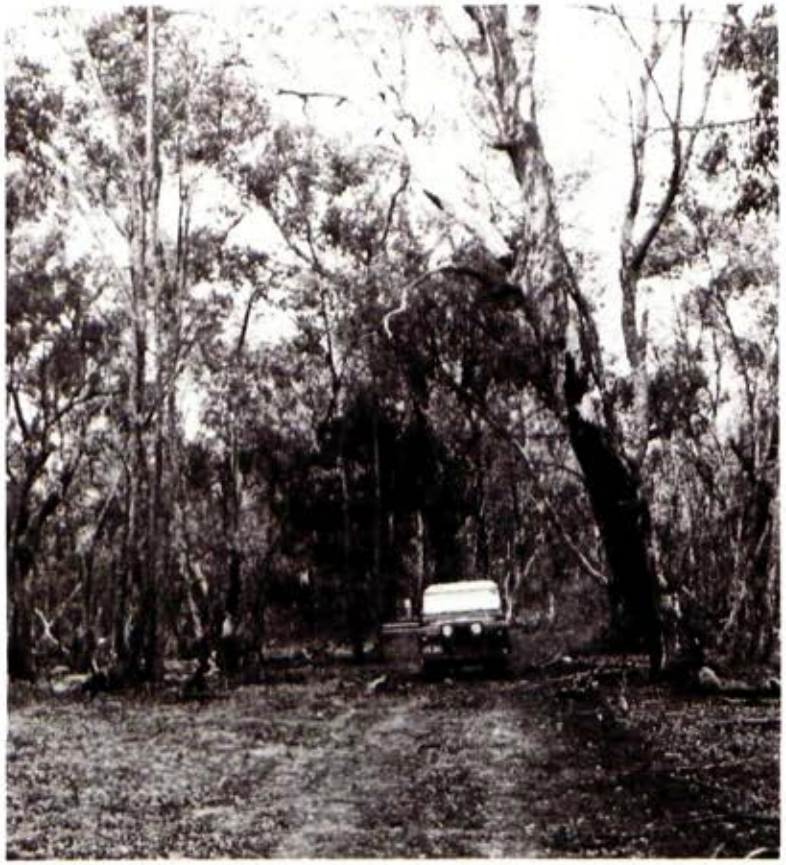
Education in the components and functioning of ecosystems is an important step in the conservation of natural resources. It is becoming an increasingly important feature of school curricula at primary and secondary levels and with other groups concerned with nature appreciation.

The study of ecosystems is indispensably linked with field studies. Obviously some aspects of this type of education can take place in areas primarily used for production of, say, hardwood timber. Other aspects can only be dealt with in areas where the flora have been preserved in their natural state. However, nature is to be felt, heard, smelled, and collected, and in some circumstances laboratory facilities and associated accommodation are needed so that successive groups can undertake long-term studies. As these activities may not always be compatible with full preservation, some land may need to be set aside specially for education.

Endemic and endangered species

Every living thing is a unique assortment of biological characteristics, evolved over millions of years. Each offers a potential enrichment of human

Silvertop-stringybark forest, a vegetation type being used extensively for timber production



White box woodland, a typically inland vegetation type that reaches its south-eastern limit in the study area

knowledge limited only by our capacity to appreciate and understand. The loss of any species therefore erodes the quality of the human environment. Many people feel than Man also has a moral responsibility to preserve endangered species.

It may be possible to ensure the continued survival of all species in zoological and botanical gardens, but only preservation in their natural environment will permit a full understanding of the physical and biological factors that surround them.

Species endemic in the study area and endangered species must receive high priority for preservation. Chapters 8 and 9 list those found in the area.

Special values

Particular areas of land are often needed to preserve distinctive values.

The occurrence of a species is of unusual scientific interest near the limits of its distribution. A large number of plant and some animal species mentioned in chapters 8 and 9 reach these limits within the study area.

Some animal species (for instance the colony of Australian fur seal on the Skerries) favour certain areas as breeding localities. Nomadic or migatory animals favour others as stop-over places: a good example is Mallacoota Inlet.

Some areas provide particularly good examples of a geological feature or process, such as the exposures of sedimentary formations on the coast at Seal Creek and the site of the ancient fossil footprints in the Genoa River.

The East Gippsland study area has some significance to systematists. In scientific work, plant and animal names must be applied with precision, for the validity of much research work hinges on the accurate identification of the materials involved. The type specimen chosen by an author when naming a new species fixes the application of that name and is basic to correct identification. The locality at which the type specimen was collected is therefore of considerable importance and every possible protection from destruction or degradation should be approved for such areas.

Several plant species have been described from specimens collected from the study area.

In other natural sciences, type sections or materials are used to define, for example, soils or stratigraphic units.

Small areas

A host of smaller areas can contribute to nature conservation. They include narrow reserves along coasts, streams, and roads, as well as remnants of the natural vegetative cover that have survived on areas originally set aside for purposes such as gravel, water, cemetery, and camping reserves.

Since these small areas of public land still bear (perhaps in a modified form) their original type of vegetation, they make a contribution to regional character out of all proportion to their size. They are also the only refuge of many of the remaining native animals. They are of less importance in East Gippsland than in many other parts of the State, but are still significant, particularly on those land types that have been extensively altered.

In the past many of these small areas have not been properly administered, nor have they been well known to the public. Because of this they have not been used as they might otherwise have been nor have they been as secure against alienation or despoliation as they should have been. Proper management and rights of access are essential.

Productive areas

Some native species have high value for productive uses. Game-shooting, a popular form of recreation, depends on the reliable supply of native ducks and quail. Many of the eucalypt species provide honey and hardwood timber.

Viability of areas

The viability and effectiveness of nature conservation areas depend on a number of factors, including the size of the area, the type of community or ecosystem we wish to conserve, and the degree to which we can manage the area and control influences that tend to upset the natural balance.

Large reserves have less perimeter relative to their area and so tend to be better buffered against the effect of intrusive factors. Generally the conservation of birds and mammals will require larger areas than those required for the maintenance of plants, insects, or amphibians. Communities that exist in more variable climatic zones - prone to drought, floods, or fire - usually require larger areas (or more examples set aside) to ensure survival.

Careful management may enable small areas to remain viable. Management may take the form of controlling fire, culling animal populations, practising silviculture, strictly controlling the number of visitors, fencing to exclude introduced animals, or eradicating introduced species.

Choosing areas

In addition to considerations of viability, many other factors influence selection of areas for nature conservation.

Land is a limited resource, and good planning requires compatible uses to be grouped together on the one area if possible. Where possible, a single reserve should cover a number of land types and should have high scenic value.

The migratory and nomadic existence of some animals requires corridors of habitat linking, for example, breeding and feeding grounds. Such corridors may be used for a number of other uses such as hardwood production, or they may be planned strips left through areas used for agriculture or softwood production.

In some cases few alternatives are available, as only remnants of the natural systems remain. Where alternatives do exist, areas with natural boundaries such as watersheds should be selected, as they are usually easier to manage and maintain.

A balanced system of nature conservation is likely to include a few fairly large areas (more than 20,000 ha) in which the major communities and land types are represented, supplemented by a greater number of smaller areas more intensively managed for a particular purpose.

The Study Area

Because of their relatively natural condition and the variety of plant and animal species found there, several parts of East Gippsland are of particular value for nature conservation: this does not imply that they are not also valuable for other types of land use. Those areas of high value for nature conservation are discussed below.

Almost all the coastal country east of Sydenham Inlet remains relatively undisturbed. The scenery here is quite spectacular and is free of the eye-sores of uncontrolled development. This belt of country is also of interest and value

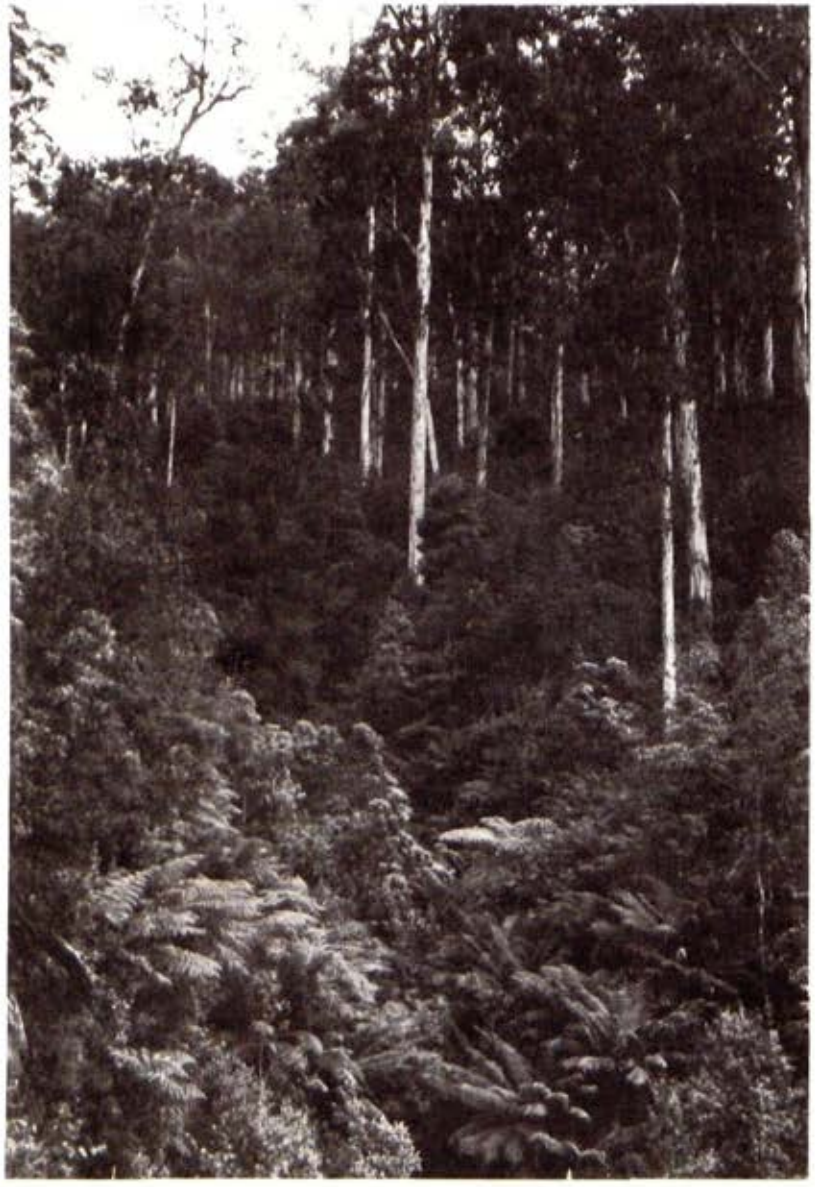
for its vegetation and fauna, particularly the coastal heaths. These have a diversity of plant species, including many with attractive flowers. Orchid species found in these heaths and occurring nowhere else in Victoria include leafless tongue-orchid *(Cryptostylis hunterana)*, which was first discovered on the Marlo Plains, tartan tongue-orchid *(C. erecta)*, small wax-lip orchid *(Glossodia minor)*, and leek orchid *(Prasophyllum appendiculatum)*. Numerous other uncommon or rare orchids, although more widespread in Victoria, occur in the heaths, which also support some rare fauna such as the eastern bristle bird, ground parrot, and smokey mouse.

Coastal heathland, habitat of many rare plant species

The area east of Mallacoota Inlet contains a variety of environments: subtropical rainforests, fern gullies, euclaypt forests, and coastal heathlands, with two freshwater lakes and miles of wide sandy beaches. Many plant species that occur in this part of the study area have been found nowhere else in Victoria. (These are discussed in the block description for the Mallacoota Block.)

Patches of subtropical rainforest are scattered through the lowland country of East Gippsland, where the flora includes a number of lianas or creepers (such as the pearl vine and the jungle grape, which may have stems 20 cm thick), several tree species, a number of orchids (including the epiphytic tangle orchid, *Plectorrhiza tridentata)*, and a variety of ferns.

Above elevations of about 600 m, areas of montane rainforest occur dominated by sassafras, blackwood, and black olive-berry. Gippsland waratah is a common and attractive understorey species. In one area (a variant of the montane rainforest of great scientific interest) mountain plum pine occurs as a tree species up to 10 m high. This extrordinary occurrence of plum pine is possibly the result of a prolonged period without fire.



Shining gum open forest with montane closed forest understorey

Two other inland natural areas occur along the Genoa and Snowy Rivers. These rugged areas have remained fairly inaccessible and so are little disturbed. They both contain a number of plant species that are very rare elsewhere in Victoria, or are known only for these particular locations.

The Genoa River area is well known for its remarkable variety of species of *Pomaderris*; 17 grow in this small area, and several *Pomaderris* type specimens were collected along the Genoa River gorge. Ancient fossil footprints of great scientific importance found there also lend interest. The Snowy River, being in a rain-shadow area, has a variety of plant species that do not occur in the surrounding localities. The Snowy River gorge is also the site of a major colony of brushtailed rock wallabies. This area is particularly rugged, with many high cliffs and rocky bluffs.

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RECREATION

Recreation involves activity undertaken without compulsion for the pleasure of the individual. It takes a multitude of forms, and individual preferences vary.

This chapter concerns recreation on public land, which can involve such activities as fishing, hiking, camping, picnicking, driving, nature study, or simply seeking solitude. Some recreation activities, such as golf, require land solely for that use. However, most activities can be accommodated on land managed for additional purposes.

Factors affecting demand

The increasing demand for land for recreation can be attributed to a number of factors.

The size of the population as well as its density in particular areas will strongly influence the demand. Victoria's population has doubled in the past 35 years and is now about 3,500,000. An overwhelming proportion is concentrated in the Melbourne metropolitan area; most of those involved in recreational activities within the study area come from Melbourne. Other cities, such as Canberra and Sydney, may also be important sources of such demand. However, local residents also use the area for recreation.

Most of the population has an increasing amount of time available for leisure, and an increasing amount of money to spend on leisure activities. Increased mobility enables people to travel long distances for holidays.

Additional factors such as education, age, and fashion can influence the degree of participation.

Indicators of increased demand

Evidence indicating the increasing demand for outdoor recreation in recent years can be obtained from the few Victorian figures available. These indicate that, while the population has been increasing at 2% per year (doubling every 35 years), the number of people using developed areas of national parks and other outdoor recreation areas, the number of car and motor-boat registrations, sales of recreation equipment, and similar indices are all increasing at 10 - 15% every year (doubling in less than 7 years). Use of Victorian national parks in 1971/72 amounted to more

The beach west of Cape Conran

than 725,000 visitor-days compared with about 350,000 visits in 1966/67. Recreational use of forests is increasing at a rate of 15--20% per annum, and in 1971/72 totalled about 3,000,000 visitor-days. Use of camping parks in the study area, indicated by revenue, has increased considerably since 1962 (see Table 9.)

Although the demand is clearly increasing, the nature of this increase is hard to predict. It has been suggested that by the end of this century the Australian population will total 22 million, a 3- or 4-day working week will be common, and *per capita* income will be trebled in real terms.

Activities that are popular now may not be so in the future, and completely new activities are certain to emerge. Plans for outdoor recreation must not only cater for increasing demand, but must also be as flexible as possible to cope with possible changes in the nature of the demands.

Choosing land

As previously mentioned, outdoor recreation is often compatible with other forms of land use. However, sometimes areas must be set aside specifically for recreation.

The area and nature of the land chosen will depend upon the type of recreation to be pursued. At one extreme, small areas that retain little of the natural environment are used for such activities as tennis, golf, and picnicking. Major usage of these areas occurs after work and at week-ends, and is invariably located close to the population using them.

At the other extreme, areas of many thousands of hectares are required to provide for such activities as hiking, sight-seeing, camping, fishing, and nature study. These areas receive greater use during holidays. Development is usually limited to a small part of the area, the rest being undisturbed, and the most favoured areas are associated with outstanding natural features.

TABLE 9

SHIRE OF ORBOST - CAMPING PARKS REVENUE ($)

Year ending September 30	Marlo	Orbost	Mallacoota	Genoa**	Bemm River	Cann River	Total
1962/63	1,194.86	2,465.70	N.A.*	-	-	-	3,660.56
1963/64	1,399.10	3,141.50	N.A.*	-	-	-	4,540.60
1964/65	1,629.10	3,604.30	N.A.*	-	-	-	5,233.40
1965/66	1,823.06	4,193.20	4,515.68	88.78	220.40	466.80	11,307.92
1966/67	2,707.55	4,472.15	8,764.80	214.20	319.90	448.80	16,927.40
1967/68	3,462.00	7,153.00	N.A.*	175.00	336.00	539.00	11,665.00
1968/69	3,378.00	7,521.00	N.A.*	274.00	540.00	478.00	12,191.00
1969/70	3,984.00	8,874.00	14,498.00	135.00	702.00	171.00	28,364.00
1970/71	4,722.00	6,220.00	17,006.00	118.00	771.00	282.00	29,119.00
1971/72	8,009.30	8,865.71	20,605.80	-	2,114.75	738.50	40,334.06
1972/73	8,053.04	8.995.60	32,280.53	-	2,968.20	731.40	53,028.77
Total	40,362.01	65,506.16	92,670.81	1,004.98	7,972.25	3,855.50	216,371.71

** destroyed by flood, February 1971

* local committee of management control

Fees (pre 1/10/73):

power 40¢ per day or $2.40 per week

site fee $1.20 per day or $7.20 per week

Area of land required

In many respects, the carrying capacity of an area for outdoor recreation can be assessed in physical terms - a particular site can accommodate a certain number of cars and people, and greater concentrations result in damage to the vegetation and soil, leading to deterioration of the land.

Moreover, a psychological element must also be considered; over-crowding detracts from people's enjoyment of the area, although the land may not suffer physical damage. Attractive and accessible parts of a recreational area tend to be heavily used while large parts are little used.

The Study Area

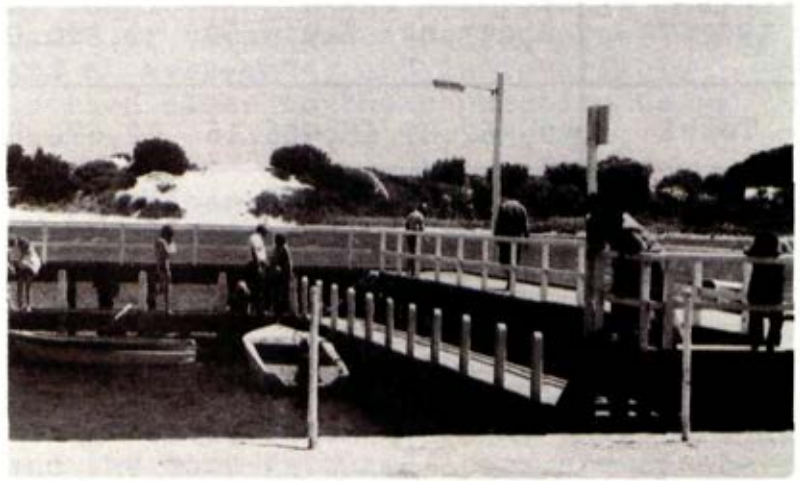
Environments

The study area has a number of environments, each with a different appeal to visitors, that together give variety to the landscape. The inlet environment of Mallacoota, Tamboon, and Sydenham Inlets is an important attraction. Other major types are the open coastal environment, heathland (with its profusion of wildflowers), mountain forest, rugged inland areas, and rural environment.

Recreational features

Outdoor recreational activities are concentrated around the accessible inlets. They include boating, fishing, swimming, and sight-seeing. Public activity in these water-based recreational prusuits varies considerably from season to season, with a very marked concentration in the few weeks of the Christmas--New Year holiday period. During the summer, existing facilities required for recreation may be fully committed, but for the rest of the year people participating in recreational activities can be readily accommodated. Table 10 lists the relevant recreational activities and their requirements for land.

Apart from recreation at the inlets, the area supports little other open-space recreation at present, although it has considerable potential. A number of features of public land likely to become important as recreational attractions are outlined below.



Marlo jetty

Most of the open coastline, being relatively inaccessible, remains in a natural condition. The scenery is most impressive, while beach and rock fishing is outstanding. The coast is also very valuable for enjoyment of the pristine beauty.

The vegetation of the study area has many interesting features. The best-known of these, the remnant subtropical rainforest, occurs in many lowland gullies and on some steep southerly-facing hillsides. Lilly-pilly and kanuka are the dominant tree species, instead of the eucalypts that dominate elsewhere, and lianas abound. Numerous species of ferns inhabit these rainforests, and epiphytic orchids and mosses grow from the trunks of trees and tree-ferns. Such rainforest is visually appealing, and of interest because it is unusual in Victoria.

The montane rainforest is equally attractive, but less accessible to tourists.

Mount Ellery, a prominent inland peak, with a summit comprising a pile of huge granite tors, provides excellent views of the coastal country to the south and the mountainous country inland. Other mountainous parts of the study area are the Bowen Range and Mount Tingaringy.

Two inland areas are especially rugged, and are traversed only by rough four-wheel-drive tracks. Downstream from

A small beach at Cape Conran

where it crosses the Victoria--New South Wales border, the Genoa River winds through a maze of sandstone cliffs and gorges. On the western boundary of the study area the Snowy River has carved a series of remarkable gorges where it runs through the rhyodacite of the Snowy River volcanics.

The area east of Mallacoota, most of which is accessibly only be walkers, has a number of interesting features. It contains two freshwater lakes, Baracoota and Wau Wauka. Howe Hill, a prominent granite outcrop, dominates the landscape and commands a magnificent view over the whole of Mallacoota Inlet, Gabo Island, a long stretch of coastline, and the country inland. The vegetation varies

Table 10

MAIN TYPES OF OUTDOOR RECREATION IN THE STUDY AREA AND THEIR LAND REQUIREMENTS

Type of recreation	Land requirements
Passive outdoor pursuits	
Driving for pleasure	General protection of diversity in the landscape
Sight-seeing	Preservation of historic points, scenic lookouts, and outstanding natural features
Picnicking	Provision of suitable facilities in open-space surroundings readily accessible from urban centres; fire protection
Nature walks	Preservation of natural areas, provision of walking tracks and interpretative services, and exclusion of vehicles
Walking for pleasure	General protection of diversity in the landscape, and provision of access to areas of public land, including stream frontages and coastline; exclusion of vehicles from some areas
Recreation on developed sites	
Organized outdoor sport	Some areas of public land may be required for golf courses, football grounds, and airfields close to urban centres
Caravanning	Provision of facilities in pleasant surroundings; fire protection

Table 10 (cont.)

Type of recreation	Land requirements
Open-country recreation	
Hiking	Preservation of extensive areas of open space, particularly areas with diverse landscape and outstanding natural features; exclusion of vehicles from some areas
Camping	Provision of suitable facilities in areas of open space close to water and outstanding natural areas; fire protection
Hunting	Preservation of habitat for game species
Cross-country driving	Provision of open-space areas that can withstand this type of recreation, some distance from areas being used for other forms
Horse-riding	Provision of open space with paths
Water-based recreation	
Swimming or sun-bathing	Provision of access and suitable facilities at safe beaches and other swimming areas, particularly those close to urban areas
Boating or water-skiing	Provision of access and suitable facilities along stream frontages and shorelines
Fishing	Provision of access to stream frontages and coastline; protection of stream banks and aquatic habitats

from coastal heathlands and low forest to fern gullies and rainforest.

This study area also has a number of "waterfalls", although most are rapids rather than direct falls. (The main exception, the Raymond Creek Falls, has a vertical drop of about 20 m into a large pool.) Among these, the Genoa Falls is a cascade a few feet high in attractive surroundings. Others in the area include an attractive series of cascades and minor waterfalls on Beehive Creek, and the Tonghi Falls, which are cascades on Tonghi Creek. A number of tributary creeks of the Combienbar River have sizeable falls.

Tourism

Because relatively few people live within the area, most of those involved in recreational activities are visitors, so recreation is closely linked with tourism.

Canoeing on the lower Wingan River

East Gippsland is distant from Melbourne, Canberra, and Sydney, and many areas closer to these cities have great recreational attraction. Consequently there has been relatively little development of tourism in East Gippsland to date. However, with improved transport and improved roads, distance will become a less significant factor.

At present East Gippsland is too far from the cities to be of major importance for week-end trips; it is likely to be important mainly for longer holidays of a week or more. (A survey conducted by the Australian National Travel Association in December 1971 indicated that the average length of stay at Mallacoota was about 10 days). The area will also derive some tourist benefit from through-traffic using the Princes and Cann Valley Highways, particularly if people can be encouraged to stop for a day or two.

The ANTA survey of East Gippsland (including Sale, Bairnsdale, Omeo, and Lakes Entrance areas as well as Orbost Shire) estimated that in 1969/70 the travel industry contributed about 15% ($13 million) of the total production for the region. This industry has potential for further expansion, so tourism is an important factor in the local economy. The population would

benefit from improvement and publicity of the tourist attractions, and recreation must be recognized as an important land use.

At present recreation is restricted by lack of accommodation. Shire Council camping areas are frequently filled to capacity in summer, and large numbers of campers are unable to find accommodation in serviced camping areas. (Up to about 80 groups per day were refused admission to the Marlo camping area during the 1972/73 season.) Increased numbers and sizes of camping areas, and improved facilities at existing areas, are needed to meet existing demands. There is also a need to provide cabin-type accommodation and to increase the availability of more expensive types (such as motels and guest houses) in selected areas.

Such tourist development must be carefully controlled to minimize disturbance of the scenic attractions of the area. New centres of development may become necessary, requiring new roads or the upgrading of existing roads, and provision of services such as electricity, water, and sewerage.

Some tourist villages could be sited close to bodies of water suitable for boating, fishing, and swimming - preferably with a variety of recreational

Marlo camping area during summer

environments accessible. The coastal inlets offer suitable sites - they are scenically attractive and provide safe swimming and boating, as well as being near the surf beaches of the open coast. Villages of this type should be set back from the coast and carefully sited so that they do not intrude on the landscape.

AGRICULTURE AND APICULTURE

Agriculture

Present land use

The study area covers a total of 970,000 ha, of which only about 123,000 ha or 12% is held as freehold. About two-thirds of the freehold (80,000 ha) is cleared for agriculture, the other one-third remaining as bush. Large areas of public land in the study area, particularly in the eastern and northern parts, are leased for cattle grazing.

At March 31, 1971, the study area contained 437 rural holdings. The most intensively developed agricultural area lies within a 25-km radius of Orbost township in the south-western corner, and comprises the flats of the Snowy and Brodribb Rivers, the adjoining undulating country, and the flat land near the coast. It mainly supports dairying in association with beef and vegetable-growing.

Another developed area in the north includes the settlements of Deddick, Tubbut, Cabanandra, Dellicknora, Delegate River, Bonang, and the larger Bendoc settlement. These are not all continuous, but stretch more than 60--80 km from west to east. Beef and sheep production are the main industries.

Other settled areas in the study area include the Cann River valley, Combienbar, Cabbage Tree Creek, Genoa, and Mallacoota. Further small areas of freehold, some cleared, some still in bush, are scattered through most parts.

During the last 5 years, the beef cattle industry has become the most important livestock industry in the study area. Table 11 shows the livestock statistics.

Beef industry

As in most other parts of the State, a big increase in the beef cattle population has taken place in the study area during the last 10 years (see Table 11), amounting to 60% between 1968 and 1972.

About 85% of the cattle are Herefords, 5% are Angus, and the remainder other breeds and crossbreeds.

Herds mainly comprise breeders, with an annual turn-off of store calves sold to other areas for growing and fattening. The milder areas close to the coast, particularly on the Snowy

TABLE 11

LIVESTOCK NUMBERS ('000s)

Year	Dairy cattle	Beef cattle	Total cattle*	Sheep
1959/60	18.1	13.3	31.3	62.5
60/61	19.0	15.3	34.3	62.5
61/62	18.7	17.8	36.5	61.9
62/63	20.3	18.1	38.4	57.8
63/64	19.7	19.0	38.7	58.1
64/65	21.5	18.0	39.5	60.0
65/66	21.0	21.1	42.1	66.8
66/67	21.0	22.1	43.1	70.4
67/68	20.7	25.2	45.9	63.4
68/69	19.7	25.0	44.7	60.9
69/70	18.8	30.0	48.9	65.5
70/71	18.3	34.5	52.8	67.4
71/72	17.9	40.3	58.2	55.0

Source: "Rural Industries." (Commonwealth Bureau of Census and Statistics: Melbourne, 1961-73.)

* Differences due to rounding

River flats at Orbost, produce vealers, fat steers, and bullocks.

Time of calving varies. In the colder mountain areas, calves are normally dropped from July to September. In the warmer coastal areas greater flexibility in calving time is possible, and calving as early as March--April is not uncommon.

Climate is again important in determining the levels of supplementary feeding required. In the mountain areas, up to 40 bales of hay per head are fed between April and September. In contrast, hand feeding is much less needed near the coast, and in some years is unnecessary.

Pasture improvement programs have increased carrying capacity. Improved pastures can carry a cow and calf to 1.6 ha in the mountain areas and to every 1.2 ha on the low foothills. On the river flats, stocking rates of a cow and calf to 0.5 ha are common.

Remoteness is a problem in northern and eastern grazing lands of the study area. Implementation of intensive managerial techniques such as pregnancy testing and artificial insemination is expensive.

Dairy industry

At present, about 110 dairy farmers remain in the study area, showing a decline over the last 10 years (from 180 in 1963).

Although the number of dairy-farms has decreased over recent years, the number of dairy cattle has not dropped correspondingly. Herd sizes of the remaining farms have increased, as has total production.

About 75 of the dairy-farms are within 30 km of the township of Orbost. The Cann River--Noorimbee area has about ten, the Combienbar area five, and the Wairewa area eight. The rest are widely scattered.

Pigs are no longer important on these dairy-farms. Most farmers now supply whole milk, so do not have skim milk available for pigs. Sidelines to dairy-farming include beef and vegetable production.

The only dairy factory in the study area, at Orbost, mainly produces butter and skim-milk powder.

Cattle grazing on the Snowy River flats

Sheep industry

Most of the sheep are concentrated in the areas of low rainfall in the northern parts of the study area. The granite hills are sound sheep country. Good lucerne stands are of great value for fattening as well as for wool production.

The Tubbut area can suffer from extensive dry spells and is regarded more as Merino country, although comebacks are well suited, while the high-rainfall country towards Bendoc supports prime lamb production. Markets are to the north at Delegate and Bombala for sheep, and wool is sold in Melbourne.

Crossbred flocks for production of prime lambs once flourished in the southern part of the area. However, the low wool and lamb prices of the early 1970s, together with the problems associated with running sheep in high-rainfall country, have resulted in contraction of the sheep industry to the dryer areas in the north.

Sheep numbers have declined to a small extent in recent years, due partly to a general swing to cattle and partly to the effects of drought during the last 2 years.

Vegetable industry

Vegetable production in the study area is concentrated in the river and creek

valleys, and particularly on the flats of the Snowy River near Orbost.

Mild summer temperatures, good summer rainfall, and relatively high humidity make the area particularly suited to summer-growing vegetables. In 1972/73 its main crops were beans (530 ha), sweet corn (140 ha), potatoes (60 ha), and capsicums (40 ha). The areas under different crops vary from year to year depending on market prices and grower interest.

Beans are grown for processing, for dry edible beans, and for seed. Seed bean demand has declined considerably over the last 10 years, but the dry edible bean industry has been increasing.

Maize-growing has declined from 700 ha in 1963/64 to less than 40 ha in the last 2 years. However, production of sweet corn for the fresh market and hybrid sweet corn seed is a new and expanding part of the vegetable industry.

Production of other fresh market vegetables is being attempted and may become of increasing importance. The distance from major markets is a problem.

Remote districts

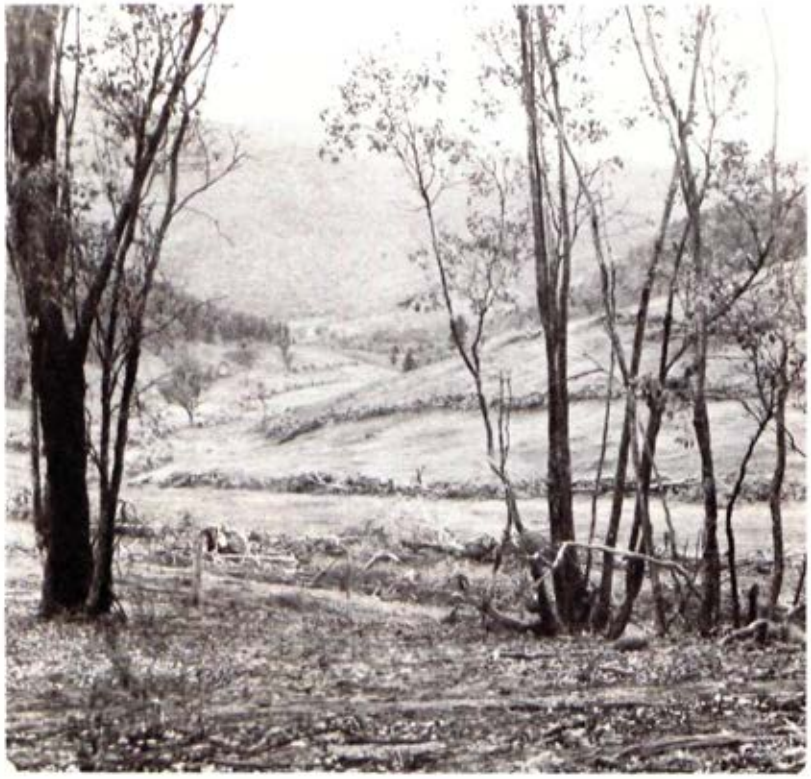
Some rural properties in the study area are relatively isolated, and are distant from the nearest Victorian railhead (Orbost).

Market garden; Brodribb River flats

This, together with unsealed and mountainous roads leading to some districts, has the effect of increasing the cost of transporting farm inputs and outputs. The cost of carting and spreading superphosphate is about $10 a tonne more at Tubbut than at Orbost.

Education for the children of farmers in these areas is usually satisfactory at the primary level, but becomes a major problem when they reach secondary level. Older children may have to board away from home to obtain a secondary education.

Because many of the remote settlements are scattered, most have lengthy boundaries adjoining public land. Not only do the farmers have to meet the full cost of fencing, but they have to



Windrows of what was white box woodland on steep granitic slopes at Deddick

contend with rabbits, wombats, and kangaroos. Occasionally, wild dogs are a problem.

Farmers in areas close to the border of New South Wales often rely on towns in that State for supplies and as markets. For example, Genoa is reasonably close to Eden, and people from Tubbut and Bonang are closer to Delegate than they are to Orbost or Cann River.

Potential of alienated land

During the last 10 years, the numbers of sheep and dairy cattle in the area have remained fairly static. However, beef cattle numbers have increased from 18,100 to 40,300. The total stock carried, expressed in terms of dry-sheep equivalents, has increased by 44%. Some of this increase is due to enlarged grazing areas resulting from development of bush country. However, most of it would be due to pasture improvement and greater utilization of pasture.

The area topdressed with superphosphate has risen from 16,500 ha in 1961/62 to 20,750 ha in 1970/71. The amount of superphosphate used rose from 2.3 million kg to 3.7 million kg over the same period.

Considerable potential for increasing production still remains. This increase could come in at least five ways:

- Applying fertilizer more regularly to existing sown pasture. In 1970/71, only 21,000 ha of the total of 44,000 ha of sown pasture were topdressed.

- Improving existing native pasture by topdressing with fertilizer, and possibly sowing down. "Rural Industries", lists 100,000 ha of native pasture for 1970/71. Probably at least half of this is lease country, but the remainder could be improved.

- Developing irrigation. Probably less than 400 ha of pasture are irrigated in the area each year. There is some scope for further increasing the area irrigated.

- Clearing and developing pastures on what is currently bush country. Most of the better freehold country is already cleared, but timbered areas on some properties could be developed.

- Increasing the grazing on existing pastures. While stocking rates have risen over the last 10 years, they could rise further in some cases.

These methods of increasing productivity are not applicable to all properties. Some are already highly improved, and productive. For others, careful consideration must be given to the economic aspects. A major deterrent to further property improvement, particularly in the more remote parts of the study area, is the high cost of farm inputs. Mallacoota is about 160 km from the nearest Victorian railhead (Orbost). Bonang (93 km) and Tubbut (124 km) have the added problems of unsealed roads and mountainous terrain.

Because of the high transport cost of both inputs and outputs, practices that in less remote areas would be economically sound have to be seriously considered. For this reason, agriculture in the more remote areas tends to be extensive rather than intensive.

Potential of public lands

Public land in the study area covers such a large area that its potential for agriculture could be expected to vary considerably. Obviously, some parts are far more suitable for agriculture than others, and it is likely that each will have other potential uses, which may or may not be compatible with agricultural use.

In assessing the suitability of an area for agricultural uses, a number of factors must be taken into account. These include soil quality, climate, slope,

Improved pastures at "Fairhaven", Mallacoota Inlet

and, particularly important here, access to existing communication lines. Economic factors must also be considered.

The alienation of areas large enough to constitute new farms would be possible along the coastal strip south of the highway from Lake Tyers to the Snowy River. Experimental and demonstration work at the Tostaree Pilot Farm indicates that good-quality pastures can be developed from bush country, although at a high cost (see Appendix 4). It may well be more profitable to purchase and improve land already cleared than to clear bushland.

In other localities within the study area, public lands of moderate agricultural potential adjoin existing farms. Economic factors and convenience add to their value for agriculture.

Forest grazing

In many parts of the study area, livestock graze on public land under lease or agistment terms. Stock are grazed in the bush mainly during the winter in the southern areas, and in the winter and summer in the northern area.

Less use is made of public land now than was the case in the past. Two reasons are advanced for this. Firstly, with pasture improvement the freehold properties are better able to carry the stock and there is less need for outside grazing. Secondly, the careful control of burning has reduced the grazing value of some runs, or parts of runs.

In general, cattle-grazing in forest country does not appear to have led to deterioration of this land.

Apiculture

Although only two commercial apiarists live within the study area, large quantities of honey have been produced throughout the area. This is because apiarists travel widely to harvest honey from different regions as different honey-producing species flower, and many of them visit East Gippsland when conditions are favourable. Improved transport and roads have increased the mobility of apiarists. Improved access to forest areas and more intensive apiculture could result in increased honey production in East Gippsland.

Two environmental hazards threaten apiculture: fire and clearing. Bush fires may destroy whole apiaries, and may seriously damage choice sites, making them unproductive for many years. Widespread clearing of native vegetation could seriously reduce both honey-producing eucalypt forests and coastal scrub types that are valuable for breeding and building up hives.

Eucalypts are the most important honey-producing species, but other plants are also valuable, particularly for building up hives in the spring. These include

hop bush, coast banksia, sunshine wattle, sea box, and coast tea-tree. They yield nectar and pollen in spring, which stimulates brood-rearing and enables a beekeeper to have strong healthy hives in time for the eucalypt honey flows. However, honey from these species is of inferior flavour.

The most important honey-producing eucalypt species merit more detailed discussion, as the industry depends on them.

Blue box (locally known as fuzzy box or round-leaf box) is a valuable species, supporting an average production of 50 kg of choice honey per hive in an average to good season. The most useful occurrence of this species is in the Hartland--Waygara area.

Red box varies - flowering may be very irregular, but it may yield up to 40--50 kg per hive every 2--4 years. Production of 15--25 kg per hive has been reported for the Sardine Creek area. The main occurrences of this species worked by apiarists are north and east of Nowa Nowa (to Waygara and Bete Bolong) and Sardine Creek.

Southern mahogany has been worked for honey from Lake Tyers through Hartland, Mount Raymond, Yerung River, Tonghi Creek, Reedy Creek, and Tamboon Inlet to the Thurra River. Flows producing substantial crops of honey have been observed, but no data are available.

White stringybark may yield a heavy crop (up to 50 kg per hive) of good-quality honey under favourable conditions. It has been worked extensively throughout the coastal strip of the study area.

Red stringybark is a very useful species in the north of the area, in the vicinity of Deddick and Tubbut. Yields of 70--80 kg of honey per hive every 2 years have been recorded, but production has declined to 40 kg every 2--3 years. Poorer yields have been recorded in the Waygara area, where the species may not bloom for several consecutive years - 15 kg per hive is considered satisfactory in a good year for the Waygara area.

Mountain grey gum, which is widespread throughout the study area, has been

A truck-load of 16 tonnes of white stringybark honey from Noorinbee

recorded as yielding 80 kg of good honey per hive in a good year.

White box is one of the best sources of high-grade honey in the study area, but lack of access restricts its use to the Deddick Valley.

Red bloodwood is of major importance to the beekeeping industry, although restricted to the far east of the study area. It flowers only spasmodically, but provides a heavy flow of good honey, and improved access could increase the number of apiaries that could work it.

Brown barrel yields a dark, strongly flavoured honey, at a rate of production of up to 25 kg per hive every 3 or 4 years. The main stands worked by apiarists are in the Bonang--Goongerah--Errinundra area.

TIMBER PRODUCTION

Hardwood

Hardwood forests cover most of the public land in the study area. Utilization of these forests for timber products commenced in the 1850s in the Bendoc area, which was the first portion of the study area to be settled, and continued at a fairly low level for almost the whole of the next hundred years. Production of sawlogs increased rapidly from the 1950s: the area has now become very important for the maintenance of Victorian supplies of sawn timber and will remain so for many years to come.

The main forest product from the area is logs for sawn timber. Other forms of forest produce have been less important, although the area has been significant for the production of beams and railway sleepers since this commenced around 1916. The forests of the area currently produce about 20% of the State's requirements for railway sleepers; however, in the decade from 1950 they produced about 40%. Up to 60% of Victoria's requirement for hewn beams was once met from the study area.

Between 1850 and 1950, sawlog production was largely associated with gold-mining and agricultural development. However, as a result of the heavily increased Victorian demand for timber after World War II, sawmilling has developed to the stage where the forests of the area are most important.

The post-war expansion of the sawmilling industry has been most significant in development. The settlements of Cann River, Club Terrace, and Bendoc depend heavily on the industry, while it has provided a solid industrial segment to the previously mainly agricultural base of the largest town, Orbost.

Forest Types

About 87% of the land within the study area is forested, and its wide range of climate, soil types, topography, and aspects result in the occurrence of a large number of *Eucalyptus* species, many of which have high commercial value.

Table 12 lists all the known eucalypts of the study area together with an indication of their occurrences and uses. Table 13 shows the productivity of the main timber-producing species.

TABLE 12

OCCURRENCE AND COMMERCIAL USES OF EUCALYPTS OF EAST GIPPSLAND

Scientific name	Common name	Main East Gippsland occurrence	Current use in East Gippsland
E. agglomerata	Blue-leaved stringybark	Cann River, Genoa	H, F
E. albens	White box	Deddick	M, P
E. aramophloia	Scent-bark	Cann Coast	N
E. bauerana	Blue box	Nowa Nowa, Waygara	H, F
E. baxteri	Brown stringybark	Murrungowar, Cann River, Waygara, Thurra River	M
E. blakelyi	Blakely's red gum	Snowy River Gorge	N
E. bosistoana	Gippsland grey box	Snowy River, Noorinbee, Wangarabell, Wallagaraugh River	P, S, H, F
E. botryoides	Southern mahogany	Coastal belt west of Wingan Inlet	M, S, H
E. bridgesiana	But but	Widespread on coastal and lower foothills	N
E. camphora	Mountain swamp gum	Bendoc	N
E. cephalocarpa	Silver-leaved stringybark	Lowland heaths	N
E. consideniana	Yertchuk	Coastal and lower foothills	M, S
E. cypellocarpa	Mountain grey gum	Widespread	M, H
E. dalrympleana	Mountain gum	Bendoc, Errinundra Plateau	M
E. delegatensis	Alpine ash	Bowen Ranges, Errinundra Plateau	M
E. dives	Broad-leaf peppermint	Bendoc, Dellicknora	M
E. elata	River peppermint	Lower foothills	N
E. fastigata	Brown barrel	Widespread - high foothills and plateau	M, P, H
E. fraxinoides	White ash	Howe Range	N
E. glaucescens	Tingaringy gum	Mt. Tingaringy	N
E. globoidea	White stringybark	Widespread central and foothills	M, P, S, F, H
E. goniocalyx	Bundy	Tubbut	N

TABLE 12

OCCURRENCE AND COMMERCIAL USES OF EUCALYPTS OF EAST GIPPSLAND

Scientific name	Common name	Main East Gippsland occurrence	Current use in East Gippsland
E. gummifera	Red bloodwood	Mallacoota, Wingan Inlet	N, H
E. macrorhyncha	Red stringybark	Dry foothills	S, H
E. maculata	Spotted gum	Mottle Range	M
E. maidenii	Maidens gum	Foothills	M, P
E. mannifera	Brittle gum	Orbost, Nowa Nowa, Dellicknora	N
E. melliodora	Yellow box	Nowa Nowa, Snowy River, Tubbut	P, S, H
E. muellerana	Yellow stringybark	Widespread foothills	M, P, S, H
E. nitens	Shining gum	Widespread on Errinundra Plateau	M
E. obliqua	Messmate	Widespread all areas	M, P, S
E. ovata	Swamp gum	Coastal	N
E. pauciflora	White sallee	Bendoc, Mt. Tingaringy, Bowen Mts	N
E. perriniana	Spinning gum	Bowen Mts	N
E. polyanthemos	Red box	Widespread dry exposed slopes	H, F
E. pseudoglobulus	Gippsland blue gum	Widespread in gullies	M, P
E. radiata	Narrow-leaf peppermint	Bendoc, Bowen Mts	M
E. regnans	Mountain ash	Errinundra R., Rodger R.	M
E. rubida	Candlebark	Bendoc, Bonang, Bowen Mts	N
E. sideroxylon	Red ironbark	Scattered dry sites	P, S, H
E. sieberi	Silvertop	Coastal and foothills	M, P
E. smithii	Gully gum	W.B. Line, Bowen Mts, Maramingo	N
E. stellulata	Black sallee	Bendoc, Bonang	N
E. viminalis	Manna gum	Foothills	M

Uses: M - Saw, veneer, and pulp logs
P - Poles and piles
S - Sleepers and beams
H - Honey
F - Farming uses (posts, rails, etc.)
N - Not used for timber production

The management aims of the commercial stands in the area selected for cutting are to utilize the existing mature and over-mature trees and to regenerate the cut areas with a new crop of vigorously growing trees. Management prescriptions vary according to the characteristics of the different forest types. Within the limits of certain environmental constraints, the maximum productive potential of the site can then be realized.

Plateau forests

Plateau forests occur above 800 metres altitude on deep reddish or brownish gradational soils. Little rainfall information is available, but limited observations indicate annual totals of 2,000 mm on some parts of the Errinundra Plateau and lower totals nearer Bendoc. Stand heights are rarely less than 40 m and commonly exceed 70 m.

Two plateau zones are recognizable: one, commonly referred to as the Errinundra Plateau, embraces the heads of the Errinundra, Brodribb, and Delegate Rivers; the other embraces the heads of the Rodger and Yalmy Rivers and Mountain Creek.

The predominant species are shining gum (on the Errinundra Plateau), brown barrel, alpine ash, and narrow-leaf peppermint - occurring in pure stands or as mixtures of a few species. Mountain ash occurs in pure stands in the upper catchments of the Rodger River and Mountain Creek.

Fire, although an essential ingredient for the natural regeneration of these forests, is infrequent, the last catastrophic fire having been more than 200 years ago. Major fires in this century did not reach many parts of the plateaux, but were confined to the more exposed ridges, forested mainly by alpine ash. In these areas, dense regrowth stands have developed that are similar to ash stands elsewhere in Victoria. Brown barrel has its most extensive occurrence in the slightly more exposed or dissected zones just away from the main plateaux, where it occurs either in pure form or in mixture with shining gum.

The high volumes per hectare and fast growth rates of the predominant species of this zone (see Table 13), together with the high quality of their timber, make these species most important commercially. Termites and decay have caused considerable damage to timber in the over-mature trees, resulting in current yields that do not accurately reflect the productivity potential of these forests. High-grade flooring, architraves, window frames, panelling, and select building scantling are the main lines produced from sawmilling.

Conditions required for the regeneration of these forests are exposed soil or an ash bed, no overhead shade, and a supply of seed. Such conditions occur naturally following intense wildfire, but can be created artificially by clear-felling,

TABLE 13

HARDWOOD PRODUCTIVITY

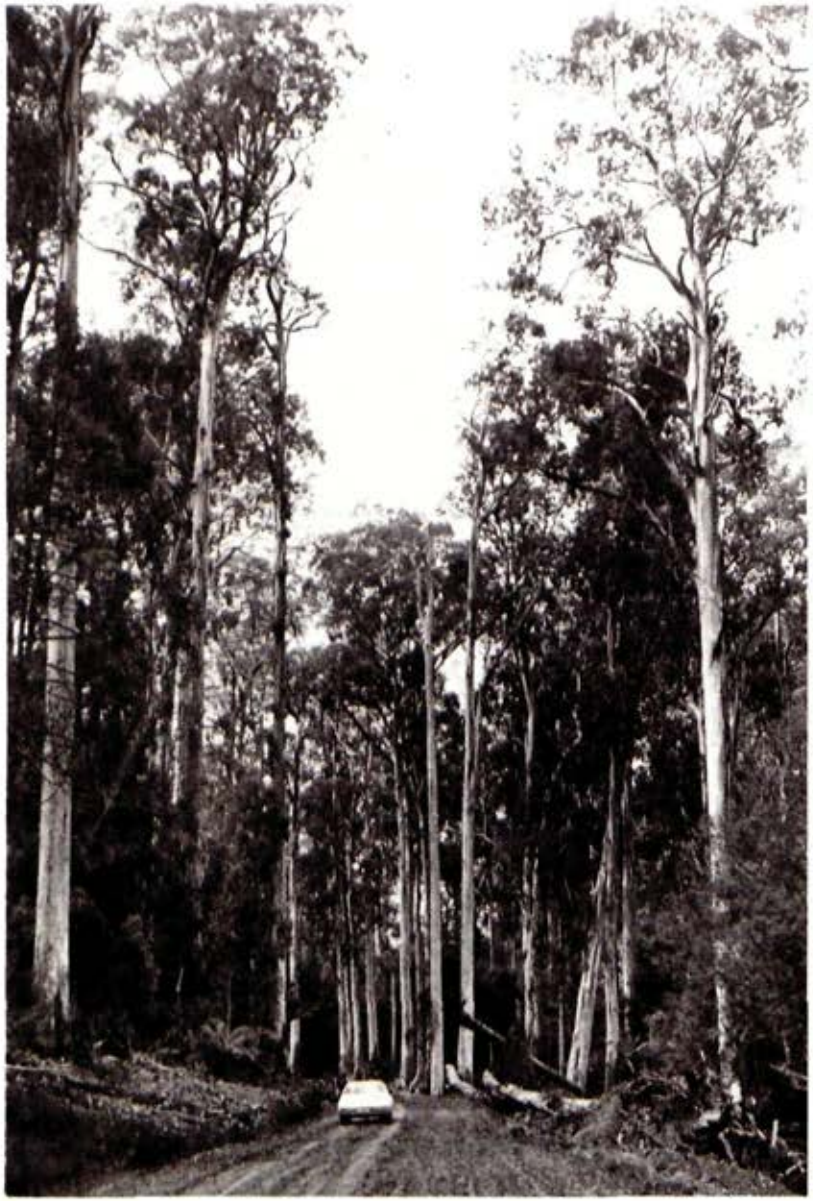
Category	Structural form	Main timber species	* Productivity (M.A.I in m^3/ha/an)
High to very high	Open forest IV	Alpine ash, mountain ash, shining gum, brown barrel	MAI range 8--20 Suitable for sawlogs and pulpwood
High	Open forest IV	Silvertop, mountain grey gum, messmate	MAI range 5--10 Suitable for sawlogs and pulpwood
Moderate	Open forest III	Messmate, stringybarks, mountain grey gum, narrow-leaf peppermint	MAI range 3--7 Suitable for sawlogs, sleepers, and pulpwood
Low	Open forest II	Stringybarks, gums, peppermints	MAI < 3 Suitable for some sawlogs, sleepers, and minor produce and pulpwood
Very low	Open forest I	Red box, peppermints, red stringybark	MAI very low Suitable for minor produce only

* Notes on productivity:

1. MAI (mean annual increment) = Total volume production to a 10-cm small-end diameter bark divided by rotation length in years.

2. The MAI's used are for broad-hectare figures for large areas (including unstocked and sparsely stocked area).

3. The proportion of pulpwood volume to sawlog volume varies from about 7 : 1 to 1 : 1 depending on the site, quality of the stand, and their past history of utilization and fire.



Newly constructed forest road through shining gum forest

controlled firing, and seeding. The difficulty of collecting sufficient seed from shining gum has often made it necessary to hand-plant after utilization in order to re-establish this species.

Mountain forests

The mountain forests occur at elevations between 450 m and 800 m and occupy the upper catchments of the major river systems. Rainfall is probably about 1,500 mm per annum. The deep friable soils of this zone support a wide range of species, the principal of which are brown barrel, messmate, mountain grey gum, narrow-leaf peppermint, and, to a lesser extent, mountain ash. Stand heights are generally well in excess of 40 m, but lesser heights occur on the more exposed northerly slopes.

Brown barrel grows best in sheltered moist gully hrads. It occurs in pure form and in mixture with messmate and mountain grey gum. Although these latter two species can survive relatively intense fire, subsequent defect to the timber often results, and many of the trees in the over-mature stands of this zone are defective as a result of past burning.

The sawn timber these forests produce is highly regarded for house-framing and heavy constructional uses.

The requirements for regeneration are similar to those of the plateau forests,

being complete removal of the overstorey and understorey and exposure of the soil, followed by seeding. As seed from mountain forest species generally can be readily collected, planting after utilization is not normally necessary.

Coastal and foothill forests

The coastal and foothill forests occupy a wide belt of moderately to gently undulating land across the southern half of the study area. Soils vary greatly, from the sandy podzols of the nearer coastal areas to the loams of the dissected foothills. The range of soils supports a diversity of species, the most important being silvertop, white stringybark, yellow stringybark, mountain grey gum, yertchuk, southern mahogany, and Gippsland grey box. Rainfall is about 850 mm per annum. Forest stand height is normally greater than 30 m and often exceeds 40 m.

Silvertop is the major commercial species and often occurs in pure stands, the other species commonly occurring in a wide range of mixtures. Silvertop reaches its best development on ridges or better-drained sites, and on the best sites it is capable of very high growth rates.

Fire has long been an integral part of the coastal and foothill environment, being frequent and usually intense. The tree species are not easily killed, but fire has often caused severe damage,

Messmate regeneration 3 years old

especially to regenerating areas. However, it has also been responsible for establishment of large areas of regeneration. The combined effects of utilization and fire have now resulted in an extremely diverse forest, ranging from regenerating to over-mature and covering all degrees of productivity.

Satisfactory regeneration may be obtained in the coastal forest, using either retained trees as the seed source or artificial seeding associated with clear-felling. This latter technique does not involve the same problem of seed supply as for the plateau and mountain forest, since little difficulty is experienced in seed collection from coastal species.

All regeneration methods require a reduction in overhead shade. When clear-felling is adopted, overhead shade is not a problem. When seed trees are retained it is necessary to reduce stocking to a basal area of about 10 square metres per hectare. Reduction to such a level can seldom be achieved through purely commercial felling when sawlogs are the only product harvested. In such circumstances, the production of pulpwood in conjunction with sawlogs materially assists regeneration.

A wide range of produce has been, and is being, obtained from these forests. This includes sawn structural and house-framing timbers as well as sleepers, poles, and beams. Timber from silvertop is most versatile in use. It is highly sought after for house-framing and, when free of defect, can be seasoned and used for joinery and other specialized purposes.

Rain-shadow forests

An extensive rain-shadow zone with rainfall below 700 mm per annum occurs in the Deddick River Valley and extends westwards over the Snowy River. The major species is white box, which is utilized on a limited local basis for domestic purposes and also valued by apiarists.

The Timber Industry

The timber industry is the most important primary and secondary industry in the study area, offering employment opportunities in 23 widely scattered communities. Because many of these are small and often originally based on agriculture, the forest industries have offered alternative or additional employment to rural people who have found difficulty in maintaining themselves from agricultural activities alone.

Currently, the timber industry directly employs about 650 people (including 36 sleeper and pole cutters and 25 employed on cartage of sawn timber), with an additional 52 permanently employed by the Forests Commission. The total of about 700 represents 11% of the people living within the study area (6,301 in June,

1971). Assuming each employee has 3 dependents, the forest industries of the study area directly support 44% of the population of the area. This statistic considerably underestimates the significance of the industry to the region as more than half of the people engaged in tertiary or service industries indirectly owe their means of livelihood to timber production.

Table 14

LOCATION AND NUMBER OF EMPLOYEES OF SAWMILLS DEPENDENT ON STATE FORESTS

Location	No. of sawmills	No. of employees
Bemm River	2	32
Bendoc	2	68
Bonang	1	11
Cabbage Tree Creek	2	36
Cann River	5	70
Club Terrace	4	95
Combienbar	1	17
Maramingo	1	5
Newmerella	1	16
Noorinbee North	1	9
Orbost	3	133
Waygara	1	74
Outside the study area		18

Sawmilling

Table 14 lists the number of sawmills and the number of people directly em-

Felling shining gum on the Errinundra Plateau

Snigging a shining gum log

ployed by sawmills at each location. The equipment and personnel available from sawmill sources is a most important part of the total fire-fighting force available from within the study area.

The forests of the study area provide 26% of the 1.23 million cubic metres of hardwood sawlogs currently produced each year from public land in Victoria. About 5,000 ha is cut annually to supply the log requirements of the sawmilling industry in the area. Of this, about one-third (1,600 ha) is clear-felled and the remainder is selectively logged.

The clear-felling is not practised in large consolidated blocks, but as a number of separate, widely dispersed operations. In this type of operation, large uncut tracts are temporarily retained between cut-over areas, thus retaining interim habitats for the populations of native species in the study area. All clear-felled areas are immediately given appropriate regeneration treatment, by planting, by artificial seeding (mostly from the air), or by induced seed-fall from retained seed trees.

Sawlog demand

Most of the sawn timber produced in the study area is used for house framing. At present timber-frame houses cost less than houses built with alternative materials. Approximately 97% of the new houses erected in Melbourne each year use timber for structural framing. The number of new houses commenced is currently at a record level and activity is expected to continue because of the housing shortage. East Gippsland framing is of good quality and is in high demand. As the East Gippsland study area is one of the most important single areas for the Victorian sawn timber industry, it is extremely important for

the continued production of new housing in the State.

Predictions of timber consumption by the State of Victoria to the year 2020 indicate an anticipated doubling of present consumption in the next 50 years. *Per capita* consumption is expected to decline slowly as alternatives to wood become available, but the anticipated population increase during the period will more than compensate for any decline in *per capita* consumption, resulting in a nett increasing demand.

Sawlog demand

Present annual sawn timber consumption in Victoria is the equivalent of 2.37 million cubic metres of sawlogs. Of this volume, 1.42 million cubic metres come from State forests and 0.14 million cubic metres from private forests within the State. The remainder is imported. About one-third of these imports come from overseas (mainly from New Zealand and North America), and two-thirds from Tasmania (hardwoods) and South Australia (softwoods).

Three major sources of sawlog supply exist in Victoria: the mature hardwood forests, the extensive regrowth ash forests of central Gippsland, and softwood plantations.

The softwood plantations presently contribute 0.19 million cubic metres or about 13% of the total State production from State forest, and output will increase gradually over the next 20 years to a level of about 0.90 million cubic metres. Availability from this source will increase rapidly from the mid-1990s. Provided current planting programmes are maintained, it is predicted that log output from this source will be 2.7 million cubic metres by the year 2020.

As the ash regrowth forests will not begin to reach maturity (and thus realize their greatest productive potential) for the next 20 to 30 years, it is necessary that the native hardwood forests continue to contribute the major part of the State's log supply at least until

Loading logs onto a truck

TABLE 15

HARDWOOD MILL LOG PRODUCTION (m^3) FROM STATE FORESTS

Year	Victoria	East Gippsland study area	East Gippsland as percentage of Victorian production
1940/41 ø	768,000	3,600	0.5
1951/52	1,129,000	90,000	6.4
1956/57	1,380,000	163,000	10.8
1961/62	1,180,000	202,000	16.5
1966/67	1,281,000	259,000	19.8
1967/68	1,161,000	262,000	22.5
1968/69	1,265,000	302,000	23.9
1969/70	1,219,000	290,000	23.8
1970/71	1,275,000	309,000	24.3
1971/72	1,288,000	343,000	26.7
1972/73	1,225,000	319,000	26.1

ø Approximate

the mid 1990s if the present shortfall is not to be increased.

As Table 15 illustrates, the forests of the study area have increased their contribution to total State hardwood production from 6.4% in 1951/52 to more than 26% at present. They represent the major resource of mature hardwood in the State, and so will be heavily relied upon to meet the community's needs for sawn timber for the next 20--30 years.

It is estimated that 600,000 ha of State forest (75% of the total area) carries forest that is greater than 30 m in height. This forest is all capable of moderate to very high sawlog production. A further 100,000 ha (13% of the total) is capable of lower-level log production and pulpwood production.

A volume of 5.4 million cubic metres of sawlog has been removed from the area. It is estimated that a maximum of 20 million cubic metres of sawlog remains to be harvested from mature stands there.

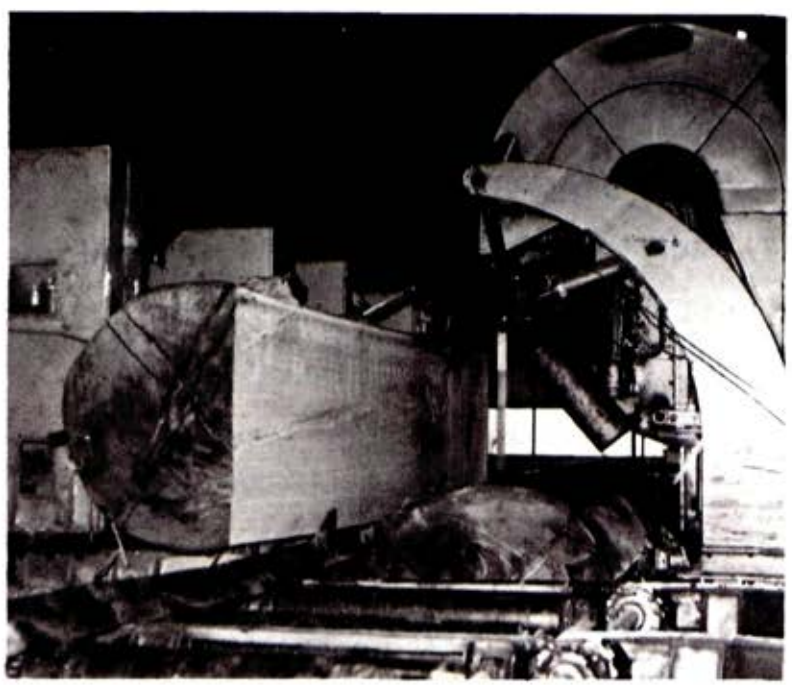
Pulpwood production

Demand for paper and paper products is increasing at a greater rate than demand for any of the other products of forest industry. There is a world-wide shortage and imports are becoming scarcer and dearer. The forests of the study area contain the raw material to supply much of the short-fibre pulp this State will require in the next few years. As overseas demand is strong, pulpwood in the form of wood chips produced as a by-product from the sawmilling industry is currently being exported from the area to Japan.

As Australian demand increases and imports become scarcer and more expensive, it can be anticipated that such pulpwood will be required for use within Australia. Such development could also provide the opportunity for the introduction of a major new industry in the form of a pulpmill in East Gippsland.

The forests of the area provide a significant potential resource for the development of the pulpwood-using industry. Millable timber would not be used for this purpose, but pulpwood could be procured from the following sources:

* Waste from sawmills. Part of this is currently being chipped for export, the remainder as waste.



First cut in conversion of log to sawn timber - Brodribb Sawmilling Co Pty Ltd

* Residues from areas currently logged. As pointed out earlier, about 5,000 ha is now cut over annually to provide the raw material requirements of the local sawmilling industry. Residues from trees felled as sawlogs and trees remaining standing because they are suitable for sawlogs provide a large potential resource of pulpwood.

* Forests that are currently at low sawlog productivity, as a result of past selective felling, but have a high potential for timber production. The sawlog trees have been removed from these forests but low-quality trees, unsuitable for sawlogs but suitable for pulpwood, remain. While these remain, regeneration is inhibited and regrowth occurring in the gaps has malformed crowns. Removal of these trees as pulpwood, which is desirable silviculturally, will achieve commercially what could not be carried out at public expense due to the cost involved.

Without a pulpwood-using industry, the wood referred to in the second and third categories above (amounting to more than half a million tonnes annually) is burnt or left to rot, and in fact public money must be spent to fell the standing trees if satisfactory regeneration is to be achieved.

A pulpwood industry could be sustained in East Gippsland using wood obtained largely from areas at present cut over for sawlogs. Recovery of pulpwood from these areas has economic advantage through utilization of material now wasted, social advantage through employment opportunity, and advantage to the forest through the opportunity provided for desirable silvicultural treatment.

Any logging, whether for sawlogs or pulpwood, causes some disturbances to the environment. Vegetation and wildlife habitats are altered, and bared soil is prone to erosion. Logging must therefore be conducted in accordance with prescriptions designed to minimize any adverse effects. Measures include confining cutting to small discrete areas, with uncut buffer areas between them, leaving the vegetation along gullies and watercourses undisturbed.

Other forest products

The production of railway sleepers is an important function of the forests in the study area. Currently these produce approximately 70,000 annually, satisfying about 22½% of Victorian requirements. Because of the declining availability of timber from the naturally durable species produced from the forests of the State's northern areas, it is expected that a greater proportion of future Victorian sleeper requirements will come from this study area.

Beam production has been a small but important section of the industry for many years, dating back to the early

part of the century, but is restricted to the highly durable species such as Gippsland grey box.

In addition, the forests of the study area have supplied large quantities of poles and piles over many years.

Softwood

No softwood plantations have been established within the study area but certain areas within the coastal and mountain forests are suitable for softwood growth. A number of experimental plots in the Nowa Nowa, Orbost, and Genoa localities are providing data on the potential for growth at various sites.

Much of the peppermint-type forest in the Bendoc area is highly suitable for softwood growth. The New South Wales Forestry Department has established the Bondi plantation, a major area of softwood development in that State, immediately across the border to the east of Bendoc.

MINING

No major exploitation of metals has taken place in East Gippsland, but small to moderate quantities of gold, silver, lead, molybdenum, iron, and manganese have been mined. Little mining activity is current, although exploration licences have been issued in several areas.

Moreover, the area contains few major quarries. Extraction for road-making has occurred from small nearby pits, which have been abandoned after project completion. Sand and gravel pits are also small, with some exceptions near the larger settlements.

The potential for the exploitation of silver--lead--zinc deposits is considerable in some parts of the study area, particularly near Deddick.

Gold

Prospecting for gold has been most intensive in the Bendoc--Clarkeville--Bonang--Delegate River district. In this area thick layers of surface loam make prospecting difficult, but at several mines quartz reefs have been worked to depths of about 100 m. At the Rising Sun reef at Bonang one shaft was sunk to 170 m. Alluvial flats along the streams have been worked for gold. On the western margin of the area, the small Tara gold-fields produced rich yields.

A number of quartz reefs have been worked in the vicinity of Club Terrace, and nearby Poddys Creek, where the metamorphosed beds contain highly mineralized reefs up to 2.5 m wide. At Combienbar some rich but short leads were mined. Around Mallacoota several minor gold-bearing deposits were worked, but only to shallow depths.

Iron

An iron ore deposit north of Nowa Nowa has not been exploited. Outcrop is limited to a few broken ridges of haematite along its western margin, and reserves are 5.5 million tonnes. The ore consists of massive and micaceous haematite at the surface, passing at deeper levels to magnetite, with micaceous haematite, pyrite, and chalcopyrite. Iron content ranges from 45 to 68% (average 50%), and in one bore, ore with a copper content of up to 0.59% was obtained over a depth of 20 m.

Victoria Star gold mine, south of Bendoc

Accommodation Creek Copper Mine

Bodies of a similar nature, some rich in manganese, outcrop sporadically over a distance of 10 miles along shear zones at the southern termination of the Snowy River volcanic belt.

Silver--lead

Silver--lead mines are located in granodiorite at Deddick. Assays from veins at Mount Deddick show values as high as 11% silver and 47% lead. A small quantity of silver--lead ore has been obtained from Boulder Flat, south of Errinundra. There are also galena lodes at Mount Tara.

Copper

Copper has been mined at Accommodation Creek, near Deddick. The bulk of the mineralization is associated with a

major fault that runs through the mine area. Mineralized zones have shown average copper values of about 3%.

Small copper lodes have also been worked at Sardine and Wallaby Creeks on either side of the Bonang Highway, and on the Snowy River about 26 km from Orbost.

Other minerals

Small bodies of molybdenum ore occur at Wangarabell, where shafts have been sunk to a depth of 20 m, and at Genoa Peak.

High platinum--osmiridium values have been obtained in a small sample from Boulder Flat, south of Errinundra.

At Mount Raymond, east of Orbost, largish masses of soda-feldspar adjoining a gneiss--granite contact have attracted interest, but no attempt at extraction has been made.

Graphite has been reported in small quantities on Sundown Creek about 5 km north-west of the Princes HIghway at Bellbird Creek. Barite occurs at Boulder Flat, and monazite has been produced from alluvial deposits at Pinch Swamp Creek, near Bonang. Bismuth has been recorded in quartz lodes at Mount Bendock, and in alluvial deposits at Wombat Creek.

Ores of tungsten, wolfram, and scheelite occur at Round Hill (Bendoc) and Boggy Creek.

Several small beach and dune deposits of heavy minerals with patchy distribution, mainly of ilmenite, and minor amounts of zircon and rutile have been recorded around Point Hicks and Pearl Point. The average content of heavy minerals is so low and the lateral dimensions of the deposits are so small that it is not considered a commercial proposition to mine them. Records from further east, for example at Betka River, have so far shown that insignificant amounts of heavy minerals occur in that area.

Because of ease of extraction, the Tertiary limestones exposed in valleys westwards from Orbost are an excellent source of agricultural limestone. They have been worked for this purpose, on a small scale, on the Toorloo Arm of Lake Tyers. A new quarry has recently been started near Hospital Creek, 10 km east of Nowa Nowa. This source of limestone could be the basis for a future cement-manufacturing industry.

Road-making material

Ordovician sandstone has been widely used for road-making. Fill from major cuttings, for example near Club Terrace, has been used in the Princes Highway reconstruction.

Most quarries are small and have been abandoned after use for a specific project. Some, for example on the coast near Mallacoota, have been used for small supplies from time to time.

There has been little attempt to exploit the best-quality metamorphosed Ordovician beds. Hornfels has been used locally from areas indicated in Chapter 6, but only rarely carted for any distance. Because density of traffic on many of the minor roads is light, these roads do not require high-quality materials.

Quartzites and dyke rocks (mainly aplites) from near Chandlers Creek have been used on the Cann Valley Highway, and those from Nashes Camp Trail on the Princes Highway. Aplites have also been obtained from a major dyke on the eastern end of the WB Line track and a rhyodacite has been obtained from near the Bemm River road. Reef quartz has been carted over a wide area from Donalds Knob. Granite has been used locally for bridge abutments on the major highways and minor roads. It is also widely used as fill and surface material on minor roads. Weathered granites, particularly from the north-east of the study area, have been used as a road-surfacing material.

Much-hardened Upper Devonian sandstone is used in the road surface of the eastern part of the Princes Highway, but this has been obtained from sources in New South Wales.

Extensive areas of gravels and sands are present in the southern part of the area as part of residual Tertiary and Quaternary fluviatile deposits. In the north-west, Recent pebble beds in present-day

Mayfair Queen Mine, Bendoc, 1951

streams offer little more than limited local supplies of road-making materials.

Well-bedded gravels from small pits on the Drummer Track and larger pits on Browns Track nearby have also been used for road-making.

Numerous abandoned pits lie along the eastern sector of the Princes Highway, among the most prominent being those at

the East Wingan Road turn-off. Exploitation is proceeding near Mallacoota and elsewhere. While reserves are immense, economic and conservation considerations may prevent full utilization.

Sands are associated with the Tertiary gravels, but the finest, less gravelly deposits occur in the Quaternary dunes of the coastal strip and the Tertiary areas fringing these.

In summary, immense reserves of sand, gravel, and stone remain untouched as yet.

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WATER USE

Town water supply is an important use of water. The following towns have reticulated water:

Orbost
Newmerella
Marlo
Cann River (approved)
Mallacoota.

Orbost, Newmerella, and Marlo draw water from the Rocky and Brodribb Rivers north-east of Orbost; water supplies for Cann River will come from the Cann; and Mallacoota is supplied from the Betka River. The Rocky River and Betka River Catchments are proclaimed catchments. The township of Bemm River is likely to be supplied with water from the Bemm.

Irrigating beans on the Snowy River flats near Orbost

East Gippsland generally has relatively plentiful rain, and conditions are usually satisfactory for crop or pasture growth; droughts occur only occasionally. In addition, much of the agricultural land is on hilly country, and so irrigation has had little development. However, it can be beneficial, as dry periods may occur at any time of the year.

In 1971/72, 346 ha were irrigated (committing 2,000 megalitres per annum), but the area irrigated has increased since the recent drought. Most of the irrigation is on the Snowy River flats near Orbost and on the Cann River flats. There are also 36 stream diversion permits for domestic, dairy, and industrial purposes. Of these, 25 are for the Snowy River and most of the rest for the Cann River.

The total volume that could be removed under all permits is about 2,300 Ml

The water tower at Newmerella

annually. A further insignificant amount is removed under riparian rights. Water requirements for irrigation are likely to increase as cultivation of the Orbost river flats becomes more extensive and the recent drought will probably further increase the demand for new irrigation permits.

On-farm storage of run-off in dams is important for watering of stock.

Because of the ready availability of surface water, almost no underground water has been used. In 1970/71 only 16 ha were irrigated from underground water supply.

It will be important to ensure that quantity and quality of all water supplies are maintained at adequate levels. This may involve providing for further catchments and storages, and will necessitate control over activities within the catchments.

LAND USE RELATIONS

The preceding chapters described the natural resources of the study area and discussed potential uses of public land. This chapter considers interactions between the principal land uses - agriculture, mining, nature conservation, recreation, timber production, and water production.

Uses are competitive when an increase in one leads to a decrease in another based on the same set of resources, supplementary when the increase in one does not change the other, and complementary when the increase in one benefits the other.

Depending on their relative intensities, a combination of types of land use may vary between complementary, supplementary, and competitive. Generally, the most flexible are those that complement or supplement many others over a great range of intensities.

Agriculture

Agriculture may be complementary with some recreational activities, such as driving for pleasure and picnicking, because it adds visual variety to the landscape, and clearings permit views from low-level vantage points.

In East Gippsland, which is predominantly forested, agriculture may also be complementary with some aspects of fauna conservation: the expansion of grassland habitat favours some animal species, such as the great grey kangaroo and the emu.

The relation between agriculture and water production is often supplementary; however, conversion from forest to grassland can change run-off characteristics, thus affecting water quality.

Land uses with which agriculture would compete in East Gippsland include timber production, most aspects of nature conservation, and some aspects of recreation.

Apiculture

Apiculture may complement agriculture where the bees serve the useful function of cross-pollination. However, replacement of forests by pasture is usually detrimental to honey production. Apiculture is supplementary to timber

production, most aspects of nature conservation, recreation, and water production. Bees do compete with native fauna for nectar and pollen, but the significance of this competition is not known.

Timber production

Hardwood timber production is currently the major use of public land, and the present operations are supplementary with most other types of land use. Roading associated with timber operations improves access for other uses. Recently logged areas are favourable habitats for some species of native fauna, making timber production complementary with their conservation. The same areas are unfavourable for other species, making it competitive with some fauna conservation.

Timber production also competes with some forms of recreation (particularly those requiring wilderness environment), and may compete with water production when run-off from tracks and disturbed areas carries high silt loads.

However, most adverse interactions between hardwood timber production and other land uses are concentrated in or near recently logged areas, or are associated with forest roads. The long crop rotations used in producing hardwood timber mean that only a small proportion of the total forest area is logged annually.

Mining and quarrying

Although there is little mining and quarrying in the area at present, extractive industries are competitive with most other forms of land use, through site disturbance, dumping of overburden, roading, and polluted run-off. Site rehabilitation minimizes long-term effects of mining, and is most important.

Water production

Production of high-quality water is to some extent competitive with most other land uses, as logging, clearing, mining and roading may increase run-off turbidity. Water catchments are protected for water production, which thus generally complements nature conservation.

Floods in major and minor streams, with consequent inundation of their floodplains, have a beneficial effect on fish and wildlife habitat. This is particularly important for native fish and water-bird populations. While stream regulation tends to decrease the intensity and frequency of floods, it may have some beneficial effects on fish and wildlife populations under certain circumstances, such as in times of severe drought. Removal of snags from streams and similar flood-control measures may also be competitive with nature conservation.

Stream regulation, by reducing the danger of flooding and increasing water-

availability during droughts, benefits agricultural activities on low-lying land. Water storages may also be used for some types of recreation.

Nature conservation

Nature conservation may compete with almost all other forms of land use where it involves exclusion of disruptive activities. However, it is generally complementary with water production, and may be supplementary or complementary with limited recreation, timber production, and other uses.

Scientific study

Areas set aside specifically for reference must be managed to exclude activities other than limited scientific study. This use is complementary with some nature conservation and production of high-quality water.

The substantial area of public land remaining in East Gippsland provides opportunities to take advantage of beneficial relations between different land uses, and to make some provision for competing uses.

PART IV

BLOCK DESCRIPTIONS

BLOCK DESCRIPTIONS

This part describes, for each block, its general characteristics, the nature of the land, its capabilities for various uses, and the likely hazards and conflicts involved with such uses, and finally highlights those outstanding capabilities or other features that are of special significance.

A consistent format of headings and subheadings has been used so that the reader can readily find specific information within one block and compare it with others. The discussion under most sections refers specifically to public land. Only in the cases of General description, Climate, Geology and physiography, Land systems, and Soils do comments apply also to freehold land.

A diagram at the beginning of each description shows the location of that block in the study area. Greater detail for all blocks, and the relations between adjacent blocks, are shown on Map 7.

Capability

This term refers to the suitability of public land for various uses, and is based on a number of considerations. These include the inherent characteristics of the land, the proximity of public land to centres of population, the level of accessibility within it, and the relative scarcity of the type of land.

In most cases, this report has dealt with assessment of capabilities in general terms, because the amount of information available has varied from block to block, and because some of the values have been difficult to quantify. In assessing capability, comparisons have been made with other blocks and with other parts of the State.

Where productivity measures have been used, various categories have been defined and given capability ratings. Hardwood production ratings are shown on page 123.

Archaeological sites

No detailed archaeological work has been conducted in this study area, but preliminary information suggests that several hundred sites are located along the coastal strip (Blocks 1--5). Many of these sites appear to be stratified and contain well-preserved archaeological materials.

1. HARTLAND

A. General

(1) General description

This block is mainly gently undulating country forested with silvertop--stringybark. Immediately behind the coast dunes along the south of the block lies Ewing Marsh, which is vegetated with swamp species.

It contains some freehold agricultural land, situated mainly along the Princes Highway and south of Orbost.

County of Tambo: Parishes of Tildesley West, Tildesley East, Waygara, and Newmerella.

(2) Tenure and present use

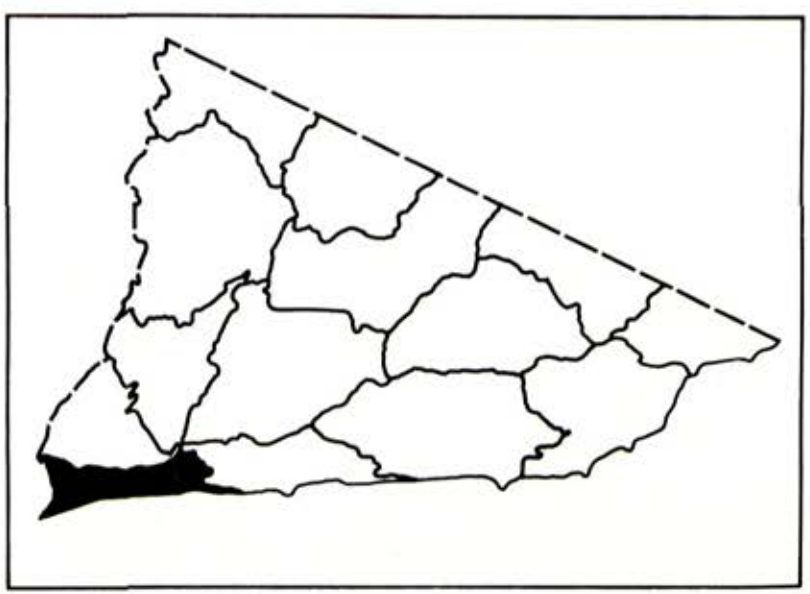
Of the 24,000 ha of public land in this block, 4,450 ha of Ewing Marsh is a State Game Reserve. The Tostaree Pilot Farm occupies 120 ha of public land. Of 7,700 ha of Reserved Forest, 1,600 ha forms part of the Lake Tyers Forest Park. The remainder of the public land is protected forest.

The forest of this block is used to some extent for production of sawlogs and sleeper cutting. Cattle are grazed on public land. Use of the area for apiculture varies considerably from year to year according to the flowering of the forest species.

B. Nature of the Land

(1) Climate

Hartland block has a temperate climate, as proximity to the sea influences temperatures. Annual rainfall is mostly



in the range 750--900 mm, but the southern part of the block may have less than 750 mm. However, mean rainfall exceeds 50 mm in each month.

(2) Geology and physiography

The surface material of most of this block is Tertiary non-marine sediments, overlying Tertiary marine sediments, but Quaternary deposits make up the southern part of the flats adjoining the Snowy River.

Most of the block (on the Tertiary deposits) is rolling or undulating country with some short steep slopes along watercourses. Those parts of the block on Quaternary alluvial and swamp deposits (the Snowy River flood-plains and Ewing Marsh) are flat. The Snowy River flood-plains are a former estuarine inlet filled with silt. Ewing Marsh was formed by the filling of the coastal lagoon behind the dune barrier.

Sand dunes running parallel to the coast form a narrow strip along the southern edge of the block behind the sandy beach, which forms part of the Ninety-mile Beach.

Lake Tyers was formed by the submergence of a stream system, during the Holocene period, and the extent of infilling by fluvial sedimentation and swamp encorachment is still limited. The lake shores are generally rocky. A sand barrier, which opens naturally from time to time, has been deposited across the mouth of Lake Tyers.

(3) Soils

The soils of this block, mainly duplex soils, were studied by Newell and

Woodruff *(Department of Agriculture Soil Survey Report* No. 34, 1962). The most extensive soil is a dark grey sandy loam, strongly bleached in the lower part, over brightly mottled yellowish brown sandy clay loam or clay at depths of 0.5--1 m. In some areas the clay subsoil, which is dense and very plastic when moist, occurs within 30 cm of the surface. Another variant of this type of soil has grey sand 1--2 m deep, sometimes with ferruginous concretions, overlying sandy clay loam.

A different soil, which occurs on old sand dunes, is grey sand deeper than 1 m and often deeper than 2 m, overlying coffee rock and soft ferruginous concretions.

Soil tests indicate that these are moderately acid and deficient in phosphorus and potassium.

The soils of Ewing Marsh include black peaty sands on sandy loams over impermeable clays, with or without an intermediate horizon of pale-coloured sand.

The Snowy River flood-plains carry deep alluvial soils - sandy loams to clay loams. They are particularly rich in nutrients.

Undifferentiated aeolian sands occur on the Ninety-mile Beach, and weekly differentiated aeolian sands on the Recent coastal dunes.

(4) Vegetation

The forest of this block is mainly silvertop--stringybark open forest III, in which southern mahogany is prominent in some areas, particularly close to the coast. There are small stands of coast grey box, red box, and blue box.

The vegetation of Ewing Marsh was described in the Vegetation Chapter (page 51).

The coastal sand dunes are covered in scrub of coast tea-tree (the dominant species), coast wattle, common boobialla, and other species, with marram grass and hairy spinifex on the beach edge of the dunes, and southern mahogany and coast banksia in sheltered positions.

Maidens wattle *(Acacia maidenii)* occurs at Newmerella and Lake Corringle, and is known nowhere else in Victoria, although common in New South Wales.

(5) Fauna

A significant part of this block as faunal habitat is Ewing Marsh--Lake Corringle, which is a rich wetland area. Its main importance lies in providing a large breeding and feeding area for substantial numbers of water-fowl. The adjacent areas of drier land also support an assemblage of fauna, which is generally representative of the coastal vegetation of East Gippsland but shows

some differences. As illustrations, the potoroo inhabits the coastal vegetation in this block and in the Marlo Plains block, but has not been recorded further east. Relatively high densities of long-nosed bandicoots also occur in this block and appear to decline further eastwards; the converse situation appears to apply to the short-nosed bandicoot.

The faunal habitats represented in this block are dry forest, coastal woodland, wetland, littoral, estuary, and agricultural land.

(6) Land systems

Waygara 81%; Noorinbee 6%; Wau Wauka 7%; and Boole Poole 6%.

C. Capabilities

(1) Nature conservation

Although Ewing Marsh is regularly burnt (illegally), it still remains a valuable breeding and feeding area for wetland bird species, and public funds are presently being spent to enhance its capabilities in this respect. Lakes Corringle and Wat Wat are also valuable wetland habitats. The surrounding drier areas of public land provide a buffer zone for protection of some of the catchments and the margins of the marshes and lakes. The maintenance of high waterfowl production in these wetlands depends on protection of their catchments and buffer zones. Also, these drier areas still support a fauna representative of that which occurred in the area prior to European settlement.

Lake Tyers is scenically attractive and preservation of its landscape qualities will depend on protection of the forested surroundings.

(2) Recreation

Lake Tyers is potentially valuable for recreation. It has good access, is more

The southern part of Lake Tyers

protected from winds than the Gippsland Lakes further west, and is scenically attractive, with forested hills sloping steeply down to the water's edge along most of the shoreline.

Old tramlines and a barge - used to transport sawlogs from the forest to a Nowa Nowa sawmill - are still indentifiable and have historic interest.

The ocean beach, a continuous sandy beach from Lake Tyers to the Snowy River, has some value for recreation, although parts are too dangerous for swimming. It is most accessible near Lake Tyers and Lake Corringle; Ewing Marsh makes access difficult between these points.

Duck-shooting is a recreational activity in the major swamps and natural waterholes.

(3) Agriculture and apiculture

Apart from the coastal strip, most of the block (Waygara land system) is suitable for agriculture. The potential of the area has been investigated with the establishment of the Tostaree Pilot Farm. Highly productive pastures can be developed with good management. Fertilizer requirements and clearing costs are high, but the good rainfall, mild temperatures, and excellent access give the area a high capability for agriculture. This block has moderate capability for forest grazing.

Parts of the forest, particularly areas of blue box and red box, are highly regarded by apiarists for honey production. Understorey species are useful for building up hives.

(4) Timber production

The forest has been selectively cut for sawlogs, railway sleepers, and poles for many years, and as a result now has a low yield of sawlogs. However, many trees suitable for sleeper production remain.

The eastern part of the block (mainly stringybark open forest III and coastal woodland II) has low capability for timber production, and the western and central parts (with a large proportion of silvertop) have moderate capability.

(5) Mining

The Tertiary sediments underlying the non-marine sediments contain limestone deposits, some of which may be commercially valuable. Gravel, sand, and material suitable for road-making occur.

(6) Water production

Catchments are small and rainfall is less than in many other parts of the study area. This block is not important for water production, except for farm dams. Capability for production of water from underground sources is high, should the need arise.

D. Hazards and Conflicts

Slopes are not generally steep except on the sides of the deeply entrenched main drainage lines, where a moderate erosion hazard exists. Gentler slopes are liable to rill erosion during cultivation. The sand dunes along the coast are very prone to wind erosion if the vegetation is damage by burning or disturbance.

Fire in the forests is a threat to agricultural settlements nearby. Fires have severely modified the vegetation of Ewing Marsh, and caused erosion of sand dunes.

Floods are a hazard on the Snowy River flats, mainly affecting freehold land. Ewing Marsh is frequently inundated, but this is advantageous for wildlife conservation.

Cinnamon fungus is a hazard to the native vegetation, particularly in positions prone to wet conditions.

Conflicts are likely to arise between different possible uses for the land. Clearing for agriculture diminishes wildlife, flora, and apiculture values, and ends timber production. Clearfelling and regenerating the forest for timber production may be economically possible if the existing poor-quality timber was used for pulpwood, but would temporarily diminish scenic, wildlife, flora, and apiculture values.

E. Significance

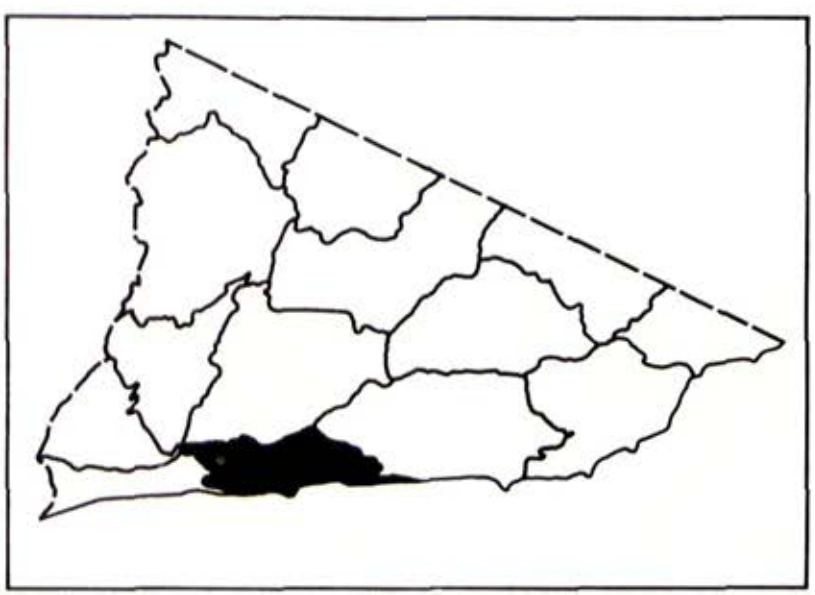
Ewing Marsh and Lakes Corringle and Wat Wat are important for fauna conservation. Lake Tyers and the ocean beach are potentially important for recreation. Much of the block is suitable for agriculture. The value of this block for a number of uses is increased by its proximity to Orbost and the Princes Highway and by east of internal access.

2. MARLO PLAINS

A. General

(1) General description

Much of this block is freehold, mainly on the Snowy--Brodribb River flats and in the Marlo--Cape Conran--Cabbage Tree Creek area. The Mount Raymond--Cabbage Tree Creek area and east of the Cape Conran--Cabbage Tree Creek road are undulating forested country, and extensive areas of heath and woodland vegetation occur in the southern part of the block.



County of Croajingalong: Parishes of Orbost East, Jirrah, Tabbarah, Jilwain, Yarak, and Bemm.

(2) Tenure and present use

The total area is 40,000 ha, of which 29,000 ha is public land. The Lake Curlip State Game Reserve incorporates 790 ha around Lake Curlip. Cabbage Tree Palms Reserve, of 250 ha, is a special-purpose forest reserve to protect the habitat of the cabbage fan palm. Cape Conran Foreshore Reserve contains about 20 temporary dwellings on permissive occupancies. The public land in the northern part of the block is Reserved Forest, and the remainder is protected forest or unreserved Crown land.

The forest is used for the production of sawlogs and some sleepers. Forest grazing and apiculture occur on most of the public land, but are seldom intensive.

Recreation is important along the coast, particularly at Marlo, Cape Conran, and Bemm River.

The summit of Mount Raymond carries a fire tower and television-translator tower.

B. Nature of the Land

(1) Climate

Temperatures are moderated by proximity to the sea. This effect is most marked close to the sea, at lower elevations. Annual rainfall is mostly 900--1,000 mm, but exceeds 1,000 mm in the north of the block and is less than 900 mm in the west.

(2) Geology and physiography

The block has a varied surface geology, but most of it is on Tertiary or Quaternary sediments: the Snowy--Brodribb river flats, the valley of Cabbage Tree Creek, and the eastern branch of Yeerung River are on Quaternary river alluvium; a belt about 4 km wide along the coast is on Quaternary sands; and most of the rest is on Tertiary non-marine sediments.

The coast between Pearl Point and Sydenham Inlet

There are minor surface occurrences of Lower Devonian granite and Ordovician sedimentary rocks - both outcrop on the coast at Cape Conran.

Land on the Quaternary alluvial deposits is flat or almost flat, and land on the Quaternary sands is also fairly flat, forming the grass-tree plains and adjacent dunes. The northern part of the block, on Tertiary sediments, is undulating, but rises more steeply and to a greater altitude at Mount Raymond, which is partly Ordovician sedimentary rock and partly granitic.

Lake Curlip is a residual of the former Snowy--Brodribb estuary, reduced by swamp encroachment and shallowed by sedimentation from floodwaters.

At its mouth, near Marlo, the Snowy flows into a lagoon, backed by a steep bluff and separated from the sea by a sandy barrier, through which the river cuts an outlet channel. Fragments of the lagoon, segmented by sand deposition and swamp encroachment, extend eastwards towards Point Ricardo.

The Yeerung River has an estuarine lagoon in its lower reaches, which is often sealed off from the sea by a sand barrier.

Dock Inlet is a former bay, cut off from the sea by a sand barrier surmounted by dunes. The barrier has not been breached in recent years, and the water of the "Inlet" is now almost fresh water.

(3) Soils

The soils on the Tertiary sediments are mostly friable yellowish or reddish gradational soils or leached sands; those on Quaternary river alluvium are similar to those described for the Hartland block.

The grass-tree plains carry strongly acid dark grey or brown sands with much organic matter and with a pronounced organic hardpan at a depth of (usually) 60--120 cm. They have low fertility in a natural state.

In waterlogged depressions the surface horizon is a peat or a peaty sand over yellow-brown sand, with a layer of peat frequently at the level of the water table, overlying coffee rock.

(4) Vegetation

Extensive areas, particularly in the southern part of the block on the Quaternary sands, support a variety of heath associations. Areas of heath are interlaced by woodland or low open forest dominated by yellow stringybark, silvertop, and southern mahogany.

Further inland, except in drainage lines, the dominant vegetation is silvertop--stringybark open forest III.

A vegetation feature of special interest is the remnant vegetation of the river alluvial soils, represented around Lake Curlip and along the Cabbage Tree Creek. It is here the cabbage fan palm occurs, the nearest other known occurrence being well into New South Wales.

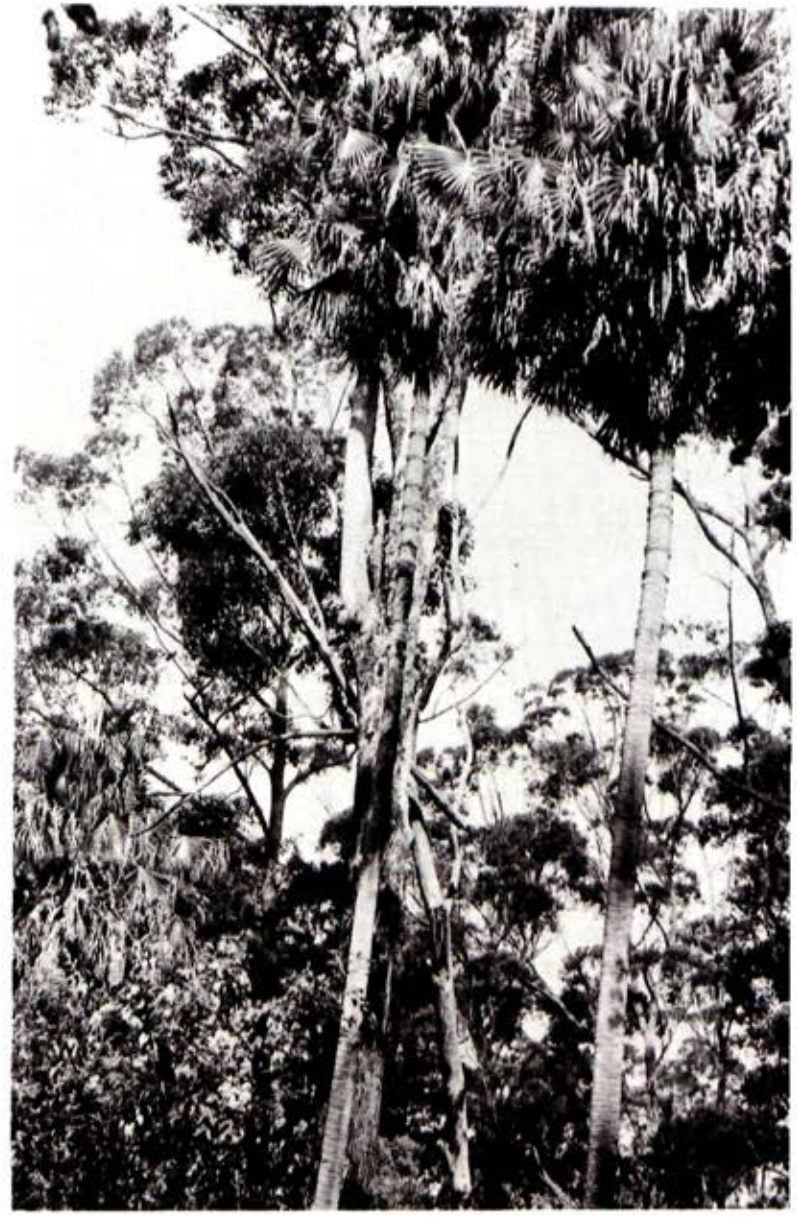
Several other plant species recorded in this block are rare in Victoria, although reasonably common in New South Wales. The tartan tongue-orchid *(Cryptostylis erecta)* is known in Victoria only from heath fringing a grass-tree swamp at Marlo. The leafless tongue-orchid *(C. hunterana)* is confined in Victoria to damp heathland of the Marlo --Cape Conran--Cabbage Tree Creek--Bellbird area, and Reedy Creek and Bottle Creek near Cann River. The purple diuris *(Diuris punctata)*, an orchid species formerly fairly common but becoming rare through destruction of its habitat, has been recorded at Marlo.

The swamp beard-heath *(Leucopogon esquamatus)* is known in Victoria only from the vicinity of Marlo and from the Howe Range.

(5) Fauna

The fauna of this block is generally representative of coastal areas of East Gippsland, but differs in some details from other coastal blocks.

The Snowy River and associated lakes, swamps, and creeks provide differing



Cabbage fan palms

Cape Conran

habitats for a variety of estuarine and fresh-water fish. The fresh-water sections of the Snowy contain the largest population of bass in Victoria. Bass also occur in Dock Inlet and the upper reaches of the Yeerung River.

Ground parrots are sighted frequently in the Marlo Plains area.

The coastal area between Bemm River and Yeerung River contains small colonies of the smokey mouse, an endemic Victorian species, as well as long-nosed bandicoots and potoroos. An extensive list of animal species can be obtained from this block, since it contains the following fauna habitats: wet forest, dry forest, coastal woodland, dense heath, open heath, wetland, littoral, estuary, and agricultural.

(6) Land systems

Pinnak 2%; Wooyoot 38%; Waygara 11%; Noorinbee 20%; Barga 27%; and Boole Poole 2%.

C. Capabilities

(1) Nature conservation

The Lake Curlip State Game Reserve and the Cabbage Tree Creek are important for nature conservation, providing feeding and nesting areas for water-birds.

The heaths and associated woodland west of Bemm River provide habitat for the smokey mouse, long-nosed bandicoot, and the potoroo *(Potorous apicalis)*, as well as many more common species.

The native vegetation of the Snowy--Brodribb river flats has been almost completely destroyed by clearing, but a remnant remains at Lake Curlip. The occurrences of cabbage fan palms in this block provide interest as they are so far from the nearest other known natural stands. Several other plant species, inhabitants of heath, are rare in Victoria, and so of special interest.

Little of the heath areas of the Marlo--Cape Conran--Cabbage Tree Creek area remains as public land.

The coastal scenery is a valuable resource, particularly where headlands such as Cape Conran protrude beyond the general coast-line.

(2) Recreation

Recreational features of this block are concentrated in the coastal sector, especially at Marlo and Cape Conran. Cape Conran provides a variety of recreational environments, with ocean surf beaches, protected bay-like beaches, and rocky shores. It is readily accessible, with a bitumen road from Orbost.

Mount Raymond is a good look-out point, providing views over Orbost and the Snowy River flats, inland to Mount Murrungowar and Mount Kuark, and eastwards to Sydenham Inlet.

(3) Agriculture and apiculture

The leached sands of the Barga land system have a high fertilizer requirement and are poorly drained. However, clearings costs are low and the proximity to intensively farmed areas indicated a moderate capability for further agricultural development.

The Wooyoot and Waygara land systems, which occur between the Barge land system and the Princes Highway, generally have high capability for agriculture. Slopes are generally moderate and, although fertilizer requirements are high, the rainfall is well distributed and temperatures are mild.

The flats and terraces along the Cabbage Tree Creek (Noorinbee land system) are acidic, but have high capability for agriculture.

This block has moderate capability for forest grazing. The forests have some value for apiculture, the most important tree species being white stringybark and southern mahogany.

(4) Timber production

The forests of this block have been used to supply logs for sawmills in Orbost and Cabbage Tree Creek for many years. Regeneration is rapid, and the block could continue to supply timber on a sustained-yield basis. The forests of the inland part contain timber of moderate quality, and more coastal forests are poor-quality. Proximity to the sawmills increases the value of these forests for timber production. Their accessibility makes them particularly suitable for sleeper production. The area also has high capability for production of pulpwood.

(5) Mining

There are no commercial mineral deposits in this block. Sands containing heavy

minerals occur, but are not considered economic.

The gold-field around the township of Cabbage Tree Creek has been well worked.

Useful deposits of gravel and roading material may occur.

(6) Water production

The Snowy and Brodribb Rivers and Cabbage Tree Creek, which flow through the block, provide water for irrigation, but (apart from farm dams) catchments in the block have no importance for water production. Underground water is available at shallow depth in Tertiary gravels.

D. Hazards and Conflicts

There is a moderate water erosion hazard on the steeper slopes above Cabbage Tree Creek.

The sand dunes along the coast are very prone to wind erosion if the vegetation is disturbed.

The fire risk is high, because the vegetation is fairly dense and dries out in summer. The risk is aggravated by the large number of tourists who drive along the Princes Highway and visitors to Cape Conran. Bemm River township, because of its location, requires special fire-protection measures.

The Snowy--Brodribb river flats are prone to flooding, affecting mainly freehold land. Stock moved from the flats may have to be grazed on public land until the floods subside.

Cinnamon fungus is a hazard to the native vegetation. Infestation is most likely to occur after a particularly wet season or where soil drainage is altered by, for example, road construction.

Some potential land uses introduce conflict. Clearing for agriculture impairs some nature conservation and apiculture values and stops timber production. Timber production impairs some nature conservation and apiculture values.

Commercial or residential development may seriously impair the coastal landscape.

E. Significance

The coast, and particularly Cape Conran, is significant for recreation. Lake Curlip, the valley of Cabbage Tree Creek, and the heath--woodland complex are valuable for nature conservation. The forests, especially nearer the north of the block, are important for timber production, and land in the north is also suitable for agriculture.

Proximity to Orbost (which is in the north-west corner of the block) and accessibility add to its value for many uses.

3. TAMBOON

A. General

(1) General description

Most of this block comprises public land, which is undulating and forested with tall silvertop--stringybark open forest. Steeper country occurs in the vicinity of Mount Cann.

The block includes Sydenham and Tamboon Inlets, and the Bemm, Little, Cann, Thurra, and Mueller Rivers flow through it.

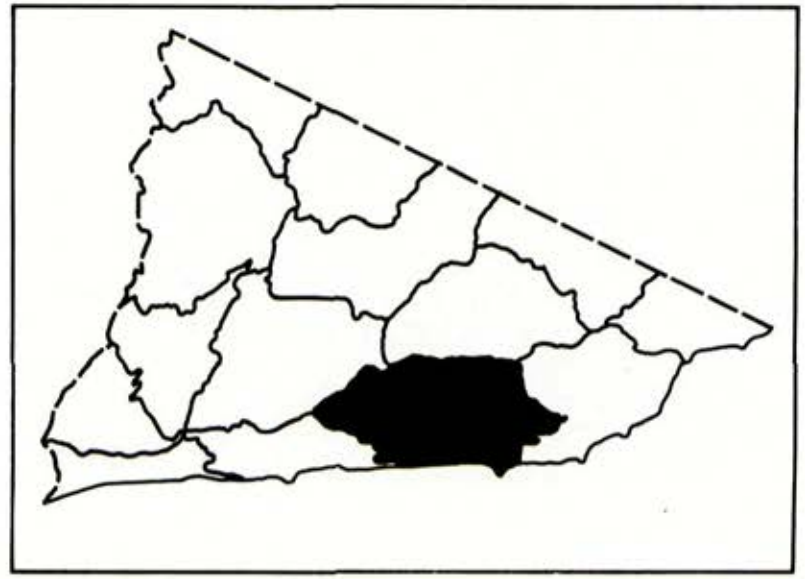
County of Croajingalong: Parishes of Jilwain, Yarak, Bemm, Nungal, Noorinbee, Tonghi, Tamboon, Toonyarak, Wooyoot, Thurra, and Baawang.

(2) Tenure and present use

Of the total area of the block (100,000 ha), 93,000 ha is public land. This includes the Captain James Cook National Park at Point Hicks (2,700 ha) and 29,000 ha of Reserved Forest, situated mainly near the Princes Highway and in the Bemm River--Mount Cann area.

Sydenham Inlet covers 1,000 ha and Tamboon Inlet 700 ha.

The forests of this block have been used extensively for the production of mill logs and have supplied four established sawmills, as well as providing substantial parts of the supply of six others during the last 25 years. The annual output from this block is 58,500 m^3. Apart from the coastal strip, logging has been conducted over most of it. The forests have also been used for extensive forest grazing and apiculture. Tamboon Inlet is used for commercial fishing.



Point Hicks

Recreation is important in the coastal areas. The township of Bemm River provides accommodation at Sydenham Inlet, in addition to some houses (some erected illegally) at Tamboon Inlet (both at the northern end of the Inlet and on both sides of the mouth) and a reserved camping area (at present unserviced) administered by the Orbost Shire Council at the mouth of the Thurra River, adjacent to the Captain James Cook National Park.

The Australian government holds 200 ha at Point Hicks for lighthouse purposes. The summit of Mount Cann carries a fire tower.

B. Nature of the Land

(1) Climate

Temperatures are mild near the coast, but become more variable in the inland parts of the block, where (particularly in the valleys) occasional frosts occur during the winter months. Mean annual rainfall is mainly 900 mm -- 1,000 mm, but elevated areas may receive more.

(2) Geology and physiography

This block has a complex geology. There are extensive areas (up to 7 km wide) of Quaternary sands along the coast. Inland of these, Tertiary non-marine sediments form an almost continuous band across the block (near Bellbird Creek and east of Cann River these extend in-

land to north of the Princes Highway). Large areas of Ordovician sedimentary rock occur on the north-west, centre, and east of the block. These are separated by Lower Devonian granite. Along some of the valleys, and on the flats around Sydenham Inlet, are Quaternary alluvial deposits.

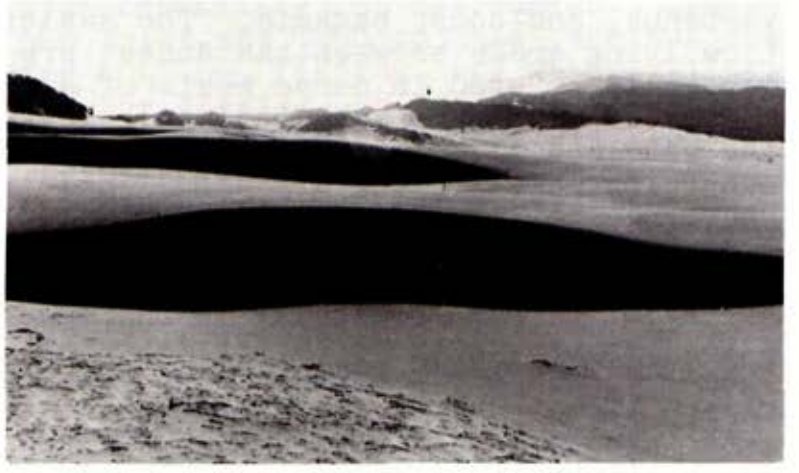
The land on granite and Ordovician sediments is generally hilly, with a complex pattern of ridges and valleys, and is often steepest in the Ordovician sediments. Mount Cann and Mount Everard, the most prominent peaks in the block, are both Devonian granite. Point Hicks is of interest being partly granite (on the east side) and partly Ordovician sedimentary rock (on the west).

The topography on the Tertiary sediments is more gentle, but some streams have deeply incised valleys.

The Quaternary alluvial deposits are almost flat, and the Quaternary sands form generally parallel dunes aligned roughly parallel to the coast in an east--west direction along the direction of the prevailing winds. These dunes are mostly low and vegetated, but north of Point Hicks are largely bare, and more than 100 m high. Here they spill into the lower reaches of the Thurra River and in some sectors have deflected the river channel. Other bare sand dunes occur on both sides of the mouth of Tamboon Inlet and east of the mouth of Sydenham Inlet.

Sydenham Inlet is a large estuarine lagoon, often sealed off from the sea. The sand barrier has frequently been opened artificially. As a result, the water of Sydenham Inlet is now more often brackish than it was naturally. The lagoon is generally up to 2 m deep, with a smooth floor developed by sedimentation, but towards the outlet a deeper channel develops with depths up to 10 m.

Tamboon Inlet is similar in origin, but differs in being fringed largely by beaches, with only limited sectors of bordering swamp. The eastern shoreline is backed by steep granite slopes, once the western shoreline of a major coastal promontory. Much of Tamboon Inlet is about 6 m deep, with a smooth floor, but some parts are up to 12 m deep.



Sand dunes north of Point Hicks

The Mueller River, joined by Camp Creek near the mouth, has a long, deep estuarine inlet (unlike the nearby Thurra River, which is filled with sand from the active dunes). Sand deposition sometimes seals off the mouth of the river from the sea.

(3) Soils

The soils in this block are very varied, largely because of the diversity of the parent material. In the southern part of the block they are mainly weakly differentiated sands (on coastal dunes) and leached sands. Inland soils are mainly gradational.

(4) Vegetation

The sand dunes are vegetated with woodland dominated by southern mahogany, brown stringybark, yellow stringybark, yertchuk, and coast banksia. The swales (low lying areas between the dunes) are generally covered in dense heath of a number of different associations. Heath and woodland also extend well inland, occurring mainly along drainage lines where the soil is often waterlogged. Away from watercourses the vegetation is open forest, of which silvertop--stringybark open forest III is the most extensive association. Other associations are messmate--mountain grey gum open forest III, in moist sheltered positions, and IV on the best sites. Closed forest occurs in some steep southerly gullies.

Three plant species recorded in this block are rare in Victoria (although relatively common in New South Wales). Olax (*Olax stricta*), the sole Victorian representative of the plant family Olaeaceae, is known in this State from margins of heathland swamps and in open scrubby forest between Point Hicks, Tamboon Inlet, and a point about 16 km south of Cann River. The rush fringe-lily *(Thysanotus juncifolius)* is restricted in Victoria to near-coastal damp heaths of the far east, including Reedy Creek in this block. The leafless tongue-orchid, mentioned earlier for the Marlo Plains block, has been recorded in damp heaths at Reedy Creek near Cann River.

(5) Fauna

The diversity of wet forest, dry forest, coastal woodland, dense heath, open heath, wetland, littoral, and estuarine habitats, and agricultural land, supports a wide variety of animal species. The short-nosed bandicoot is probably common in heaths, and the long-nosed bandicoot, which is less common, has been recorded in woodland at Bemm River and Point Hicks. The potoroo has been recorded from Bemm River and the smokey mouse from woodlands to the east of Bemm River. Ground parrots occur in coastal heaths.

Both Sydenham and Tamboon Inlets support a fish fauna that is significant to commercial and amateur fishermen.

Lake Furnell is interesting because of the large population of sea mullet that occupies the fresh to brackish environment of the lake, The shallow waters of Sydenham Inlet are an important breeding and nursery area for black bream.

Bass occur in the fresh-water swamp formed behind an encroaching sand dune several miles inland from the mouth of Thurra River.

(6) Land systems

Weeragua 2%; Kowat 1%; Koola<1%; Pinnak 17%; Wurrin 3%; Wooyoot 62%; Noorinbee 4%; Wau Wauka 1%; Barga 6%; and Boole Poole 3%.

C. Capabilities

(1) Nature conservation

Most of this block is public land that has been little disturbed apart from logging operations in most parts of the forest. Large areas remain in a relatively natural condition and include a diversity of habitats, particularly near the coast.

Landscape qualities are also important, especially along the Princes Highway and in the coastal belt, where recreation activity is likely to be concentrated, and their protection is an important part of nature conservation. The diversity of the landscape is an important feature.

Swan Lake, near Sydenham Inlet

(2) Recreation

The coastal parts of this block have high capability for recreation. Sydenham Inlet and Tamboon Inlet are suitable for boating, fishing, and water-skiing. All the coastal streams and estuaries provide excellent recreational fishing. The ocean scenery - with expansive beaches backed by high dunes, and the rocky headland at Point Hicks - is spectacular, largely because ot its natural appearance.

(3) Agriculture and apiculture

The coastal strip (Barga and Boole Poole land systems) has low capability for agriculture. The Wooyoot and Wurrin

land systems within the block are generally undulating and, together with the gentler slopes in the Pinnak land system, have moderate to high capability for agriculture, particularly in the vicinity of Cann River, where the river valley in the Noorinbee block is extensively farmed.

This block has moderate capability for forest grazing. Capability for apiculture is moderate.

(4) Timber production

Except for vegetation on Quaternary sands, the forests of this block have moderate to high capability for sawlog production. Highly valuable species such as silvertop, white stringybark, yellow stringybark, messmate, and mountain grey gum are abundant. Where logging has been intensive, regeneration following proper silvicultural treatment has been prolific.

Some parts of this block have been intensively logged in recent years, mainly north of Bemm River and along the west Wingan Road, but also elsewhere in the block.

(5) Mining

Apart from minor gold-fields north of Sydenham Inlet (which were exploited many years ago) and some uneconomic deposits of mineral-bearing sands, there are no commercial minerals known in this block. Quarries for roading material and material suitable for quarrying are scattered in the block.

(6) Water production

This block has moderate capability for water, although the sources of the major streams (other than the Mueller River) lie outside it. The township of Bemm River is likely to be supplied with water from the Bemm. Any future coastal villages or camping areas will need a reliable water supply, which could be provided by the Cann, Thurra, or Mueller Rivers.

Underground water occurs at shallow depth in Tertiary and Quaternary beds.

D. Hazards and Conflicts

Soil erosion is unlikely to be a serious problem except on steep slopes and on Recent sand dunes.

The sand dunes are particularly susceptible to wind erosion when their vegetation cover is damaged, but possibly some of the dunes have never been fully vegetated, and their present mobile state may be natural. The best example of mobile dunes is between Point Hicks and the Thurra River, where dunes up to 130 m high are spilling into the Thurra River. These dunes are very spectacular and the scenic and scientific interest they provide probably outweighs deleterious effects of the mobile sand.

Fire is a serious hazard because of the frequently dense understorey and the long dry periods that may occur from time to time. This hazard becomes important if many lives are threatened, as happens during summer when tourists are visiting the area.

Flooding is an occasional hazard, and the Bemm, Cann, and Thurra Rivers are the most flood-prone streams, A new bridge has recently been built across the Thurra River near its mouth, following the destruction of the previous bridge by the 1971 flood.

Cinnamon fungus is a potential problem in areas subject to waterlogging, which may be aggravated by roading or logging. Most eucalypt species, and the main timber-producing species, are susceptible.

E. Significance

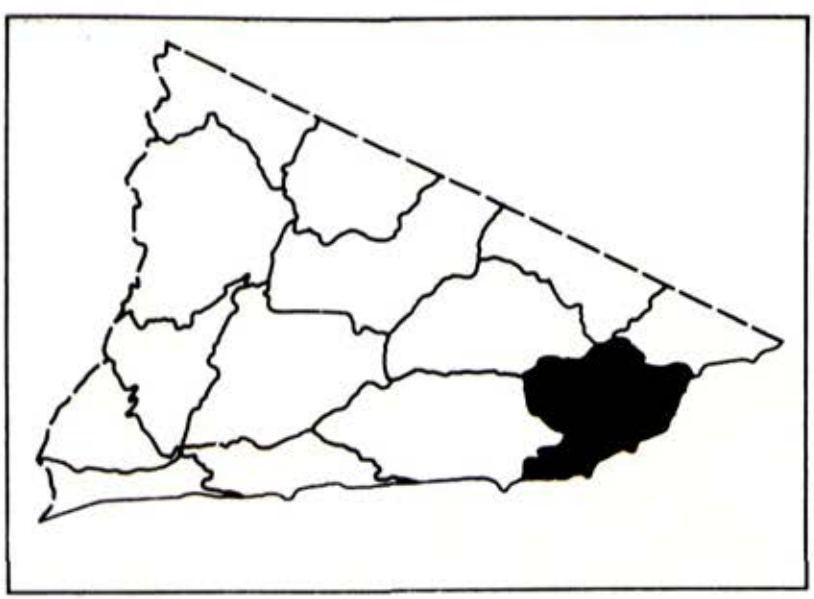
This block is of particular value for nature conservation, recreation, and hardwood timber production. Some parts are suitable for agriculture. The township of Cann River, on the northern boundary, increases the value of nearby land.

4. WINGAN

A. General

(1) General description

Wingan block is almost entirely public land, the only exception being Mallacoota aerodrome and some freehold land near Mallacoota township. The area is undulating or hilly, and most is forested. Heaths are confined mainly to within a few kilometres of the coast, but also occur in inland depressions.



County of Croajingalong: Parishes of Toonyarak, Karlo, Baawang, Wingan, Mallacoota, Betka, and Brindat.

(2) Tenure and present use

The Wingan Inlet National Park covers 1,900 ha around Wingan Inlet, including The Skerries, an offshore rocky outcrop. The remainder of the public land (67,000 ha) is mainly unreserved Crown land used for timber production, forest grazing, and apiculture (particularly when the red bloodwoods are flowering).

Parts of this block have provided sawlogs for four Cann River sawmills for more than 15 years. The Betka River supplies water for Mallacoota, and the catchment is a proclaimed catchment.

B. Nature of the Land

(1) Climate

Temperatures are moderate near the coast, but tend to be cooler in the more elevated inland parts. Rainfall is 900--1,000 mm over most of the block, but may exceed 1,000 mm in elevated, south-facing areas.

(2) Geology and physiography

The surface geology of this block involves Quaternary sands and alluvial deposits, Tertiary non-marine sedimentary deposits, Lower Devonian granite, and Ordovician marine sedimentary rock.

The Quaternary deposits are confined to a narrow and discontinuous belt along the coast, except for some areas of alluvium along inland streams.

Tertiary deposits, overlying the basement rock, are scattered.

The Lower Devonian granite forms a belt roughly 15 km wide running north--south through the block, with Ordovician sedimentary rock as the basement rock to each side. The granite-sediment interface is exposed at Sandpatch Point, and from there eastwards to Mallacoota the sedimentary rock forms sea-cliffs - consisting of strongly folded slates, schists, and sandstones - up to about 30 m high. This is the only cliffed part of the coastline in the East Gippsland study area.

A coastal plateau surmounts the cliffs; this was originally a wave-cut platform but was uplifted. Its surface is incised by deep gullies where streams run into the sea.

Lake Elusive is a typical marginal dune lake.

Wingan Inlet is an estuarine inlet formed in a similar way to Sydenham and Tamboon Inlets, although it is smaller and usually (perhaps always) open. Easby Creek (formerly Little River), Red River, Benedore River, and Betka River all have small estaurine lagoons.

The inland parts of the block are undulating or hilly, with steep dissected ridges, and Genoa Peak is prominent on the skyline when viewed from surrounding areas. Genoa Peak, like the other coastal peaks, is granitic.

(3) Soils

Most of the soils are gradational. Leached sands occur frequently in the

Coastal cliffs near Seal Creek

southern part of the block and occasionally elsewhere. Weakly differentiated aeolian sands are on Recent dunes and undifferentiated aeolian sands on Recent beaches along the coast.

(4) Vegetation

The inland parts of the block are forested, silvertop--stringybark open forest III and red bloodwood--silvertop open forest III being the most extensive associations. Messmate--mountain grey gum open forest III and red bloodwood--rough-barked apple open forest II are other common forest types.

Lowland closed forest ("jungle") is found in some gullies, a significant occurrence being on the southern slopes of Mount Drummer, in the north-west.

Patches of woodland and heath are scattered through the block, and along the coast they form an almost continuous band. The red bloodwood--rough-barked apple open forest II intergrades with woodland in this situation. These coastal heaths include extensive areas of scrub she-oak heath and spear grass-tree heath.

Several rare plant species (see pages 53--55) occur in this block. Some other species that occur here are rare in Victoria, although relatively common in New South Wales. Sword bossiaea *(Bossiaea ensata)* has been recorded in Victoria only at the mouth of the Betka River.

Variable smoke-bush *(Conospermum taxifolium)* occurs at Little Rame Head, and also in the Mallacoota Block.

Prickly tree-fern *(Cyathea liechhardtiana)* is fairly common in pockets of "jungle" at Mount Drummer and Lower Wingan River (in this block), and at Buchan (outside the study area) and in the Howe Range (Mallacoota block).

Darwinia species *(Darwinia camptostylis)* is known in Victoria only along the coast between the Benedore River and Seal Creek, and east of the Howe Range.

The rock orchid *(Dendrobium speciosum)* is restricted in Victoria to a few localities, including Wingan Inlet.

Violet nightshade *(Solanum violaceum)* is known in Victoria only from the "jungle" of Mount Drummer and from Suggan Buggan (outside the study area).

(5) Fauna

The following habitats are represented here: wet forest, dry forest, coastal woodland, dense heath, open heath, wetland, littoral, and estaurine.

The fauna is typical of the coastal areas of East Gippsland. In addition, a colony of Australian fur seals occupies The Skerries at Wingan Inlet, and ground parrots have frequently been observed in heaths of this block. The tiger cat has been recorded here recent-

ly.

The southern limit of the range of the diamond python occurs here.

A number of coastal streams in this block contain significant populations of estuarine fish species. Bass occur in the Wingan, Red, Benedore, and Betka Rivers. These streams are of special interest because they are free of introduced fish species.

Wingan Inlet and the lower part of the Wingan River

(6) Land systems

Kowat < 1%; Pinnak 7%; Wurrin 8%; Wooyoot 78%; Noorinbee 1%; Barga 2%; and Boole Poole 3%.

C. Capabilities

(1) Nature conservation

Most of this block is relatively undisturbed (much has never been logged or cleared, and some complete stream catchments are free of any major disturbance) and a great variety of habitats are represented. The flora is consequently diverse, and the fauna is presumably correspondingly varied.

The streams are significant because they contain no introduced fish species, and they generally flow through land that is undeveloped.

A number of rare plant and animal species occur in this block, and some common species, such as red bloodwood and rough-barked apple, reach one extreme of their range here.

Wingan block therefore has high capability for nature conservation.

Landscape is an important resource, particularly along the Princes Highway and in the coastal strip. The coastline of this block is among the most undisturbed in the State, which makes it outstanding.

The coastline between the Mueller River and Rame Head, backed by high sand dunes

(2) Recreation

This block is little used for recreation at present, but the coastal parts have high potential, particularly for wilderness-based recreation, and the natural coastal scenery may become an important tourist attraction. Beach and rock fishing are outstanding. The main focus of recreation at present is Wingan Inlet, a small but attractive estuarine inlet. However, there are no facilities for visitor accommodation anywhere within the Wingan block.

(3) Agriculture and apiculture

Apart from a small area just west of Mallacoota used for beef production, no land has been developed for agriculture within the block. Most of the block is part of the Wooyoot land system, and has moderate capability for agriculture. Slopes are usually gentle to undulating and rainfall well distributed. The rest of the block has low capability.

Capability for forest grazing is generally moderate.

The forests are useful for apiculture. In addition to the eucalypt species found elsewhere in the study area, red bloodwoods a valued honey-producing species, occurs here and further east.

(4) Timber production

The forests of most of this block have moderate to high capability for timber production - the dominant tree species are suitable for saw-milling, sleeper production, and pulpwood. Significant areas of merchantable timber have never been harvested. Regeneration is rapid and prolific after logging operations, provided sound silvicultural techniques are adopted.

(5) Mining

Two known deposits of economic minerals occur in this block, although neither is believed to be commercially exploitable at present. Copper ore occurs between Hard to Seek Creek and the Princes Highway, and molybdenum ore near Genoa Peak.

Roading material is quarried at several locations, and suitable material is also present elsewhere in the block.

(6) Water production

The Betka River supplies water for the township of Mallacoota, and the Betka catchment is a proclaimed catchment. The maintance of a supply of good-quality water is important, and supply in adequate quantity is vital. This is made more difficult because the period of greatest demand coincides with the period of minimal run-off (mid summer).

Other streams may be needed to supply water in the future to new villages or camping areas.

D. Hazards and Conflicts

Soil erosion is not generally a serious problem, but the steeper slopes will erode if the vegetative cover is reduced, and even the gentler slopes are subject to rill erosion during cultivation. Even minor erosion is an important problem in water supply catchments, as it increases stream turbidity.

Erosion is a hazard on sand dunes, which are very prone to wind erosion if their vegetative cover is damaged.

Fire is a serious hazard, as environmental conditions favour rapid build-up of highly inflammable fuel (mainly dense undergrowth). Some parts of this block have not been burnt for many years, and are at present in a dangerous condition. If driven by a westerly wind, fire in this block could threaten the township of Mallacoota, and the period of greatest fire risk is also the time when the township is particularly crowded.

Flooding is unlikely to be a significant problem.

Cinnamon fungus could become serious in sites subject to waterlogging. It infects some poorly drained areas, especially near Mallacoota aerodrome. Many of the tree species (stringybarks, silvertop, yertchuk, messmate) are susceptible, and some understorey species are also killed by cinnamon fungus.

E. Significance

This block has high capability for nature conservation, recreation, and hardwood timber production, and the Betka River catchment is important for water production. Fire is a particularly threatening hazard.

5. MALLACOOTA

A. General

(1) General description

Most of this block is undulating country surrounding Mallacoota Inlet. Genoa Peak (in the west) and the Howe Range (in the east) rise above the rest of it. In the south, the block carries extensive areas of heath--woodland and bare sand; other parts of the public land carry forest.

Large areas of the Genoa River and Wallagaraugh River flats are freehold agricultural land, and there are isolated small parcels of freehold land around Mallacoota Inlet. The town of Mallacoota is in the south-western corner.

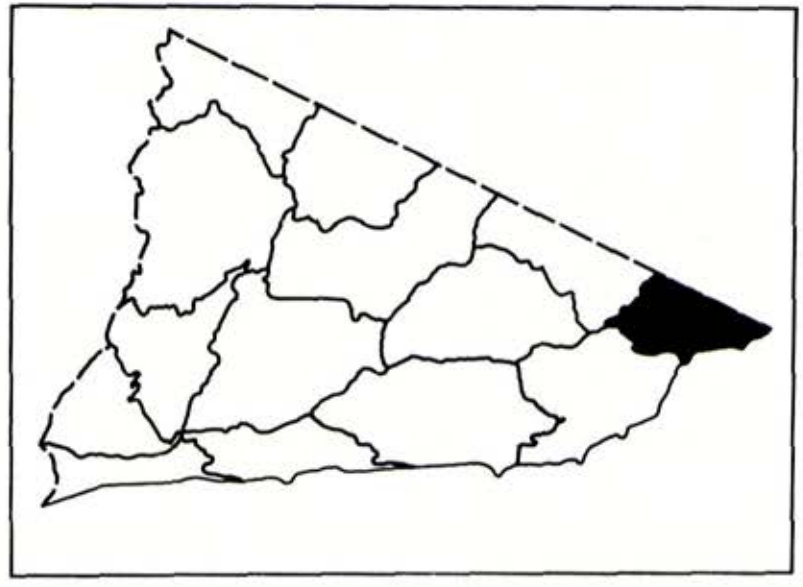
County of Croajingalong: Parishes of Bralak, Maramingo, Mallacoota, Betka, Wurrin, Wau Wauka West, Wau Wauka, and Gabo.

(2) Tenure and present use

Of the total area comprising this block (34,000 ha), 30,000 ha is public land. This includes the Mallacoota National Park, of 4,600 ha, around the shores of Mallacoota Inlet. The rest of the public land is largely unreserved Crown land. Mallacoota Inlet covers 2,650 ha.

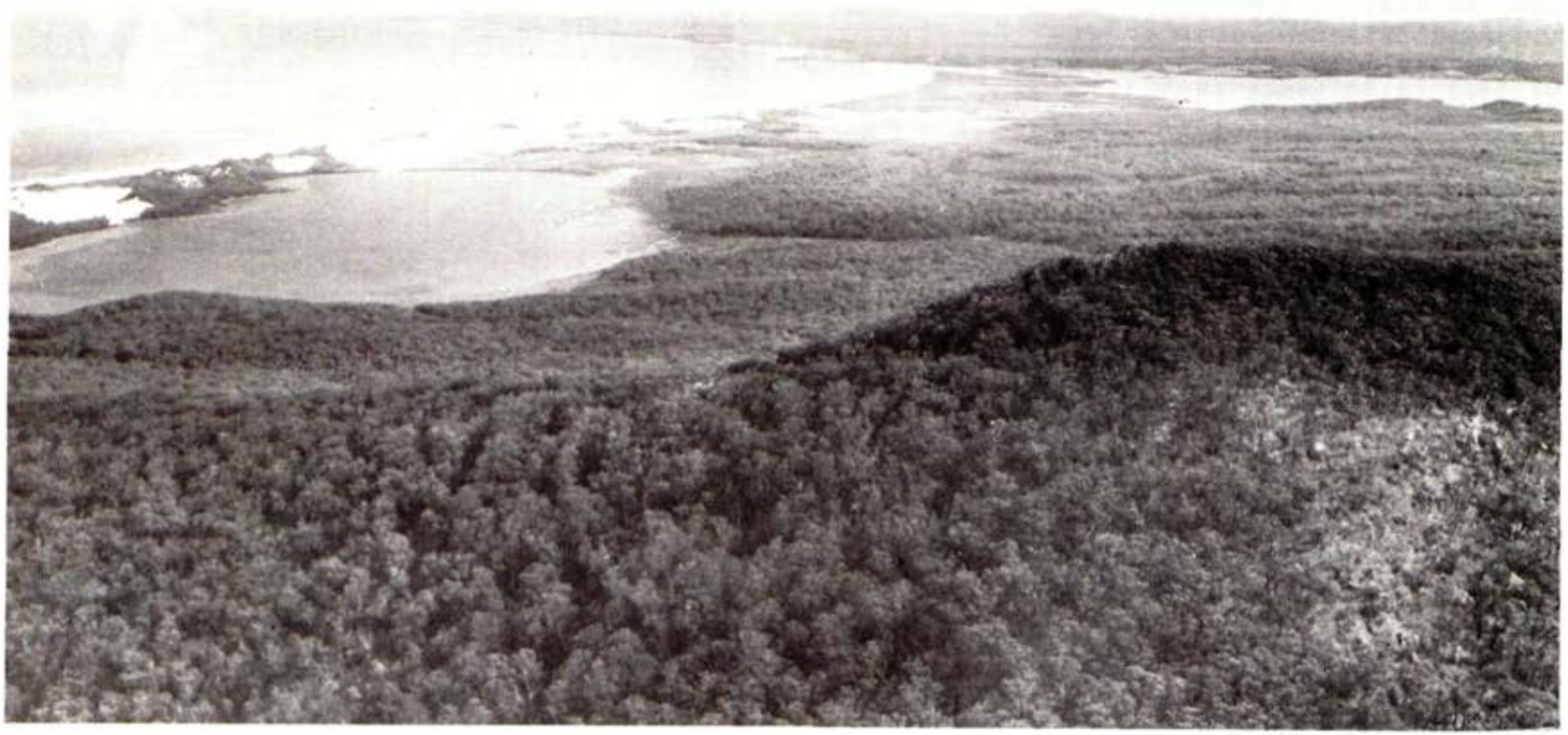
Two offshore islands are included in the block. The larger, Gabo Island, is held by the Australian government in connection with the lighthouse on the southern end. The smaller island, Tullaberga, is unreserved Crown land.

The forested public land north and east of the Genoa River is used for timber production as far south as Harrison's



Creek. Three established sawmills draw their supplies from these forests. The area south of Harrison's Creek and east to Cape Howe has not been logged, at least within the last 30 years. The forested land is also used for forest grazing, and apiculture is important when the red bloodwoods are flowering.

Mallacoota Inlet is an important tourist resort, and accommodation is fully committed during peak periods. Its attraction lies mainly in the scenic beauty, with forested hills falling to the water's edge, and in the well-reputed fishing. There are accessible surf beaches nearby.



Howe Hill (foreground), Lake Barracoota (left), Tullaberga Island (just beyond Lake Barracoota), and Mallacoota Inlet (right background)

Mallacoota is also the base for a fishing fleet and a major abalone industry.

B. Nature of the Land

(1) Climate

Temperatures are mild, and unlikely to be important in restricting the growing season. Rainfall is mainly between 900 and 1,000 mm annually, but exceeds 1,000 mm in elevated areas, particularly the Howe Range.

(2) Geology and physiography

Most of this block is on Ordovician marine sedimentary rocks, but a belt of Quaternary sands and alluvium lies along the coast, and Tertiary non-marine sediments surround Mallacoota Inlet. There are also two blocks of granite: Upper Devonian granite makes up the Howe Range, Gabo Island (which is capped with Quaternary sands), and part of Tullaberga Island (which is also partly Ordovician sedimentary rock); Lower Devonian granite occurs in the west, forming Genoa Peak.

As in other coastal blocks, country on Ordovician sediments and Devonian granite is hilly, with steep slopes and complex stream patterns. The highest parts of the block are on granite bedrock.

Country on the Tertiary sediments is flatter, but water-courses sometimes dissect deep gullies.

The Quaternary sands along the coast form dunes that are mostly active (bare and mobile). Two freshwater lakes - Barracoota and Wau Wauka - lie in this sandy strip. Lake Barracoota formed as a result of the silting up of a previous arm of Mallacoota Inlet, and this origin gives it great scientific interest.

Mallacoota Inlet was formed by the submergence of the valleys of the lower Genoa River. The islands near the mouth are deltaic and, with the Goodwin Sands, formed by the deposition of silt.

(3) Soils

Most of the soils are gradational. Leached sands are extensive in the southern part of the block and infrequent elsewhere. Undifferentiated sands occur on the coastal dunes. Riverine alluvial soils occur along the Genoa River near Genoa.

(4) Vegetation

Most of the public land is forested, mainly under silvertop--stringybark open forest III. The other major forest types are messmate--mountain grey gum open forest III, messmate--mountain grey gum open forest IV (in the Howe Range), and red bloodwood--rough-barked apple open forest II, but other associations are also represented.

Along the coastal strip extensive areas of heath occur, mainly on Quaternary de-

Spear grass-tree heath in a depression near Mallacoota

posits. These include dense thickets of swamp paperbark in the swamps between Lake Barracoota and Mallacoota Inlet.

A number of plant species growing in this block have been found nowhere else in Victoria (although they are reasonably common in New South Wales.)

The sandpaper fig *(Ficus coronata)* occurs on the east side of Mallacoota Inlet, for example in a gully running into Smellie Inlet. This is the southern-most natural occurrence of a fig anywhere.

White ash *(Eucalyptus fraxinoides)* grows in the Howe Range - it was originally mistakenly identified as blackbutt *(E. pilularis)*.

Panax *(Tieghemopanax murrayi)* - a tree species up to 20 m high, and with leaves 60--120 cm long - has been found in the Howe Range.

The peach-leaf poison bush *(Trema aspera)* is known in Victoria from only a single collection at Mallacoota in 1937.

A cranes-bill *(Geranium homeanum)* is known in Victoria only from Mallacoota.

Dwarf brunoniella *(Brunoniella pumilio)* has been found near Genoa, on the west side of the Genoa--Mallacoota road.

Trim shield fern *(Lastreopsis decomposita)* is known within Victoria only from a gully flat in Mallacoota Inlet, opposite Gipsy Point.

Golden mistletoe *(Notothixos subaureus)* occurs at Mallacoota, where it parasitizes other mistletoes, being found only on long-flower mistletoe *(Dendrophthoe vitellina)* - which is also restricted to East Gippsland within Victoria - and on creeping mistletoe *(Muellerina eucalyptoides)*.

Other plant species occurring in the Howe Range and very few other localities in Victoria include the orange-blossom orchid *(Sarcochilus falcatus)* - which perches on the limbs of lilly-pilly trees and on the massive stems of the jungle grape, variable smoke-bush, rock orchid *(Dendrobium speciosum)* - the largest of all Australian orchids, the streaked rock orchid *(D. striolatum)*, gully gum *(Eucalyptus smithii)*, finger hakea *(Hakea dactyloides)*, guinea flower *(Hibbertia diffusa)*, drumstick conebush *(Isopogon anemonifolius)*, daisy bush *(Olearia dentata)*, swamp beard-heath *(Leucopogon esquamatus)*, red passion flower *(Passiflora cinnabarina)*, jungle geebung *(Persoonia silvatica)*, green midge orchid *(Prasophyllum viride)*, tangled pseudanthus *(Pseudanthus divaricatissima)*, a pomaderris species *(Pomaderris costata)*, purple goodenia *(Coopernookia barbata)*, prickly tree fern, and the staff climber *(Celastrus subspicatus)*.

Several other species that are reasonably common in New South Wales occur elsewhere in this block and in only very few other localities in Victoria.

Darwinia *(Darwinia camptostylis)* is known from east of the Howe Range (and also from the Wingan block).

Rough-fruit pittosporum *(Pittosporum revolutum)* is recorded in Victoria from the Genoa River and Mallacoota Inlet.

The rush fringe-lily inhabits damp heaths here, and also in Tamboon and Genoa blocks.

In addition, 11 rare species listed in Chapter 8 (pages 52--55) occur here.

(5) Fauna

This block provides the following faunal habitats: wet forest, dry forest, coastal woodland, dense heath, open heath, wetland, littoral, estaurine, and agricultural land.

It has a generally similar fauna to those of the other coastal blocks of East Gippsland, but several species warrant special mention.

Grey-headed fruit bats sometimes visit the block in large numbers when the red bloodwoods are flowering.

The eastern bristle-bird occurs in dense heath (including swamp paperbark thickets) and the ground parrot inhabits open heath.

The little penguin and short-tailed shearwater breed on Gabo Island, and possibly on Tullaberga Island.

The diamond python, a typically sub-tropical snake, occurs in this block.

As is mentioned in the Fauna chapter (page 73), the invertebrate fauna of Mallacoota Inlet is scientifically in-

teresting, and some aspects are unique within Victoria. That of Lake Barracoota is also of scientific interest.

Both Lake Barracoota and Lake Wau Wauka contain populations of bass, and Lake Barracoota has a population of large sea mullet. Fish populations in both lakes may remain landlocked for considerable periods, particularly in Lake Barracoota, which joins the lower lake of Mallacoota Inlet only during periods of severe flooding.

Mallacoota Inlet (upper and lower lakes) provides an excellent habitat for a wide variety of fish species living in a fresh/salt environment. The inlet is particularly interesting because it is the southern limit of the occurrence of several northern species of marine fish, such as tarwhine, sand whiting, and trumpeter whiting.

Mallacoota Inlet is the only Victorian estuary where yellowfin bream occur in sufficient numbers to be of importance to commercial and amateur fishermen.

Both the Genoa and Wallagaraugh Rivers are of great importance as spawning areas for black bream when seasonal conditions are suitable.

(6) Land systems

Weeragua 6%; Kowat 7%; Pinnak 37%; Wurrin 21%; Wooyoot 20%; Noorinbee < 1%; Wau Wauka 2%; Boole Poole 6%.

C. Capabilities

(1) Nature conservation

Much of this block, and particularly the area east of Mallacoota Inlet, remains in a relatively natural condition. Many diverse habitats are represented, from lakes and swamps to the "jungle" in the Howe Range.

It contains a number of rare plant species (see Chapter 8) and many other species common in New South Wales but rare in Victoria (see vegetation section of this block description). The fauna also includes a number of rare or interesting species.

Consequently the Mallacoota block has high capability for nature conservation.

Its landscape is a valuable resource, and protection of the forested hills - leading down to the branching arms of Mallacoota Inlet and the lower Wallagaraugh River - is important in preserving the scenic values of the Inlet.

(2) Recreation

Mallacoota Inlet is already important for recreation, and attendance data from the Mallacoota Camp Park indicate rapidly increasing numbers of visitors. It is scenically very attractive, and provides opportunities for swimming, fishing, and boating. The golf-course there has recently been extended to 18 holes.

The area east of the Inlet has high capability for bush-walking. This has a number of features of interest - Lakes Barracoota and Wau Wauka, Howe Hill, the wreck and cairn at Cape Howe, and the extensive remote beach.

Genoa Peak is an excellent look-out point.

(3) Agriculture and apiculture

Areas within Wooyoot land system around Mallacoota, and an area of the Wurrin land system north-east of Genoa and south of the Highway, have moderate capability. Rainfall is good and slopes generally moderate.

The remainder of the block has low capability for agriculture.

Capability for forest grazing is high around Mallacoota Inlet, near the Princes Highway, and in the south (near Lake Barracoota, but is low--moderate elsewhere.

The block is useful for apiculture, with bloodwood a common forest species in addition to white stringybark and silvertop.

(4) Timber production

Silvertop open forest III and messmate--gum open forest III and IV have moderate to high capability and other vegetation types have low--moderate capability for timber production, but slopes in some parts are too steep for logging. Forest south and south-west of Harrison Creek has not been logged in the last few decades, but logging has been conducted over much of the remainder of the block.

Regeneration on logged areas is prolific, provided sound silvicultural techniques are adopted.

(5) Mining

Several economic minerals occur in the Mallacoota block, but they are not now commercially exploited. Gold occurs on

Looking east to the Howe Range and Lake Barracoota from above the entrance to Mallacoota Inlet

the east of Mallacoota Inlet, tungsten near Genoa, and molybdenum near Gipsy Point and near Fairhaven (on Harrison Creek). Sands bearing heavy minerals occur at Mallacoota.

Roading material has been quarried here, and will no doubt be required in the future. A quarry on Gabo Island produced granite for building, but production ceased many years ago.

(6) Water production

Water production is not important at present, but may become so in the future. The lower reaches of the Genoa and Wallagaraugh Rivers, and lesser streams that flow directly into Mallacoota Inlet, are possible sources of water for future use.

D. Hazards and Conflicts

The steeper parts of the block present an erosion hazard if their vegetative cover is damaged. Bank erosion along the Genoa River and extensive sand deposition on the flats occur during occasional high floods such as in February, 1971. The sand dunes along the coast are also prone to erosion, and they are largely bare and mobile at present.

Fire is a serious potential hazard - the fire risk is intrinsically high because of the nature of the vegetation and the climate. The large numbers of tourists who visit the area in summer increase this hazard, which is also aggravated by the continuity of forest cover to the west and north, including State Forest and the Nadgee Nature Reserve in New South Wales.

Flooding is an occasional problem on the river flats of the Genoa and Wallagaraugh Rivers, and stock may need to be moved from the low-lying freehold to nearby elevated public land for the duration of the flood.

Cinnamon fungus is a potential problem in areas subject to waterlogging. Stringybarks, silvertop, messmate, and yertchuk are susceptible tree species. Many understorey species are also affected by the disease.

The continued expansion of Mallacoota will be directly related to tourism, and will aggravate problems such as town water supply and disposal of effluent and garbage.

E. Significance

This block has high capability for nature conservation and recreation, and parts have high capability for timber production.

All adjoining land in New South Wales is Crown Land - the eastern part is the Nadgee Nature Reserve.

The township of Mallacoota is within the block.

6. GENOA

A. General

(1) General description

Apart from the agricultural land in the Wroxham-Wangarabell and Genoa areas, most of this block is public land. It is mainly forested and hilly, but becomes mountainous in the north (Mount Coopracambra, Mount Merragunegin). The Genoa River flows through it, cutting a winding gorge upstream from Wangarabell, and another gorge between Wangarabell and Genoa.

County of Croajingalong: Parishes of Kowat, Loomat, Koola, Wangarabell, Derndang, Bralak, Wurrin, and Maramingo.

(2) Tenure and present use

Genoa block covers a total area of 50,000 ha, of which 2,700 ha is freehold land. Of the public land, 10,800 ha is Reserved Forest and the remainder is unreserved Crown land.

Forest in the Genoa--Wangarabell area is used for timber production, and also for forest grazing and apiculture.

A fire tower tops Maramingo Hill.

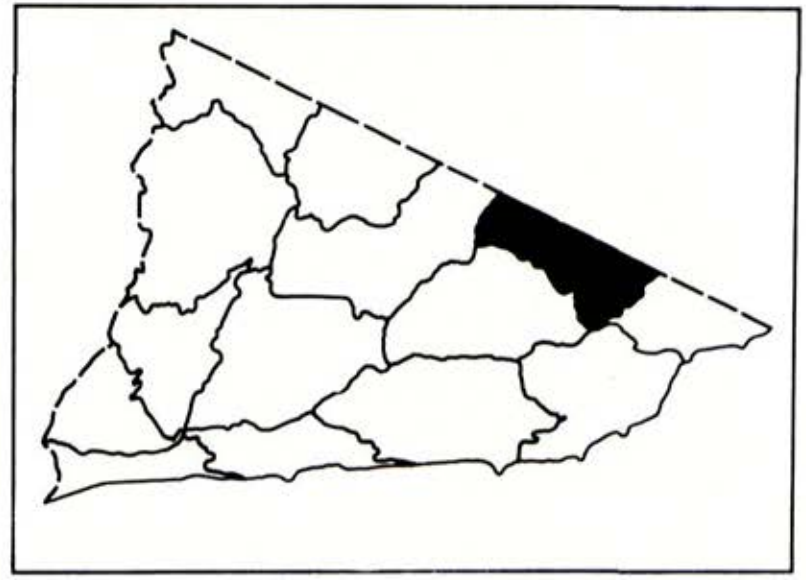
B. Nature of the Land

(1) Climate

Temperatures are mild with cool winters. Probably 3 months have mean temperatures below 10°C in the inland part. Annual rainfall is in the range 800--1,000 mm.

(2) Geology and physiography

The eastern and western ends of this block are on Lower Devonian granite,



underlying a capping of Tertiary non-marine sediments west of Genoa. Also several small remnant areas of Tertiary sediments remain in the eastern portion. Ordovician marine sediments outcrop in the centre and east of the block, and Upper Devonian non-marine sediments occur in the area north-west of Wangarabell. Ancient fossil footprints, found in the Upper Devonian sediments beside the Genoa River, aroused great scientific interest. These are believed to be the oldest fossil records of a land-dwelling vertebrate.

Genoa River flats at Wangarabell, with Maramingo Hill in the background

Two small areas of Tertiary alluvial deposits occur on river flats at Wangarabell and Genoa.

The eastern half of the block, which is mainly on Tertiary sediments or granite, is hilly and undulating. Land on Ordovician and Devonian sediments is much more rugged, with steep slopes, narrow ridges, and deeply dissected stream systems. Where the Genoa River crosses the Devonian sediments it has incised a winding gorge between discontinuous cliffs up to 20 m high.

Mount Coopracambra (nearly 1,000 m elevation), a prominent peak of granitic rock, rises high above the surrounding country.

(3) Soils

Soils are mainly reddish brown and yellowish brown gradational soils, with undifferentiated stony loams on steep slopes, and massive brown duplex soils on dry ridge-tops of the Koola land system.

(4) Vegetation

Almost all the public land of this block is forested. The most common forest association is silvertop--stringybark open forest III; other important associations are messmate--mountain grey gum

open forest III, coast grey box open forest III, red stringybark--red box open forest II, and yertchuk--red stringybark woodland. Low-lying areas support some areas of heath, and lowland closed forest occurs in gullies on Mount Merragunegin.

Some plant species that are rare or localized in Victoria but reasonably common in New South Wales occur in this block.

Two old trees of smooth ramboutan *(Alectryon subcinereus)* have been recorded on private property near Stony Creek.

Stunted sheoak *(Casuarina nana)* is restricted in Victoria to sandstone outcrops near the junction of the Genoa River and Yambulla Creek.

Long-leaf bitter-pea *(Daviesia wyattiana)* is known in Victoria only from Wangarabell and Mount Kaye (Noorinbee block).

The rock orchid occurs in several localities.

Dainty wedge-pea *(Gompholobium glabratum)* has been recorded in Victoria only in the upper Genoa River area and at Mount Kaye.

Two-colour panic *(Panicum simile)* has been recorded as abundant on sedge flats at Maramingo Creek, but is unknown elsewhere in Victoria.

Dwarf purple-flag *(Patersonia longifolia)* is known in Victoria only from the sandstone area along the upper Genoa River and Yambulla Creek.

Rush fringe-lily occurs near Genoa and at Maramingo Creek, inhabiting damp heaths - it is also recorded in Tamboon and Mallacoota blocks.

Blue-leaved stringybark *(Eucalyptus agglomerata)* occurs on the dry hills.

Rusty velvet-bush *(Lasiopetalum ferrugineum)* has been recorded in the gorge of the Genoa River.

This block is also botanically important because it contains the type localities for a number of species, including several pomaderris species (mainly along the Genoa River), and 16 of the rare species discussed on Pages 52--56 are found here.

(5) Fauna

The following faunal habitats are represented here: wet forest, dry forest, inland woodland, open heath, wetland, and agricultural land. The common animals inhabiting these habitats are listed in Appendix 3.

(6) Land systems

Weeragua 16%; Kowat 23%; Koola 7%; Pinnak<1%; Wurrin 36%; Wooyoot 16%; and Noorinbee 1%.

C. Capabilities

(1) Nature conservation

This block has high value for nature conservation because of the number of indigenous rare plant species, most of which are found in the vicinity of the Genoa River upstream from Wroxham, but some of which inhabit a heathy swamp on Maramingo Creek. Fossils of scientific interest, including footprints mentioned earlier, also occur here.

Upper Genoa River

The vicinity of the Genoa River upstream from Wroxham is relatively undisturbed, and consequently suitable for nature conservation.

(2) Recreation

Part of this block has high capability as a bush-walking area. The vicinity of the Genoa River upstream from Wroxham has several features desirable for bush-walking - permanent water, rugged scenery, several prominent peaks, and lack of vehicular access. This lack would be a disadvantage in an emergency.

The lower gorge of the Genoa River, between Wangarabell and Wroxham, is more readily accessible, and may become a feature of interest to tourists if access and sign-posting were improved.

(3) Agriculture and apiculture

In the north-western parts of the block, the country is too steep for agriculture. In the south-east, slopes are more gentle in some areas and capability for agriculture is moderate.

Capability for forest grazing is low in the north and moderate in the south.

The forests are useful for apiculture, mainly for white stringybark (which is widespread), but also for red bloodwood,

confined to the area near the Princes Highway.

(4) Timber production

Most of this block, except for the area north of the Genoa River and west of Wroxham, has moderate capability for timber production. However, some forest (mainly height class I or II) is unsuitable for production of sawlogs, although suitable for production of pulpwood. Proximity to a wood-chip mill at Twofold Bay increases the value of the forests of this block for pulpwood.

(5) Mining

Apart from a small gold-field near Mount Merragunegin, and an uncommercial occurrence of molybdenum ore at Wangarabell, no known deposits of economic minerals occur. Material suitable for road construction is present, and several quarries have been used in the past.

(6) Water production

A water supply for Genoa may be required in future. The Genoa River is the most probable source, but Genoa Creek may be a suitable alternative. Water production will otherwise be unimportant.

D. Hazards and Conflicts

There is a moderate to severe water erosion hazard on the steeper slopes. The hazard is probably greatest in that part of the Genoa River valley in Koola land system, particularly the northern aspects where rainfall is relatively low, slopes steep to very steep, soils poorly structured and ground cover incomplete. Slumping of road batters and table drain erosion occurs on granitic material, particularly on steeper country such as the Kowat land system.

Fire is a hazard, and the inaccessibility of some parts of the block hampers control of wildfires, increasing the value of fuel-reduction burning as a preventive measure.

Flooding is an occasional problem on the Genoa River, affecting the gorge tracts as well as the freehold land on the open river flats.

Cinnamon fungus could become a problem on waterlogged sites. Many of the eucalypts and understorey species are susceptible.

E. Significance

This block has high capability for nature conservation and recreation, mainly in the vicinity of the Genoa River between the State border and Wroxham.

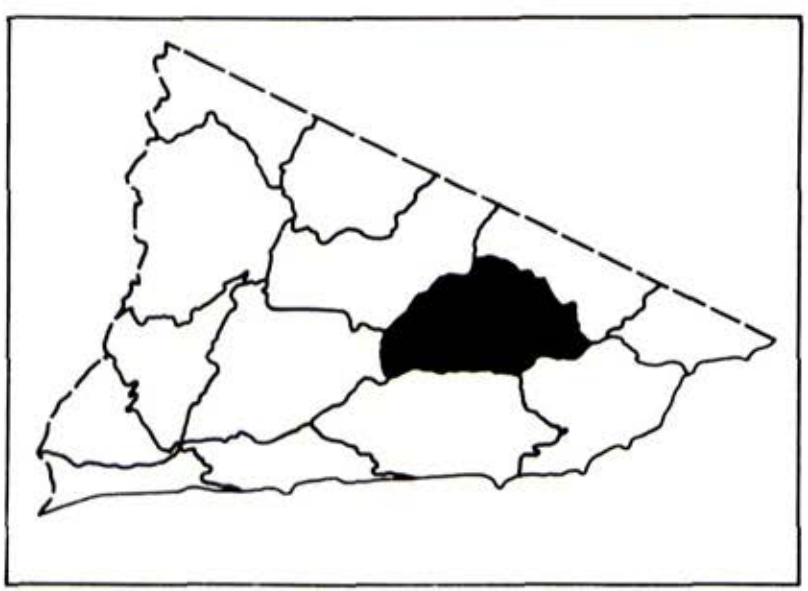
All adjoining land in New South Wales is Crown land - part, around the Genoa River, is reserved for nature conservation.

7. NOORINBEE

A. General

(1) General description

Most of this block is moderately steep hilly or mountainous country, forested mainly with silvertop--stringybark open forest. The Cann River valley with its alluvial flats bisects the block, and small areas of alluvial flats occur elsewhere, on Tonghi Creek and the Wingan River; these are all mainly freehold land.



County of Croajingalong: Parishes of Bungywarr, Winyar, Nungal, Tonghi, Weeragua, Combienbar, Noorinbee, Loomat, Cooaggalah, Kooragan, Koola, Derndang, Karlo, and Bralak.

(2) Tenure and present use

Public land covers 73,000 ha, of which 37,000 ha is Reserved Forest; most of the remaining public land is unreserved Crown land. Part of the Alfred National Park, amounting to 1,100 ha, occupies land at Mount Drummer.

The forests of this block have been the source of supply of sawlogs to six sawmills during the past 23 years. Currently, 49,000 m^3 of sawlogs per annum is supplied to sawmills. Past and present operations have been confined to the southern part of the block and large areas of productive stands remain unharvested.

The forests are important for forest grazing and apiculture, particularly in the southern parts surrounding private property. Some quarries for road-making material are situated on public land.

Noorinbee Hill carries a fire tower.

B. Nature of the Land

(1) Climate

Summers are mild and winters are cool. Mean monthly temperature is probably less than 10° for 3 months each year. Rainfall ranges from below 1,000 mm per annum to about 1,250 mm, the variation being due to topography.

(2) Geology and physiography

The geology is complex, with several separate occurrences of each of Quaternary alluvial deposits, Tertiary non-marine sediments, Devonian granite, and Ordovician marine sediments.

Quaternary alluvial deposits occur in the valleys of some streams; the most important is in the Cann River valley.

Tertiary non-marine sediments occur in the southern part of the block as a discontinuous capping over granitic or Ordovician sedimentary bedrock.

Much of the block is on Devonian granitic rock, which forms the prominences of Mount Kaye and Mount Drummer, and the Noorinbee Ridge, the hard rock being particularly resistant to weathering.

Ordovician sediments occur mainly in the east of the block, but also in the centre and west. Country on Ordovician sediments is more deeply dissected by streams than country on granite.

Mount Kaye from the Cann River valley

(3) Soils

The soils of the stream flats, on Quaternary alluvium, are brown loams on the youngest terraces and yellowish brown gradational soils on older ones.

The hilly country mainly carries yellowish brown gradational soils, with reddish brown gradational soils predominating in Weeragua and Pinnak land systems. In addition, friable reddish and brownish gradational soils occur above 850 m in Kowat land system and undiffer-

entiated stony loams on the steepest, most exposed sites.

(4) Vegetation

Various vegetation associations occur in this block. Silvertop--stringybark open forest III is the most abundant forest type, but messmate--gum open forest III is common on moist sites and brown barrel open forest IV occurs on the wettest southerly-facing slopes. Coast grey box open forest III is found in the Cann River valley. Stringybark--silvertop--red box open forest II occupies dry sites, usually on steep northerly or north-westerly slopes. Yertchuk woodland II and heath associations occur in wet low-lying positions in the south. Lowland closed forest occurs in wet gullies.

Apart from the rare plant species of this block mentioned in Chapter 8 (pages 52--55), several species that are rare within Victoria but reasonably common in New South Wales also occur here.

Long-leaf bitter pea is known in Victoria only from Mount Kaye and from Wangarabell (Genoa block).

Dainty wedge-pea has been recorded in Victoria only from Mount Kaye and from the upper Genoa River (Genoa block).

Croton verreauxii has been found near Noorinbee, but is not known anywhere else in Victoria.

Lomandra obliqua is known in Victoria only from Mount Kaye.

(5) Fauna

This block provides wet forest, dry forest, woodland, heath, agricultural land and wetland habitats. Although the fauna of this block has not been surveyed in detail, species typical of these habitats could be expected to occur here.

The Cann River valley represents a flight path for several types of subtropical butterflies.

(6) Land systems

Errinundra < 1%; Bullamalk 5%; Weeragua 3%; Wat Wat 5%; Kowat 23%; Pinnak 10%; Wurrin 21%; Wooyoot 26%; Noorinbee 7%.

C. Capabilities

(1) Nature conservation

Parts of this block have high capability for nature conservation. Mount Kaye is a rugged feature of the landscape, and because of its inaccessibility remains undisturbed. It carries a variety of vegetation types, and most of the rare plant species of this block have been found there.

Mount Drummer and Karlo Creek provide good examples of lowland closed forest, which, in conjunction with the adjacent

The black wallaby, a common species throughout most of the study area

area south of the Princes Highway, form one of the major occurrences of this vegetation type in Victoria.

(2) Recreation

The main value for recreation lies in the more-rugged, little-disturbed parts of the block, which are suitable for bush-walking.

(3) Agriculture and apiculture

Public land suitable for agriculture adjoins existing freehold land along the Cann River valley, and in other undulating areas described in the Wurrin and Wooyoot land systems.

Mild temperatures, good rainfall, and the proximity to freehold land that is extensively farmed indicate high capability for agriculture in the southern part of the block. The northern areas have low capability due to steepness.

Forest grazing is an important part of the agriculture of the block. Currently 40,000 ha are leased for grazing, but use is not intensive. The potential for further intensification of forest grazing is high in the southern part and low--moderate over the northern areas.

Capability for apiculture is moderate.

(4) Timber production

Capability for timber production is high, the most important species being silvertop, white stringybark, yellow stringybark, mountain grey gum, brown barrel, and messmate. Proximity to the sawmills at Cann River increases the value of this block for timber production.

(5) Mining

Apart from an uncommercial bismuth deposit north of Mount Drummer, no known economic mineral deposits have been found so far. The only quarries - for road-making material - are along roadsides.

(6) Water production

The Cann River and Tonghi Creek provide water for irrigation, and Cann River township is to draw water for domestic purposes from the Cann. However, most of the River's catchment is outside this block, so water production is not wholly controlled by land use within the block.

D. Hazards and Conflicts

The erosion hazard is generally low to moderate and is greatest on the steeper granitic slopes.

Fire is a hazard, as the climate favours rapid accumulation of fuel and a long fire season. The location of the Princes Highway and Cann River township on the southern edge of the block adds to the importance of fire protection.

Flooding is an occasional hazard in the Cann valley. Most of the agricultural land is low-lying, on the river flood-plain, and stock must be moved to high ground during floods. This sometimes involves public land, as many graziers do not own sufficient elevated land for the purpose.

Cinnamon fungus is likely to be a serious problem only in low-lying areas in the south.

E. Significance

This block is highly significant for timber production, and also has high capability for recreation and nature conservation in parts.

The township of Cann River is centrally situated on the southern boundary.

8. MURRUNGOWAR

A. General

(1) General description

Most of this block is heavily forested mountainous or steeply hilly country. Large areas carry regrowth forests. It is mainly public land, with small scattered areas of freehold used predominantly for grazing beef cattle. The Princes Highway forms the southern boundary.

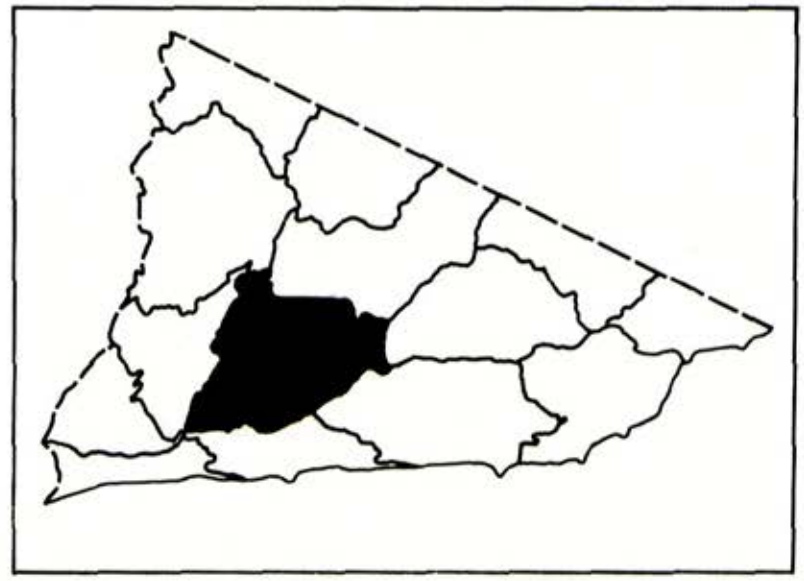
County of Croajingalong: Parishes of Wat Wat, Wibenduck, Neeran, Curlip, Orbost, Orbost East, Noonga, Kuark, Murrungowar, Jirrah, Jilwain, Bungywarr, Goolengook, Purgagoolah, Yarak, Winyar, and Nungal.

(2) Tenure and present use

Public land occupies 91,000 ha (87%) of the land in this block. Of this, 47,000 ha is Reserved Forest and 1,200 ha forms Lind National Park; most of the remainder is unreserved Crown land.

Sawlogs from the forests of this block are supplied to seven sawmills. Logging has been in progress for 27 years, during which time 1,170,000 m^3 of sawlogs have been harvested. Current operations are proceeding at the rate of 74,000 m^3 per annum.

Forest grazing and apiculture are important in the south. The Rocky River catchment is a proclaimed catchment, supplying water for domestic use in Orbost, Marlo, and Newmerella. A few quarries produce road-making material. There is a fire tower at Murrungowar.



B. Nature of the Land

(1) Climate

Temperatures are generally mild, but the winter is fairly cold in the north of the block. Three of four months have mean temperatures below 10°, the cold period being longest in the north.

Rainfall ranges from less than 900 mm to more than 1,250 mm, and is subject to marked topographic influence. It is greatest on south-facing slopes at higher elevations, and least in the south of the block and in a rainshadow belt along the Brodribb River valley.

(2) Geology and physiography

Most of this block is on Ordovician marine sedimentary rock, but various other rock types are also represented.

A belt of metamorphic rock extends through the centre, almost from the northern boundary to the southern boundary. This exists as a down-faulted block, as does the Upper Devonian non-marine sedimentary deposit along the Bemm River. A small capping of Tertiary (Oligocene) basalt overlies part of the Upper Devonian sediment, and an outlier of the Snowy River volcanics occurs to the north. There are a few scattered areas of granite - mostly Lower Devonian but Upper Devonian in the north. Tertiary non-marine sediments occur as a capping over the bedrock in a belt along the southern part of the block. Quaternary alluvial deposits occupy some valley floors along streams.

Land is undulating on the Tertiary deposits, but is steep and hilly or mountainous elsewhere. The Ordovician marine sediments that underlie most of the block tend to form a complex topography, with many deeply incised streams.

(3) Soils

Most of the soils above about 700 m are reddish and brownish gradational soils with undifferentiated stony loams on the steepest, most exposed sites. At lower elevations, reddish brown gradational soils predominate in Werragua and Pinnak land systems, yellowish brown gradational soils in Wurrin land system, friable yellowish or reddish gradational soils on the deeply weathered granodiorite of Wooyoot land system, and reddish brown or yellowish brown duplex soils in Waygara land system.

(4) Vegetation

Over much of this block silvertop--stringybark open forest III is the most common vegetation association, with stringybark--silvertop--red box open forest II and (in the south-west corner) red stringybark--yertchuk woodland II on steep dry sites. Yertchuk woodland II, frequently associated with areas of heath, occurs on sandy soils in the south-west.

Brown barrel open forest IV and messmate --gum open forest IV occur extensively in the wet elevated parts.

Lowland closed forest occurs in wet gullies and along streams.

No rare plant species have been recorded in this block.

(5) Fauna

Wet forest, dry forest, and small areas of woodland, heath, and wetland habitats occur in this block. Typical animal species for these habitats probably occur here - there is little specific information on the fauna.

(6) Land systems

Bullmalk 21%; Weeragua 21%; Wat Wat 8%; Koola 3%; Pinnak 27%; Wurrin 6%; Wooyoot 7%; Waygara 7%; Noorinbee <1%.

C. Capabilities

(1) Nature conservation

Because of the variety of vegetation associations present, and the high proportion of public land, capability for nature conservation is high.

Elevated parts of this block, particularly the Mount Murrungowar--Kuark area, are a prominent feature of the landscape, being visible from surrounding areas.

Five-year-old silvertop regeneration in Murrungowar block

An attractive streamside environment

(2) Recreation

Some parts of the block have moderate capability for recreation because of their attractive appearance, which gives them value for pleasure driving, sightseeing, and picnicking. Examples are the beautiful ferny gullies in the higher parts, the patches of jungle, and the river environments of the Brodribb and Bemm Rivers.

(3) Agriculture and apiculture

Land in the Wooyoot and Waygara land systems adjoins the Princes Highway in the southern part of the block and, because of temperature, rainfall, good access, and the proximity to Orbost, has moderate capability for agricultural development. The less-steep parts of the Pinnak land system also have moderate capability. Because of their proximity to existing settlements, small areas of land around Murrungowar and Club Terrace also have moderate capability. The northern part of the block is steeper than the southern section and generally has low capability. Some parts have high capability for forest grazing.

Capability for apiculture is moderate. The most important honey-producing

An isolated farm south of Goongerah

species are white stringybark, which is widespread except in the wetter parts, and red box, which occurs in dry areas, particularly around Sardine Creek.

(4) Timber production

Most of the block has a high to very high capability for timber production, the most important species being silvertop, white and brown stringybark, messmate, mountain grey gum, and brown barrel. The roading systems developed in association with log extraction have made much of the block accessible.

The areas close to Orbost are suitable for growing softwood species.

(5) Mining

Apart from minor gold-fields at Cabbage Tree Creek, Club Terrace, and near the Goolengook River, so far no deposits of economic minerals are known.

Several quarries produce material suitable for roading.

(6) Water production

The Orbost--Newmerella--Marlo town water supply comes from the Rocky River and the Brodribb River. Much of this block has moderate rainfall, and stream-flow is of good quality. The streams have high capability for water production, but there is no immediate additional demand for water. Expansion of the demand could easily be met from the streams of this block.

D. Hazards and Conflicts

Most present erosion results from limited sheeting or rilling of tracks and gravelled roads. The greatest potential erosion hazard exists on the long, steep slopes of the Bullamalk and Wat Wat land systems.

Fire hazard is high, particularly with respect to the settled areas around Orbost, Murrungowar, Cabbage Tree Creek, and Club Terrace and to the valuable regrowth forests. Open forest IV is generally too wet to present a serious fire hazard.

Cinnamon fungus is unlikely to be a problem, except possibly at wet sites in the south.

E. Significance

This block has significance for timber production, nature conservation, and water production.

9. ERRINUNDRA

A. General

(1) General description

This block is mostly heavily forested and mountainous. It includes the steep country rising from the valleys of the Brodribb, Errinundra, Combienbar, and Cann Rivers to the Errinundra Plateau and associated ridges, and contains the intermontane basins of Goongerah, Errinundra, Combienbar, and Buldah.

Most of the block is public land, the freehold land being confined to the river valleys.

County of Croajingalong: Parishes of Dellicknora, Goongerah, Noonga, Errinundra, Cobon, Bungywarr, Goolengook, Winyar, Bondi, Coopracambra, Werragua, Combienbar, and Kowat.

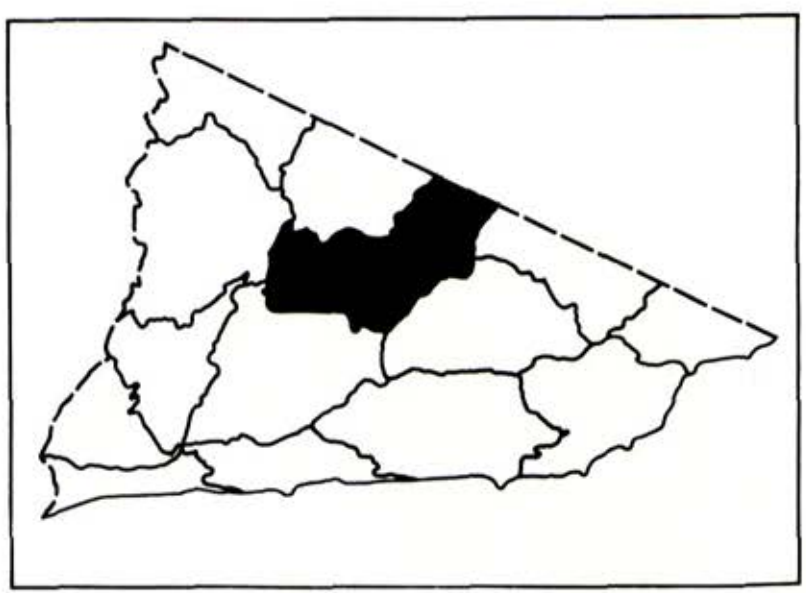
(2) Tenure and present use

Public land covers 93,000 ha (94% of the block), of which 39,000 ha are Reserved Forest and the remainder is unreserved Crown Land. The Reserved Forest includes the Goonmirk Rocks Scenic Reserve (200 ha) and Kanuka Creek Scenic Reserve (100 ha). Sawlog production in this block commenced in 1966 and at present amounts to 42,000 m^3 per annum, supplying three sawmills. A feature is the dense regeneration that has replaced the cut-out over-mature forest on the Errinundra Plateau.

B. Nature of the Land

(1) Climate

Summers are mild but winters are cold. Snow falls from time to time in winter,



but only occasionally remains on the ground. Temperatures in the valleys are influenced by cold air drainage. Rainfall varies from less than 1,000 mm at Goongerah and Buldah to probably as much as 2,000 mm on south-easterly aspects at high elevations.

(2) Geology and physiography

This block is mainly on Ordovician sediments or Devonian granite.

The Ordovician marine sediments are widespread, but are interrupted by other rock types in scattered locations. Lower Devonian granitic rock occurs in the east, mainly between the west and east branches of the Cann River. Upper Devonian granite occurs in the west, in a large massif between Goongerah and Errinundra, and as smaller outliers in the Goonmirk Range area.

Upper Devonian non-marine sediments are preserved as two down-faulted blocks around Combienbar and Buldah.

Also preserved in a down-thrown block is an outlier of the Snowy River volcanics, near the confluence of the Errinundra and Combienbar Rivers. This includes beds of limestone.

Quaternary alluvium occurs along some watercourses.

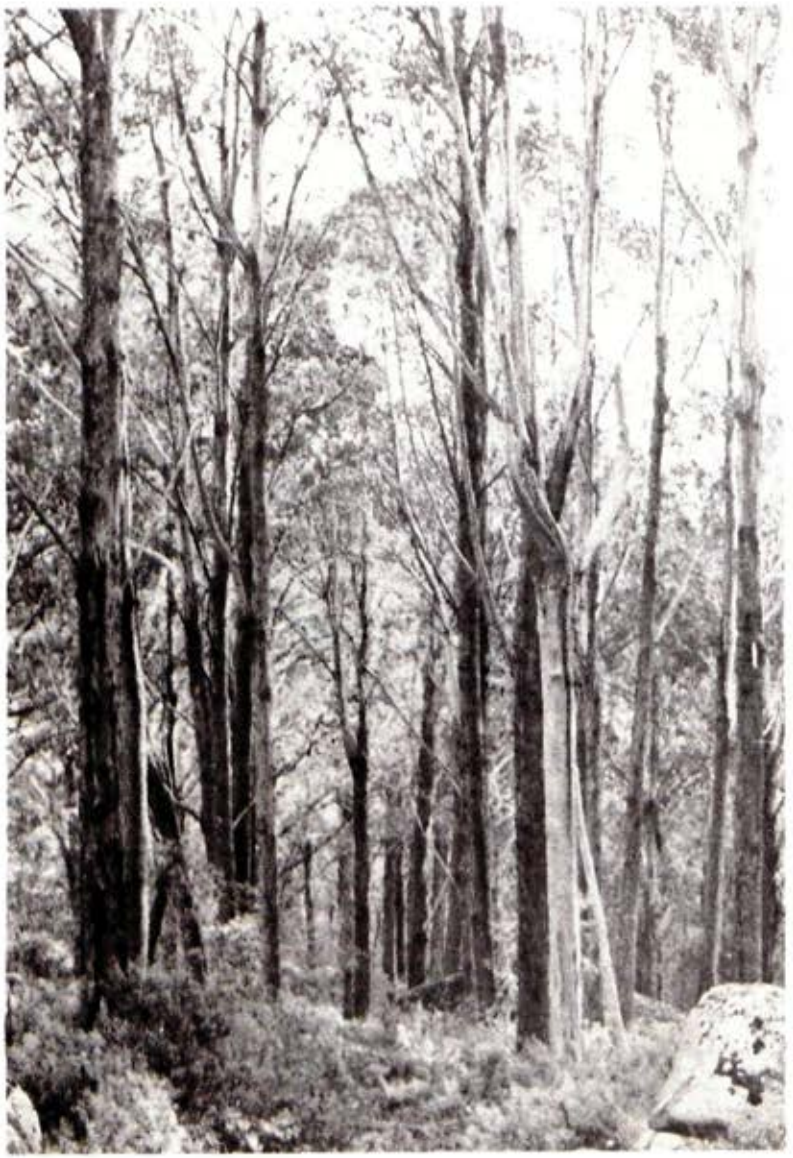
The broad physiographic pattern (of elevated land separated by steep slopes

The Errinundra valley

from the river valleys 900 m below) is independent of the underlying rock types.

The valleys of Buldah and Combienbar lie in Upper Devonian non-marine sediments in down-faulted blocks. The valleys have been formed by differential erosion of the rock preserved in these blocks.

The valley of the Broddribb River at Goongerah lies along a major wrench fault, and may have developed as a res-



Alpine ash open forest growing on Mount Ellery

ult of differential erosion of altered rock along this fault.

Mount Ellery is a prominent peak visible from many miles away. It is granitic, and the many huge granite tors exemplify a characteristic feature of granite country (see photograph on page 24).

(3) Soils

Most of the soils are friable reddish or brownish gradational soils, with undifferentiated stony loams on the steepest, most exposed sites.

Below about 800 m, reddish brown gradational soils predominate in Weeragua and Koola land systems, yellowish brown gradational soils in Kowat land system, and brown loams on Recent alluvium.

(4) Vegetation

The vegetation is very varied, due to the great range of environmental conditions represented.

Open forest IV occurs in the high parts and also extends down to low altitudes on the wet slopes of southerly or easterly aspect. Shining gum open forest IV occupies the highest wet sites and alpine ash open forest IV occupies high but generally drier sites.

Mountain ash open forest IV occurs in protected positions on the south fall of the Goonmirk Range - its restricted

occurrence here is the eastern limit of its range.

None of these types occurs in the eastern part of the block.

Brown barrel open forest IV occurs extensively on moist sites, generally at lower altitudes than shining gum or alpine ash, and messmate--gum open forest IV usually occupies pockets within the brown barrel forest.

Montane closed forest occupies many gullies in the open forest IV, and often occurs as the understorey beneath open forest IV. Small areas of closed forest without a eucalypt overstorey occur on the Goonmirk Range, notably at Goonmirk Rocks. Here the closed forest consists of a dense tangle of unusually large trees of a mixture of species (see page 38), and probably represents an extremely long period of complete absence of fires.

Lowland closed forest occurs on some wet low-altitude sites, particularly in gullies and along streams. An unusual mixture occupies the eastern slopes of Mount Ellery, where species typical of lowland closed forest and montane closed forest grow together, with emergent shining gum forming a sparse overstorey.

Open forest III - occupying generally drier sites than open forest IV - comprises silvertop on ridgetops, messmate--gum in gullies and south-facing slopes,

Shining gum open forest, with sassafras closed forest in the foreground

and silvertop--stringybark mainly on north- and west-facing slopes.

On the driest sites the vegetation is stringybark--silvertop--red box open forest II.

Two rare plant species (rare bent grass and green midge orchid - see pages 51 and 54) are recorded from this block.

(5) Fauna

The fauna habitats are mainly wet forest and dry open forest. The species described in Chapter 9 as being typical of general forest, wet forest, and dry open forest may be expected to occur and many of them have been recorded in this block.

The wet forest area is particularly interesting because of the large population of bobuck occurring within this and adjoining blocks. This animal lives in a fairly restricted habitat and appears to favour the dense fern gullies found in the ash and shining gum forests. There is evidence to show that the animals will intrude onto agricultural lands in the winter in search of food.

Mount Ellery

The potoroo has been recorded in wet forest here.

The Combienbar and Errinundra Rivers contain populations of blackfish and grayling.

(6) Land systems

Errinundra 5%; Bullamalk 46%; Weeragua 8%; Wat Wat 24%; Kowat 6%; Wurrin 4%; Noorinbee < 1%.

C. Capabilities

(1) Nature conservation

Capability for nature conservation is high. Most of the block is forested and it provides a valuable range of forested habitats. The contrasts between low-altitude valleys and high plateaux and peaks in close proximity are a special feature of interest.

The occurrences of mountain plum pine closed forest and sassafras closed forest on the Goonmirk Range are of great scientific interest.

Areas where mountain ash reaches the eastern limit of its range have high conservation value because of scientific interest and value as a gene pool.

Mount Ellery has high capability for nature conservation because of its range of habitats and the mixture of closed forest types.

The landscape qualitites of this block are a valuable resource. Mount Ellery is a particularly prominent feature of the landscape.

(2) Recreation

Capability for recreation is generally moderate, since the block has some value for bush-walking abd pleasure driving. Improved access and facilities would increase the value for pleasure driving and picnicking, as the mountain forests are very attractive, with their ferny understorey and tall trees. The rocky sunmit of Mount Ellery provides extensive views of the coast to the south and the mountainous country inland.

(3) Agriculture and apiculture

Most of the block is steep and has low capability for agriculture. Small areas adjoining existing freehold land around Combienbar and Buldah have moderate capability where the land is not too steep.

Parts of the Errinundra land system are undulating. They receive high rainfall, the soils are highly fertile, and, although low winter temperatures would restrain growth for some months, the more gently sloping areas have high capability for agriculture. Capability for forest grazing is limited by dense understorey and steepness.

Capability for apiculture is generally low, but is moderate where white stringybark, red stringybark, and red box occur.

(4) Timber production

This block contains extensive stands of high- to very high-quality timber-production forests, many of which have not been harvested. These are capable of supplying timber suitable for most purposes.

The main timber-producing species are, cut-tail, alpine ash, shining gum, mountain grey gum and messmate.

Wet conditions restrict access to the elevated parts of the block during winter.

(5) Mining

Barytes, limestone, platinum, lead, silver, and gold occur in this block, although not in commercial deposits.

Quarries for road-making material have been excavated and further quarries for new projects are likely to be needed.

(6) Water production

This block includes the land within the East Gippsland study area receiving the highest annual rainfall. It forms the upper catchment of the Bemm River, and most of the upper catchments of the Brodribb and Cann Rivers. It thus has high capability for water production.

D. Hazards and Conflicts

Present erosion is mainly limited to a little sheet erosion and track rilling with resultant stream turbidity, particularly on steeper slopes. In addition, severe (although limited) table drain erosion occurs in Koola land system at Buldah. The long, steep, wet slopes of Bullamalk and Wat Wat land systems, which predominate in the block, are potentially the most hazardous.

Fire is a hazard in the drier parts and poses threats to the settled areas of Combienbar, Buldah, and the Cann valley but the wet forests (open forest IV) rarely become sufficiently dry to create a fire hazard.

Conflicts may arise between timber production and some aspects of nature conservation and recreation, although roading associated with timber production improves access for recreation.

E. Significance

This block is highly significant for timber production. It also has high capability for water production and nature conservation.

Fire is significant adjacent to settled areas.

Land in New South Wales adjoining this block is Crown land, some of which forms part of the Bondi pine plantation.

10. BENDOC

A. General

(1) General description

The block is mainly undulating or hilly country, of which about one-third is freehold land; the remaining public land is forested. Unlike the other parts of the study area, it drains northwards, into the New South Wales headwaters of the Snowy River.

The town of Bendoc and part of Bonang form population centres in this block - Bendoc services surrounding rural areas, and two sawmills provide employment.

County of Croajingalong: Parishes of Kirkenong, Bidwell, Dellicknora, Bendock, Errinundra, and Bondi.

(2) Tenure and present use

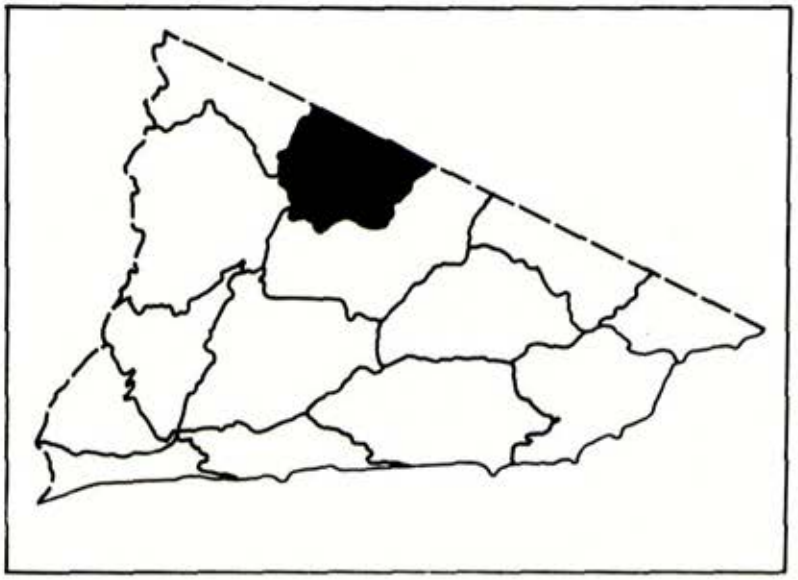
Public land occupies 41,000 ha; it includes 24,000 ha of Reserved Forest, and most of the rest is unreserved Crown land. The Reserved Forest includes The Gap Roadside Reserve, of 172 ha.

Sawmilling commenced here in the last century, associated with mining and land settlement, but did not develop as a significant industry until the 1950s. Currently four sawmills (holding annual log allocations of 57,000 m^3) draw log supplies from the block. More than 500,000 m^3 has been removed. The summit of Mount Delegate carries a fire tower.

B. Nature of the Land

(1) Climate

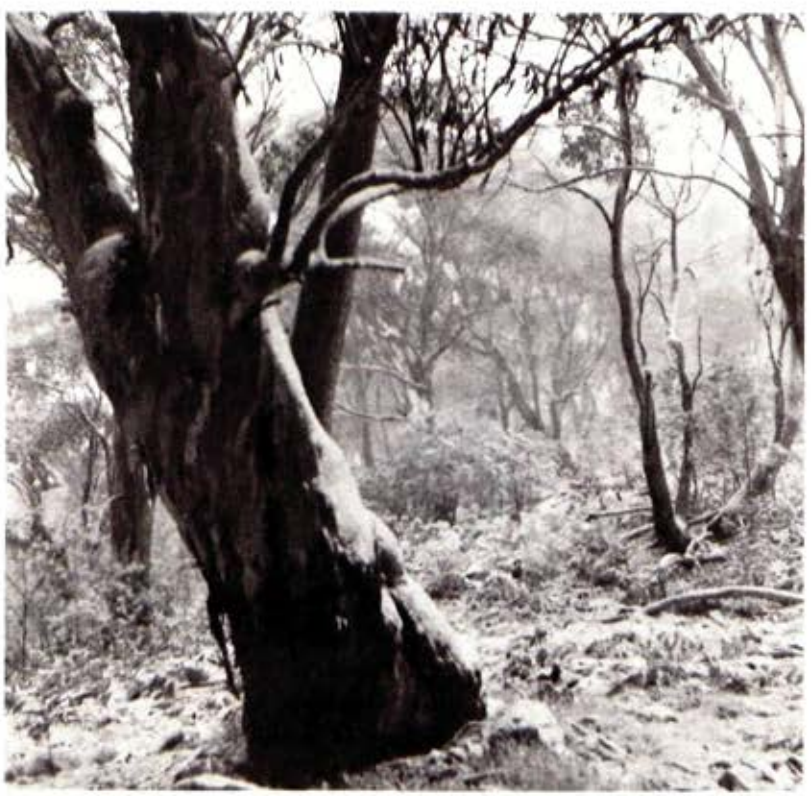
Summers are mild and winters are cold. Frosts may occur over most of the year,



and snow-falls are common in winter. Mean monthly temperatures are less than 10° for at least 5 months annually. Rainfall is only about 750 mm in the north of the block, but may exceed 1,200 mm in the south.

(2) Geology and physiography

Almost all of this block is on Ordovician sedimentary bedrock of marine origin. Of the several small scattered areas on Lower Devonian granitic rock, the most important is at Delegate River, where the land cleared for agriculture corresponds almost exactly to the area on granite.



White sallee woodland in snow on Mount Delegate

There is a very small area of Tertiary non-marine sediments near Mount Bendock, and Quaternary alluvial deposits near Quinburra.

Physiographically this block is the southern limit of the Monaro Tablelands of New South Wales. The northern part of the block is gently rolling, except for Mount Delegate (which rises steeply above the surrounding country, and is a prominent feature of the landscape) and the ridge between Hydens Bog and the Delegate River. The southern part is steeper, and rises to Goonmirk Range.

(3) Soils

Friable reddish and brownish gradational soils predominate and, except on the gentler slopes of the Kirkenong land system, these are usually stony throughout and lacking a clay subsoil. Undifferentiated stony loams occur on steep, rocky, and exposed sites (for example Mount Delegate). Limited areas of peats occur in bogs.

(4) Vegetation

Almost all the public land is forested. Brown barrel open forest IV is the most

extensive vegetation association. Shining gum open forest IV, alpine ash open forest IV, and messmate--gum open forest IV also occur in this block. Peppermint --gum open forest III and messmate--gum open forest III occupy drier sites, mainly in the northern half.

White sallee open forest I occurs in some low-lying areas, principally along the Delegate River, and also on Mount Delegate. Bogs and swamps also occur in low-lying areas.

Two rare sun-orchid species (see page 55) grow here. In addition, *Gahnia subaequiglumis* (a saw-sedge) is known in Victoria only from Castle Hill near Dargo and from the Upper Delegate River in this block, although it also occurs in New South Wales, the Australian Capital Territory and southern Queensland.

(5) Fauna

Bendoc block provides wet forest, dry forest, agricultural land, and wetland habitats. Typical species of these habitats probably occur here, but no rare animal species have been recorded. Little specific information is available.

(6) Land systems

Errinundra 61%; Kirkenong 22%; Cabanandra 9%; Moonkan 2%; Bullamalk 4%; Wat Wat 3%.

C. Capabilities

(1) Nature conservation

Capability for nature conservation is moderate. The diversity of habitats and the proportion comprising public land are not as great as for the other blocks, nevertheless large areas remain in a relatively undisturbed condition.

The swamps along the upper Delegate River are of particular interest for their flora, which includes several rare species.

(2) Recreation

This block has some value for recreation mainly pleasure driving and picnicking. Capability for these forms of recreation is moderate.

Mount Delegate is an accessible peak providing excellent views in all directions. The larger streams offer good trout-fishing.

(3) Agriculture and apiculture

The Kirkenong land system and the more gently sloping parts of the Errinundra land system have high potential for agriculture. The fertile soils, reasonable rainfall, and proximity to freehold agricultural land enhance its value for grazing enterprises, but winters are cold, severely reducing pasture growth. On steep slopes capability is low.

Grazing land near Bendoc, with Mount Delegate in the background

Capability for forest grazing is moderate to high where the understorey is not too dense.

Capability for apiculture is low.

(4) Timber production

Capability for timber production is high, as much of the block carries highly to very highly productive forest, the main species being brown barrel mess-mate, mountain grey gum, and some alpine ash. Large stands of brown barrel are located in the southern and eastern portions of the block.

Those parts of the area carrying peppermint--gum forests are suited for the growth of softwood species. Large softwood plantations in New South Wales adjoin the block east of Mount Tennyson.

(5) Mining

The first and most important discoveries of gold within the study area were made here, and the gold-fields were worked until the early 1950s.

Bismuth and tungsten ores occur near Mount Bendock, but the deposits are not commercial.

Material suitable for road-making occurs in this block.

(6) Water production

Capability for water production is moderate. Parts of the block receive relatively high rainfall, but the catchments are small. Water could be required for the township of Bendoc, and for irrigation in the drier parts.

D. Hazards and Conflicts

Erosion and fire are minor hazards. Dingoes and wild dogs living in the forest sometimes attack sheep.

Timber production may conflict with some aspects of nature conservation.

E. Significance

This block is highly significant for the production of hardwood timber and contains large areas suitable for the growth of softwood species. Part of it adjoins the Bondi pine plantation in New South Wales.

This block forms the southern extension of the Monaro Tablelands and is readily accessible from Bombala in New South Wales.

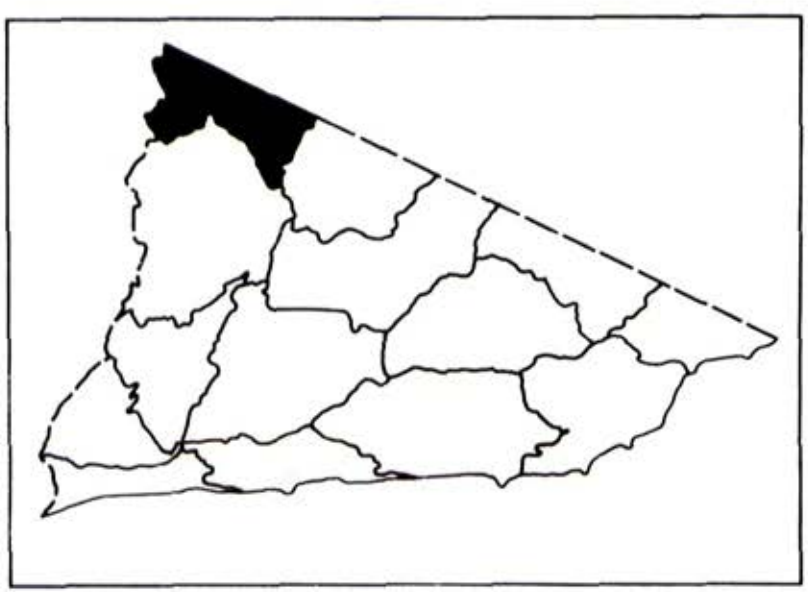
11. TINGARINGY

A. General

(1) General description

Most of the block is steep and relatively dry, vegetated with open forest II or woodland I--II. Parts are very rugged, with cliffs or very steep slopes, particularly at Mount Tingaringy.

Two large blocks of freehold land occur at Dellicknora (in a broad valley) and at Amboyne (on steep country).



County of Croajingalong: Parishes of Wyangil, Jingallala, Boorpuk, Tubbut, Cabanandra, Bonang, and Bidwell.

(2) Tenure and present use

The public land in this block is mainly unreserved Crown land, amounting to 36,000 ha.

It is used for forest grazing and apiculture.

B. Nature of the Land

(1) Climate

Temperatures are mild in summer and cool in winter. Probably 5 months have mean temperatures below 10° (May to September), and snow lies on the higher ground occasionally.

Rainfall is generally less than 800 mm annually in the rainshadow areas along the Snowy and Deddick Rivers, but may exceed 900 mm on high hill-tops.

(2) Geology and physiography

Most of this block is on Ordovician sedimentary rock of marine origin. How-

ever, there are also large areas on Lower Devonian granite, and two small areas on two types of extrusive igneous rocks - Tertiary basalt near Bonang, and Lower Devonian hornblende diorite near Mount Taylor.

Most of it slopes steeply, with high ridges and peaks forming a complex pattern. Mount Tingaringy (1,448 m) - the highest mountain in the East Gippsland study area - is bounded by extensive cliffs on the west.

The eastern part is more gently sloping, and the Dellicknora valley has affinities with the Monaro Tablelands of New South Wales.

(3) Soils

Wyangil land system carries mainly stony reddish brown gradational soils with undifferentiated stony loams on the steepest, most exposed sites. However, in most of Cabanandra land system, and in Wyangil land system at higher altitudes, friable reddish and brownish gradational soils predominate. In Jingallala land system brown gravelly loams occur on steep colluvium, and in Tubbut land system the soils are mainly yellowish brown duplex.

(4) Vegetation

The predominant vegetation types are white box woodland and yertchuk woodland (in which bundy is often a common species)

Mount Tingaringy

with peppermint--red stringybark open forest II in the east.

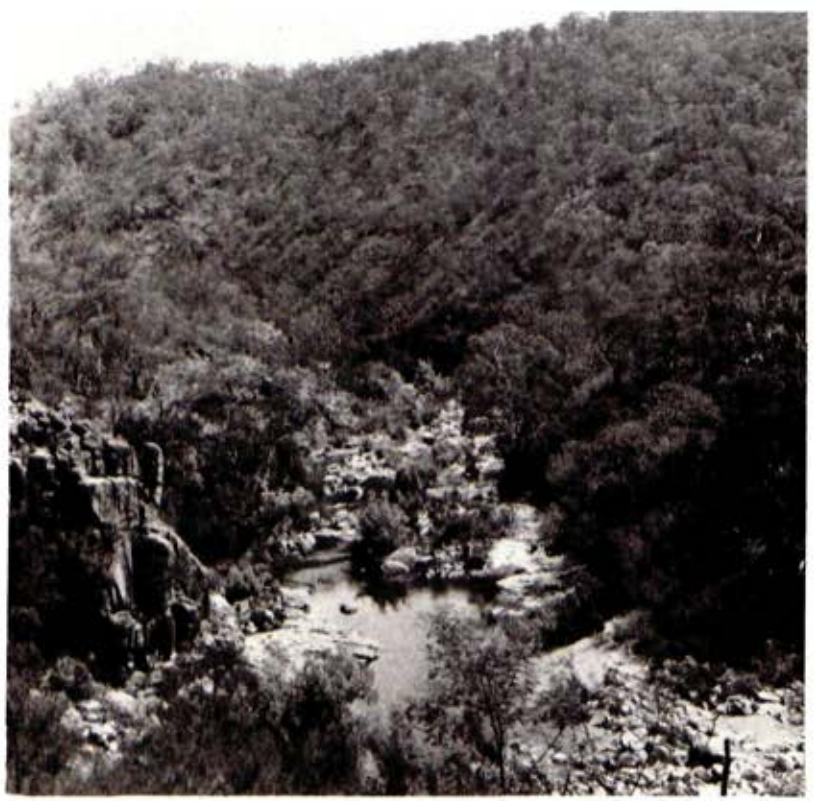
Other vegetation types represented include cypress pine woodland (in the west), stringybark--silvertop--red box open forest II, messmate--gum open forest III, peppermint--gum open forest III (in the east), brown barrel open forest IV and alpine ash open forest IV (on Mount Tingaringy and near the Bonang Highway), and white sallee open forest I (mainly on Mount Tingaringy).

In addition to the three rare plant species from this block listed in Chap-

ter 8 (pages 53 and 54), two other species common in southern New South Wales but rare in Victoria occur here: these are pinnate goodenia *(Goodenia grandiflora)* and slender myoporum *(Myoporum floribundum)*, both from the upper Snowy and Deddick River valleys.

(5) Fauna

Wet forest, dry forest, inland woodland sub-alpine complex, agricultural land



Deddick River near Tubbut

and wetland habitats are represented in this block, but wet forests and sub-alpine complex are confined to small areas, and wetland is confined to a few streams.

In addition to the animal species normally associated with these habitats, two species that are rare in Victoria - the brush-tailed rock wallaby and the wallaroo - occur here.

Some species, such as the rainbow bee-eater, are confined within this study area to the rainshadow areas of this block and the Rodger block.

(5) Land systems

Errinundra 2%; Kirkenong < 1%; Cabanandra 16%; Tubbut 19%; Jingallala 18%; Wyangil 45%.

C. Capabilities

(1) Nature conservation

Capability for nature conservation is high, because of the variety of habitats represented, the relative inaccessibility of much of the public land, and the proximity to the Kosciusko National Park.

The rugged landscape differs from other parts of the study area. Mount Tingaringy (with its high cliffs) and the steep hills along the Snowy River exemplify this.

(2) Recreation

Capability for wilderness-based recreation is high, but for other forms of recreation is generally low because of poor access.

Mount Tingaringy is an important recreation feature; this impressive peak, with cliffs on the western side, offers excellent views in all directions.

The Snowy River, forming the western boundary, is another important recreation feature, and is a good canoeing stream for experienced canoeists. Fishing is also good.

(3) Agriculture and apiculture

Most development has been on the Tubbut, Jingallala, and Cabanandra land systems. Gentler slopes within these land systems have moderate potential for agriculture. Elsewhere capability is low. Although the rainfall here is lower than in the rest of the study area, good lucerne pastures can be developed on the soils of the Tubbut and Jingallala land systems.

Capability for forest grazing is generally low but is moderate on land adjoining freehold properties.

White box, which is common in this block, is a valuable honey-producing species, but poor access restricts its use.

(4) Timber production

Apart from some small areas near the Bonang Highway, capability for timber production is low. White box is used locally for fencing and construction timber.

(5) Mining

Thorium ore (monazite) occurs near Dellicknora, and gold between Dellicknora and Mount Tingaringy. These deposits are not commercially exploitable at the present time and no other deposits of economic minerals are known to occur here.

(6) Water production

Capability for water production is low.

D. Hazards and Conflicts

Sheet, gully, and track erosion occur to a limited extent, but are potentially serious throughout the block, as slopes are mostly steep and the generally low rainfall inhibits revegetation.

Reduction of the fire hazard on adjoining public land is most important for the protection of settled areas in the Tubbut and Bonang valleys. Access is poor, making control difficult, and the dry climate means fuel is often sufficiently dry to burn. However, because of the dry climate, accumulation of fuel is much less than in wetter areas.

E. Significance

This block is highly significant for nature conservation and wilderness-based recreation. Protection of settled areas from fire is significant in view of the dry nature of much of the public land.

The adjoining land across the border in New South Wales is Crown land and an area (between Mount Tingaringy and the Snowy River) forms part of the Kosciusko National Park. The land within Victoria to the west of the Snowy River is public land.

12. RODGER

A. General

(1) General description

This block is mountainous, and includes the rugged Bowen Ranges and almost all the east side of the Snowy River gorge. The vegetation varies from dry woodland to wet forest.

Most of it is public land, but a large block of freehold land occupies the Deddick River valley.

County of Croajingalong: Parishes of Jingallala, Deddick, Moonkan, Bullamalk, Yalmy, Bonang, Tingaringy, Wat Wat, and Wibenduck.

(2) Tenure and present use

Of the 120,000 ha of this block, 106,000 ha is public land: 1,000 ha of this is Reserved Forest, and the remainder is unreserved Crown land.

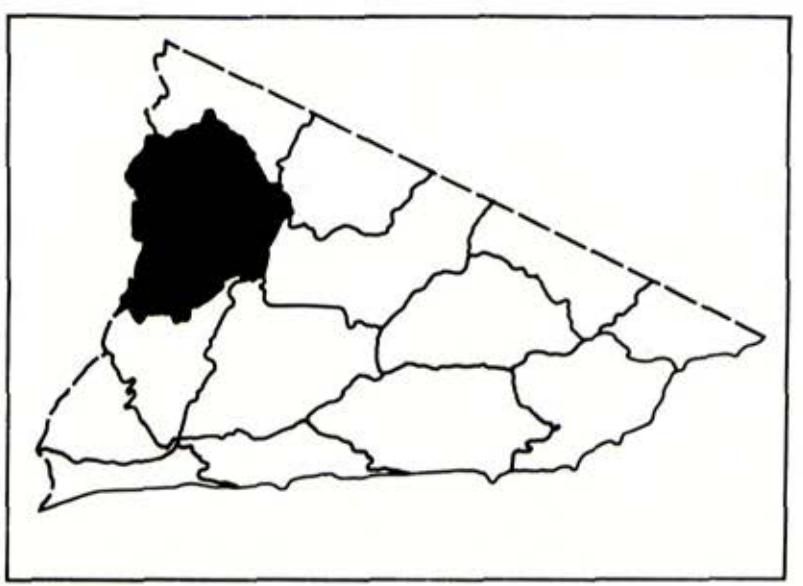
During the past 15 years, one sawmiller has depended fully and two have depended partly on this block for supply. All procurement operations have been restricted to the eastern part of the block.

Extensive areas are leased for forest grazing, but the number of cattle run here is rarely large.

B. Nature of the Land

(1) Climate

Summers are mild and winters cool. Snow lies on the higher ground intermittently during the winter. Probably 4 or 5 months have mean temperatures below 10°.



Annual rainfall ranges from less than 700 mm in the rainshadow to more than 1,200 mm (estimated) in the elevated areas.

(2) Geology and physiography

The most extensive basement rock type is Ordovician marine sedimentary rock. Lower Devonian granite occurs mainly in the north of the block, and Upper Devonian granite in the east.

The Snowy River volcanics (of Mid--Lower Devonian age) occur in down-faulted blocks in the west, and there is a small capping of Tertiary (Oligocene) basalt near Bonang.

Land on Ordovician sediments tends to be steep and deeply dissected by numerous streams. These sediments form the Bowen Range. Land on granite is also steep (for example, Mount Deddick), but less dissected.

Land on the Snowy River volcanics is conspicuously less steep and dissected than than on the other rock types, except where the Snowy River has cut a deep gorge, with very steep, and often cliffed, sides.

(3) Soils

The soils are predominantly friable reddish or brownish gradational soils, often shallow and stony, and frequently without a subsoil of clay texture.

The Snowy River gorge near Mountain Creek

Yellowish brown gradational soils are common in gentler slopes on ridges below 900 m elevation. Reddish brown gradational soils predominate below about 700 m. Undifferentiated stony loams are common on steep, exposed sites.

(4) Vegetation

Many vegetation types are represented. Mountain ash open forest IV is largely confined to the catchment of the Rodger River. Alpine ash open forest IV and brown barrel open forest IV are fairly widespread in the elevated parts of the block. Messmate--gum open forest IV is widespread on moist slopes, mainly of southerly or south-easterly aspect.

Messmate--gum open forest III and silvertop--stringybark open forest III are widespread, occupying sites of intermediate moisture status. Peppermint--gum open forest III is restricted to a few small moist sites, mainly near Bonang.

Peppermint--red strinybark--gum open forest II occurs in the north and north-east, mainly in the catchment of the Deddick River. Stringybark--silvertop--red box open forest II is widespread throughout the block on dry slopes, generally with northerly or westerly aspect.

Cypress woodland I--II and white box woodland I--II occupy dry, steep, exposed slopes in the north-west. Red stringybark--yertchuk woodland I--II occurs mainly in the western half of the block, on dry, steep, exposed sites (although not as dry as the previous two vegetation associations).

Four rare plant species from this block were listed in Chapter 8 (pages 53-55). In addition, three species that are rare in Victoria, although reasonably common in southern New South Wales, occur here. Pinnate goodenia and slender myoporum, from the upper Snowy and Deddick River valleys, were mentioned in the Tingaringy block description. Showy boronia *(Boronia ledifolia)* grows in the Snowy River gorge (as well as near the Timbarra River, outside the study area).

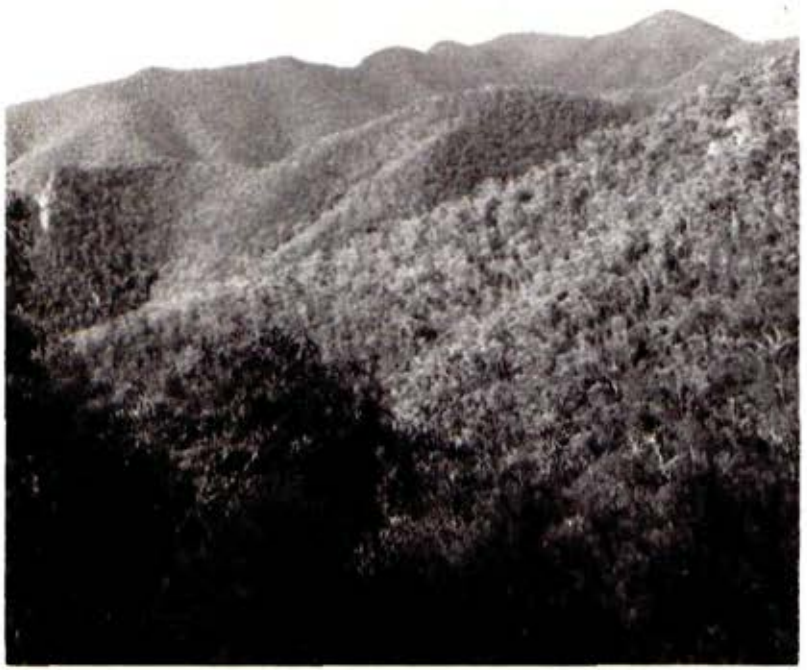
(5) Fauna

Wet forest, dry forest, inland woodland, wetland, and agricultural habitats are represented in this block. Species typical of these may be expected to occur here, but little survey work has been done.

The potoroo has been recorded in wet forest, and the brush-tailed rock wallaby is believed to live in at least two colonies in this block.

(6) Land systems

Errinundra 13%; Kirkenong < 1%; Cabanandra < 1%; Moonkan 12%; Tubbut 6%; Jingallala 7%; Wyangil 4%; Bullamalk 31%; Weeragua 7%; Wat Wat 4%; Kowat 7%;



Part of the Bowen Range

Yalmy 6%; Pinnak < 1%; Wurrin < 1%; Noorinbee < 1%.

C. Capabilities

(1) Nature conservation

Capability for nature conservation is high. Much of the block remains virtually unaltered from its condition before settlement. The rugged terrain restricts access, and there has been no logging in most of the block.

A large variety of vegetation associations is represented, and contrasting habitats occur in close proximity.

(2) Recreation

Capability for wilderness-based recreation is high, especially in the Bowen Ranges and Snowy River areas. The Snowy River gorge features particularly impressive scenery.

Development of roading to productive forest areas would enhance capability for most other forms of recreation, which is currently low due to inadequate access, but would reduce the value for wilderness recreation. Current access depends largely on a track system suitable for four-wheel-drive vehicles only. Capability for most other forms of recreation is low.

(3) Agriculture and apiculture

Agriculture in this block is currently confined to sheep- and cattle-grazing in the northern part occupying the Tubbut and Jingallala land systems. The remainder is generally too steep for agriculture, although small areas adjoining the Snowy River in the south of the block and near Goongerah have moderate capability.

An area in the centre (Errinundra land system) has good soils and rainfall; but restricted access, severe winters, and high clearing costs reduce its capabil-

ity for agriculture. Capability for forest grazing ranges from low to high in different parts.

Capability for apiculture is moderate where red stringybark, white box, or red box occur, and low elsewhere.

The Snowy River near Betts Creek

(4) Timber production

Rodger block contains extensive areas of stands with moderate, high, and very high production values. These are estimated to contain about 20% of the total sawlog resource within the study area. This resource is concentrated mainly on the Mount Gelantipy plateau (south of Sugarloaf) and in the catchments of the Rodger and Yalmy Rivers.

Limited sawlog procurement has been undertaken to this time, but, due to its location, the timber resource is important to the future of the existing sawmilling industry based in Nowa Nowa and Orbost.

The major species are alpine ash, brown barrel, mountain ash, messmate, and mountain grey gum.

(5) Mining

Mineralized zones bearing silver, lead, zinc, and copper occur near Mount Deddick, around Accommodation Creek (south of Tubbut), and in the Snowy River gorge near Campbell Knob. Mining of these deposits has produced commercial quantities of ore, and further exploration may increase the known reserves.

There is also a gold-field, previously worked, south-west of Cabanandra.

Material suitable for roading occurs in the block.

(6) Water production

The catchments of the Yalmy and Rodger Rivers and Mountain Creek receive relatively high rainfalls, and drain into the Snowy River.

D. Hazards and Conflicts

Erosion in the form of sheeting, rilling, or gullying is uncommon. However, the potential hazard is moderate on most of the block, because of the generally steep slopes, and severe on the dry westerly and northerly aspects (where the vegetation is mapped as woodland).

Fire is a serious hazard. Lightning strikes occur frequently in the drier northern and western parts, and rugged terrain and limited access inhibit speedy initial attack. In this situation, fires can reach large size and threaten valuable timber stands of this and adjoining blocks.

Use of the block for timber production or mining may conflict with nature conservation and wilderness-based recreation, but improved access may improve the capability for other aspects of recreation.

E. Significance

This block has highly significant capability for nature conservation, recreation, timber production, and possibly mining.

13. ORBOST

A. General

(1) General description

Most of this block is public land, the western half being hilly and vegetated mainly with woodland or open forest II, and the eastern half being more mountainous and vegetated mainly with open forest III. The Snowy River and the Bonang Highway form the western and eastern boundaries respectively. There is a significant area of freehold land in the south.

County of Croajingalong: Parishes of Yalmy, Pinnak, Loongelaat, Orbost, Wibenduck, Neeran, and Curlip.

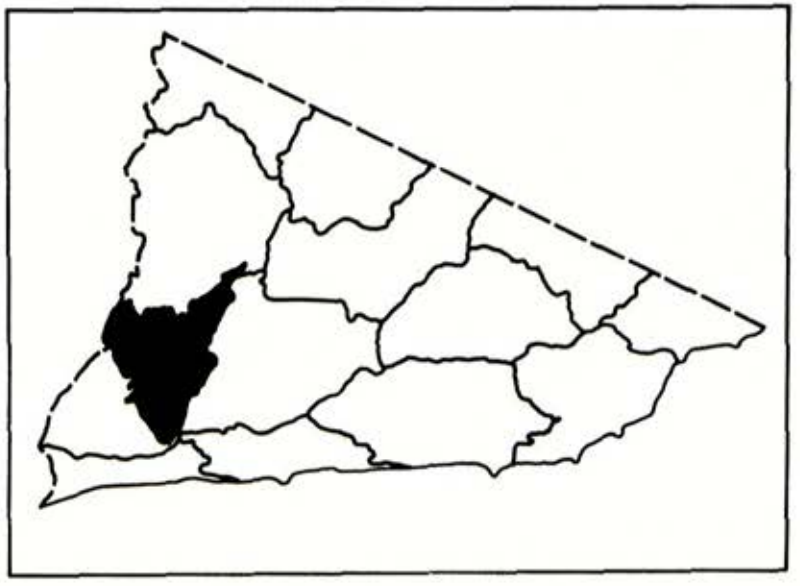
(2) Tenure and present use

In this block, public land occupies 50,000 ha, of which 7,500 ha is Reserved Forest. The remainder is mainly unreserved Crown land.

Timber supplies, especially sleepers, have been obtained from this block for many years. Currently three sawmillers draw their supplies (36,000 m^3 annually) from it. It is estimated that 570,000 m^3 of sawlogs have been removed in past procurement operations. Although these have extended over much of the commercial forests here, large volumes remain.

Sleeper production has been an important operation in the southern and western parts.

Public land in the southern half is important for forest grazing and apiculture. Mount Buck carries a fire tower.



B. Nature of the Land

(1) Climate

Temperatures in this block are influenced both by distance from the sea and by altitude. The lower and more southerly part would generally be warmer than the northerly part. Mean temperatures are less than 10° for the 3 winter months. The rainfall is probably below 900 mm per annum in the south and west and 900--1,000 mm in the remainder.

Looking eastwards into the Orbost block from Lucas Point on the Snowy River. Mount Ellery is in the top left corner. Mounts Sardine and Buck form the ends of the nearer range

Topographical variation results in local variability of rainfall.

(2) Geology and physiography

Almost all this block is on Ordovician marine sedimentary rock. However, there are small areas of a variety of other geological types. Near Orbost the Snowy River flats are on Quaternary alluvial deposits, and Tertiary non-marine sediments cap the hills around Orbost. Crossing the Snowy River between Sandy Point and Lucas Point, and on the Yalmy Road near Mount Pinnak, are areas of Lower Devonian intrusive igneous rock - hornblende-rich diorite and tonalite. The north-east contains a remnant area of Silurian rock of marine origin, and a small area of Tertiary basalt; and a corner of the Mount Ellery granite massif of Upper Devonian age lies in the extreme north-east.

Most of the block is moderately steep, with several prominent hills and ridges, such as Mount Buck, Mount Pinnak, and Mount Sardine. The area of river flats near Orbost is almost all privately owned.

(3) Soils

The soils vary greatly. Reddish or brownish gradational soils predominate, with yellowish brown gradational soils on gentler slopes. Reddish brown or yellowish brown duplex soils are common in the southern part and undifferentiat-

ed stony loams occur on steep, rocky sites.

The alluvial river flats mostly carry earthy brown or yellowish brown gradational soils.

(4) Vegetation

The eastern part of the block is vegetated mainly with silvertop--stringybark open forest III, with silvertop open forest III on a few ridges and messmate--gum open forest III occupying moist sites. The driest, most exposed sites in this part carry red stringybark--silvertop--red box open forest II.

The western half, which is drier, is covered mainly with red stringybark--silvertop--red box open forest II and yertchuk--red stringybark woodland I--II with silvertop--stringybark open forest III on moist sites.

There is a small area of coast grey box open forest III near Double Bull Creek.

Yellow milk vine *(Marsdenia flavescens)* which is rare within Victoria, has been recorded from Pipeclay Creek. Other rare plant species from this block are listed in Chapter 8 (pages 52--55).

(5) Fauna

Dry forest, inland woodland, wetland, and agricultural habitats are represented in this block. Fauna typical of these may be expected, but few survey records exist.

The white-footed dunnart, an uncommon species, has been recorded in the west of the block.

(6) Land systems

Bullamalk 4%; Weeragua 33%; Wat Wat 2%; Yalmy 4%; Pinnak 37%; Wurrin 11%; Waygara 5%; Noorinbee 4%.

C. Capabilities

(1) Nature conservation

Much of this block has moderate capability for nature conservation, but parts (for example the Snowy River gorge) have high capability.

(2) Recreation

Much of this block has low capability for recreation, but parts have high capability; the Snowy River has high capability for canoeing, and the gorge of the Snowy (north of Lucas Point) has impressive scenery and high capability for bushwalking.

(3) Agriculture and apiculture

The area north of the current freehold land occupied by the Pinnak land system varies, and parts with gentler slopes have moderate--high capability for agriculture. Proximity to the intensively

farmed area around Orbost is an important factor.

Capability for forest grazing is moderate--high.

Capability for apiculture is moderate; the most important honey-producing species are red stringybark, red box, and white stringybark.

(4) Timber production

Much of the block has moderate capability for producing sawlogs. Forests in the west are of lower productivity for sawlogs but are very significant for sleeper production. The fact that the forests are well roaded and close to a major conversion centre and rail-head at Orbost adds to their value for timber production. The principal species are messmate, mountain grey gum, silvertop, white stringybark and yellow stringybark.

(5) Mining

Copper ore occurs at Raymond Creek and north of Mount Buck, and there may be other deposits. Also, a small amount of limestone and material suitable for road-making occurs in the block.

(6) Water production

The Snowy River, which forms the western boundary, has high capability for water production, but catchments within the block have low capability.

D. Hazards and Conflicts

Erosion is a moderate hazard on steep slopes (mainly in the north), particularly dry slopes of northerly or westerly aspect.

Fire hazard is high, particularly in the vicinity of Orbost, and in forest regrowth stands.

Conflicts may arise between timber production and agriculture or some aspects of nature conservation and recreation.

E. Significance

The eastern part of the block is a valuable source of timber for sawmills in Orbost. The western part has high capability for recreation, and parts in the south have high capability for agriculture.

The location of Orbost in the south of the block is significant.

14. WAIREWA

A. General

(1) General description

Most of the block is public land, which is undulating in the southern part and steeply hilly in the north and west. The Mount Tara ridge forms the western boundary. The public land is covered almost entirely by open forest II and III. Freehold land is concentrated in the south-west and at Wairewa.

County of Tambo: Parishes of Buchan, Nowa Nowa, Nowa Nowa South, Tildesley West, Bete Bolong North, Bete Bolong South, Tildesley East, Waygara, and Newmerella.

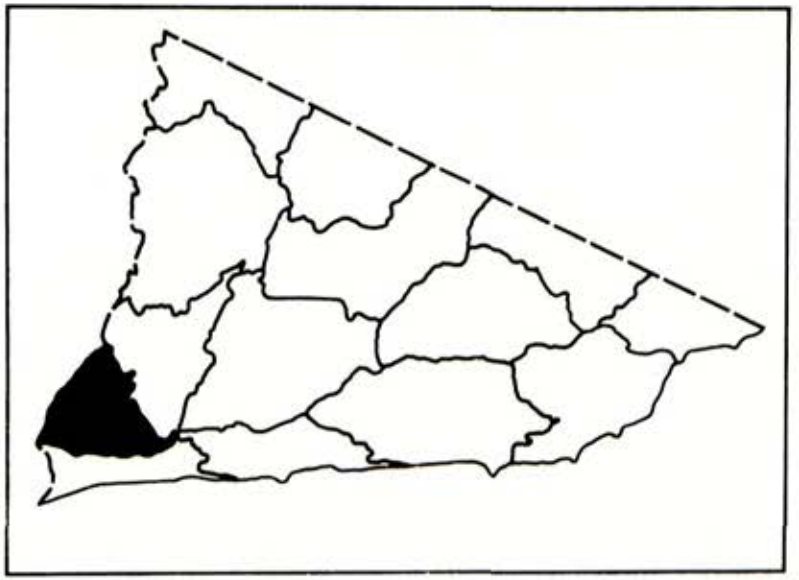
(2) Tenure and present use

Public land covers 33,000 ha, of which 26,000 ha is Reserved Forest. The Mottle Range Reserve occupies 32 ha within the Reserved Forest. This block has been an important source of supply of sawlogs and sleepers for many years. One sawmiller currently obtains supply from the area. Due to its good roading system and its favourable location, it is also an important area for emergency supply during wet weather. The forest also supports apiculture and forest grazing. Mount Tara and Stringers Knob carry fire towers.

B. Nature of the Land

(1) Climate

Temperatures are generally mild, but the winter months may be cool, particularly in the north. Probably the mean monthly temperature is less than 10°C for June, July, and August throughout



the block. Rainfall is 750--900 mm per annum in general, but may be greater on steep south-facing slopes

(2) Geology and physiography

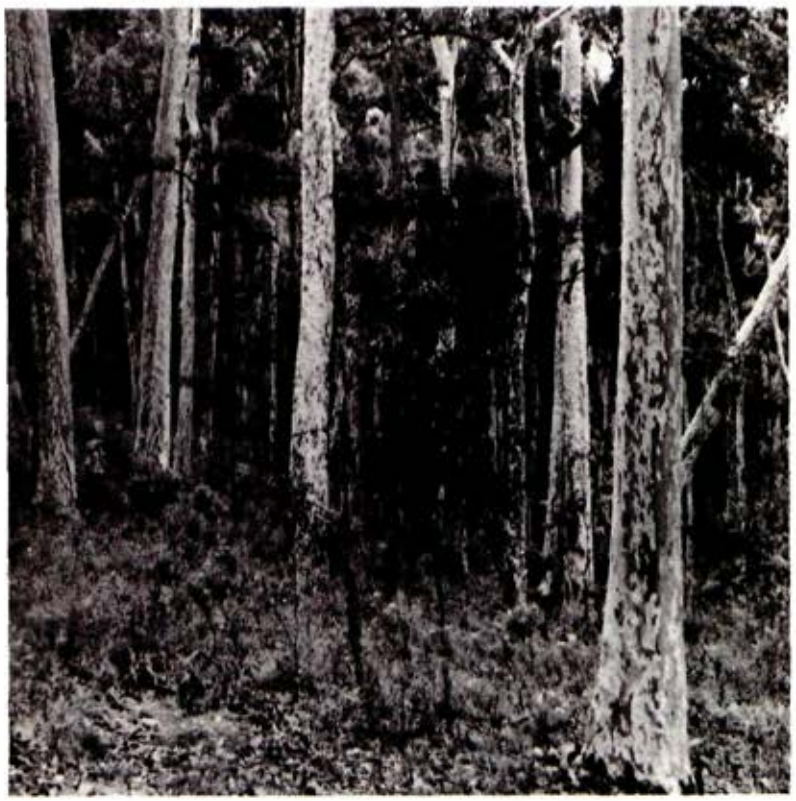
The southern part of this block is on Tertiary sedimentary deposits, except for Quaternary alluvial deposits on the Snowy River flats and along Hospital Creek. The northern part lies mainly on Ordovician sedimentary bedrock, except for two groups of igneous rocks. Near the western boundary, occurrences of the Lower to Middle Devonian Snowy River volcanics have been preserved by down-faulting. These are mainly acid volcanics such as rhyodacite and rhyolite.

The north-centre carries two areas of Lower Devonian hornblende-rich intrusive igneous rocks, mainly diorite and tonalite.

Land on Quaternary alluvial deposits is flat. On the Tertiary sediments the terrain is gently undulating. The northern part of the block, on other rock types, is steep and hilly, with numerous deeply incised gullies.

(3) Soils

The soils are mainly reddish brown or yellowish brown duplex soils, with small areas of leached sands on the Tertiary deposits and brown loams in drainage lines.



The spotted gum stand in the Mottle Range

(4) Vegetation

The steep parts of the block, in the north, are vegetated mainly with stringybark--silvertop--red box open forest II and red stringybark--yertchuk woodland I--II. The gently sloping parts mostly carry silvertop--stringybark open forest II, with scattered areas of yertchuk woodland I--II and occasionally stringybark--silvertop--mahogany woodland I--II.

A stand of spotted gum *(Eucalyptus maculata)* in the Mottle Range is of particular interest, as it is the only known occurrence of this species within Victoria, and is several hundred kilometres from the nearest New South Wales stand.

(5) Fauna

The following faunal habitats are represented: dry open forest, inland woodland, wetland, and agricultural land. Species typical of these may be expected to occur here.

No rare species have been recorded from this block, but there has been little study of the fauna here.

(6) Land systems

Yalmy 5%; Pinnak 30%; Wurrin 8%; Waygara 53%; Noorinbee 5%.

C. Capabilities

(1) Nature Conservation

Much of this block, being close to settled areas, has moderate capability for nature conservation. But some parts, such as the spotted gum stand, have high capability for specific purposes.

(2) Recreation

Capability for recreation is generally moderate, but the Snowy River has high capability for canoeing. Good access and proximity to towns contribute to the importance of the block for recreation.

(3) Agriculture and apiculture

The southern part (Waygara land system) has reasonable soils and rainfall and generally gentle topography. With its good access and proximity to intensive agricultural areas, it has high capability for agriculture.

Some development for agriculture has taken place in the north (Wurrin land system), and capability for further development is moderate. The remainder of the block has low capability.

Capability for forest grazing is moderate--high.

Capability for apiculture is moderate, the most valued honey-producing species being red box, red stringybark, and white stringybark.

(4) Timber production

Capability for timber production is low to moderate in the silvertop--stringybark open forest III that occupies most of the block. However, some sites have messmate, mountain grey gum, silvertop, white, red, and yellow stringybark, and yertchuk, which are species suitable for sleeper production.

As the block is well roaded and close to the rail-heads at Nowa Nowa and Orbost,

it is an important source of sleepers as well as being a wet-weather reserve for sawlog production.

(5) Mining

Iron ore occurs near Mount Nowa Nowa, and copper and manganese ore near Mount Tara and also at Long Point. These deposits are not commercially exploitable.

Material suitable for roading occurs here, and a parcel of public land near Newmerella has been extensively quarried.

(6) Water production

Capability for water production within the block is low, but the Snowy River forms the eastern boundary, and subsurface water is available in the Tertiary deposits.

D. Hazards and Conflicts

The erosion hazard is moderate on the steeper slopes (mainly in the northern part), particularly on dry northerly or westerly aspects.

Fire is a moderate hazard, and the settlements of Wairewa and Waygara are exposed to threat from fire in adjacent forest.

Cinnamon fungus is a problem on wet sites - it has already infected parts of this block.

Conflicts may arise between agriculture and timber production, and possibly between timber production or agriculture and some aspects of nature conservation.

E. Significance

This block is close to Nowa Nowa and Orbost, and the Princes Highway and railway line run along its southern boundary. It also has a well-developed roading system. These features increase its value for recreation, agriculture, apiculture, sleeper production, and reserve sawlog production during periods of wet weather.

PART V

APPENDICES

APPENDIX I SAMPLE OF RESULTS OF BOTANICAL SURVEY BY BOTANY DEPARTMENT, MONASH UNIVERSITY

Association	Messmate--gum open forest								Silvertop--stringybark open forest											Heath					
Site	2	51	53	57	1	3	56	58	14	4	5	9	62	61	20	8	13	36	11	64	41	42	49	50	65
Bedfordia salicina	3	3	+	1	2	2		2																	
Culcita dubia	2	1	2	+	2	2																			
Cyathea australis	2	+		2	2	+	+	2																	
Coprosma quadrifida	+	+		2	1	+	+	+																	
Dicksonia antarctica				+	1	3	3	1																	
Eucalyptus cypellocarpa	2	2	+		2																				
Eugenia smithii		+		3			4	3																	
Blechnum patersonii				2			2	+																	
Blechnum nudum				1	2	1		+																	
Elaeocarpus reticulatus	+	+	+		1	+																			
Dianella caerulea																									
Acacia longifolia	+		3		+																				
Viola hederacea	+	1	+	1	+	+					+														
Poa australis	+	2	1				+	+				+													
Leucopogon lanceolatus	+	+	+		+	+				+	+							+							
Clematis aristata	+	1	+	+	1	+		+																	
Eucalyptus baxteri	2								1	1	2		1												
Acacia botryocephala									1		+	1	1				+		1						
Lomandra longifolia										+						+	+	1	+						
Caustis flexuosa												+			1	+	1	+	+						
Banksia spinulosa												2	2	1	+	1	1	3	+						
Hakea sericea												2	1	2	+	1	1	+	+						
Billardiera scandens			+						+										+						
Acacia verticillata										+			+				+								
Lomatia ilicifolia											+	+		+	+	+	+	1	+						
Patersonia glabrata										+	+	1	+		2	+	+		+	+					
Persoonia linearis			+						2	1	1		+	1			+	+							
Eucalyptus sieberi									2	1	2	2	1	2	2	2	1		1						
Hibbertia astrotricha									+		+	1	+	+	1	1	+	+	+						
Tetratheca ciliata									+	+						+	+	1	+						
Banksia serrata									1	2				2	2	+			1			2	+		
Lepidosperma concavum									1	1	1	2	+	+		1	+		1						
Platylobium formosum									+	1	2	2	1	2	2	1	1	2	1						
Amperea xiphoclada									+	+	+	+	+	+	+	+	+	+	+						
Lepidosperma laterale										+	+		1	1	1			+							
Pultenaea daphnoides			+								+	2	+		+	1	1								
Correa reflexa									+		+	+				+			+						
Calorophus lateriflorus									1	+		1	1	1	+								2	+	+
Xanthorrhoea australis									+	+		+		1			+				3	3	3	3	3
Dillwynia cinerascens															+					1			1	1	1
Epacris lanuginosa																					1	1	+		1
Epacris obtusifolia																				+	1		1		1
Leptocarpus tenax																				1	2	2	2	2	+
Restio complanatus																				1	2	1	2	2	2
Schoenus melanostachys																				4	2	1		2	3
Selaginella uliginosa																					1	1	2	2	1
Sprengelia incarnata																				+	+		2	2	+
Xyris gracilis																				+		+		+	1

Abundance classification

\+ present

1-5 score from 1 (least abundant) to 5 (most abundant)

APPENDIX 2 INDICES OF ABUNDANCE* OF SMALL GROUND-DWELLING MAMMALS FROM EXPLORATORY SHORT-TERM TRAPPING SURVEYS

Habitat Type	Wet forest								Dry forest												Inland Woodland			Coastal Woodland							Open Heath				Dense Heath		Sub-alp. Complex	
No. of trap sites ø	36	24	36	72	48	72	36	48	42	60	24	28	22	16	32	NS	NS	NS	60	10	27	NS	NS	48	36	11	12	74	31	17	9	24	10	61	10	15	38	24	24
Brown antechinus	13	36	1	36	25	28	2	6	18	22		4	12	40	22				1		17				4	3	17	12	11	39			4	3	17	9	6	27	1
Swainson antechinus	4	11	1	1	3	1		1	10	1		1			2						3							1	9	6						2	5		
White-footed dunnart																								2															
Short-nosed bandicoot																				3	1													1	3		2		
Long-nosed bandicoot																												1											
Potoroo																												4								2	2		
Bush rat	23	10	14	17	8	20	8	17	18	7	3	20	12	6	7						10				11	15	14	12	28	10	56		4	6	10	24	37	3	
Swamp rat																					5					9		15	2		15		14	9	20	31	4		
Smokey mouse																												3											
Vegetation type	Montane closed forest II (sassafras)	Montane closed forest II (plum pine)	Lowland closed forest II	Shining gum open forest IV	Mountain ash open forest IV	Alpine ash open forest IV	Brown barrel open forest IV	Messmate--gum open forest IV	Messmate--gum open forest III	Peppermint--gum open forest III	Silvertop open forest III	Silvertop--stringybark open forest III	Silvertop--stringybark open forest III	Silvertop--stringybark open forest III	Silvertop--stringybark open forest III	Bloodwood--silvertop open forest III	Coast grey box open forest III	Peppermint--stringybark open forest II	Stringybark--red box open forest II	Bloodwood--apple open forest II	Bloodwood--apple open forest II	Cypress pine woodland II	White box woodland II	Stringybark-yertchuk woodland II	Yertchuk woodland II	Yertchuk woodland II	Yertchuk woodland II	Stringybark--mahogany woodland II	Stringybark--mahogany woodland II	Stringybark--mahogany woodland II	Stringybark--mahogany woodland II	Mealy stringybark heath	Blunt-leaf heath--scented paper-bark	Blunt-leaf heath--scented paper-bark	Blunt-leaf heath--scented paper bark	Swamp paper-bark heath	Scented paper-bark heath	White sallee--candlebark open forest I	Sub-alpine bog

* Indices indicate number of individuals of each species trapped as a percentage of the product of the number of trap sites and the number of trap nights. Traps at each site always in excess of number of mammals captured.

ø Two traps were set at each site, and each trap was set for three consecutive nights.

NS Not sampled

APPENDIX 3 FAUNA

A. BIRD LIST

This list was supplied mainly by Dr. D. G. W. Hollands, but for some species uses information from other sources.

The list shows the bird species recorded in the area and indicates the habitats in which they are most likely to be observed, and their status. Species recorded in the area only as accidental individuals have not been included in the list, as land use changes in the study area will have no significant effect on the populations of these species.

Nomenclature and systematic arrangement of the species follow the "Index of Australian Bird Names" (C. S. I. R. O. 1969). In the list, horizontal lines are used to separate families.

Habitat types (see Chapter 9)

- WF = Wet forest
- DF = Dry forest (Dry open forest, inland woodland, coastal woodland)
- H = Heath (Dense heath, open heath)
- W = Wetlands
- IES = Intertidal, estuarine, saltmarsh (Littoral habitat)
- O = Ocean
- AL = Agricultural land
- CD = Coastal dunes
- OI = Offshore islands (Gabo Island, Tullaberga Island)

Status

- W = Widespread in the study area
- L = Restricted to a few localities
- N = Nomadic - numbers fluctuate greatly from time to time
- C = Common
- F = Frequent
- U = Uncommon
- R = Rare
- B = Proved breeding within the study area

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
Emu		WFB	WFB						
Little penguin						WC			CB
Wandering albatross						WF			
Black-browed albatross						WF			
White-capped albatross						R			
Yellow-nosed albatross						R			
Giant petrel						WF			
Cape petrel						NR			
Medium-billed prion						R			
Thin-billed prion						R			
Short-tailed shearwater						WC			CB
Fluttering shearwater						N			
Wilson storm-petrel						R			
White-faced storm petrel						R			
Australian pelican				F	F				
Australian gannet						WC			
Darter				R					

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
Black cormorant				WC	WC	WC	WC		C
Little black cormorant					LF				
Pied cormorant						F			F
Little pied cormorant				WC	WC	WC	WC		
Black-faced cormorant						R			
Little grebe				WFB					
Hoary-headed grebe				F	F				
Great crested grebe				R	R				
White-necked heron				RN					
White-faced heron		WFB		WC	WC				F
Mangrove heron					NR				
Cattle egret								LC	
White egret				WF	WF				
Plumed egret				NR	NR				
Reef heron					LR				LR
Nankeen night heron				LF					
Brown bittern				WF					
White ibis				WC	WC			WF	
Straw-necked ibis				F	R			F	
Glossy ibis					NR				
Royal spoonbill				F	F				

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
Yellow-billed spoonbill				R	R				
Grass whistling duck				NU					
Black swan				WCB	WC				
Cape Barren goose							NR		
Mountain duck				WCB	WCB				
Black duck				WCB	WCB				
Grey teal				WCB	WCB				
Chestnut teal				WCB	WCB				
Blue-winged shoveller				NR					
Pink-eared duck				NR					
White-eyed duck				NR					
Wood duck				WPB				WPB	
Blue-billed duck				NR					
Musk duck				WP					
Black-shouldered kite			NF					NF	
Whistling eagle		WPB	WF	WP	WF			WF	
Australian goshawk	WF	WPB							
Collared sparrowhawk	WF	WPB							
Australian little eagle		WPB							
Wedge-tailed eagle		WPB							
White-breasted sea-eagle				LPB	LPB				F
Swamp harrier				WPB	F			WPB	
Osprey					R				
Peregrine falcon		WUB		WU	WU				U
Little falcon		WPB		WP				WPB	
Grey falcon		R							
Nankeen kestrel								WPB	
Brown hawk			WF					WF	
Stubble quail								CB	
Brown quail		U	U						
King quail			LR						
Painted quail		C							
Lewin water-rail				U	U				
Banded landrail				NF				NF	
Marsh crake				U					
Australian spotted crake				U					
Spotless crake				UB					
Dusky moorhen				WCB					
Swamphen				WC					
Coot				NLC					
Pied oyster-catcher				WCB					
Sooty oyster-catcher				LU					
Spur-winged plover				WC	WC			WCB	
Banded plover								LPB	
Hooded dotterel					WPB		WPB		
Red-capped dotterel					WCB				
Double-banded dotterel					NF				
Mongolian sand-dotterel					NF				
Black-fronted dotterel				WPB				WPB	
Eastern golden plover					NU				

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
Grey plover				NU					
Turnstone					NR				
Japanese snipe				NF					
Whimbrel					NF				
Eastern curlew					NF				
Greenshank				NR					
Wood sandpiper				NR					
Grey-tailed tattler					NU				
Knot					NF				
Great knot					NR				
Sharp-tailed sandpiper					NF				
Red-necked stint					NC				
Curlew sandpiper					NU				
Broad-billed sandpiper					R				
Bar-tailed godwit					NC				
Southern skua						R			
Artic skua						NU			
Pomarine skua						R			R
Pacific gull					WF				
Silver gull				WC	WCB				
Whiskered tern				NUB					
Caspian tern				U	WB				
White-fronted tern									NU
Little tern					LB				
Crested tern					WCB				
Peaceful dove		WFB							
Common bronzewing		WFB							
Brush bronzewing			WFB						
Wonga pigeon	LB	LB							
Rainbow lorikeet	WC	WC							
Musk lorikeet		WF							
Purple-crowned lorikeet		NU							
Little lorikeet		F							
Swift parrot		U							
Yellow-tailed black cockatoo	WC	WC							
Glossy black cockatoo		LU							
Gang-gang cockatoo	WCB	WCB							
Sulphur-crested cockatoo								LC	
Galah		R						U	
King parrot	WF	WF							
Crimson rosella	WCB	WCB	WC						
Eastern rosella								WF	
Blue-winged parrot			NR						
Ground parrot			LRB						
Pallid cuckoo		W						W	
Brush cuckoo	NU								
Fan-tailed cuckoo	WCB	WCB	WCB						
Horsfield bronze cuckoo	WCB	WCB	WCB						
Golden bronze cuckoo	WF	WF	WF						
Powerful owl	R								
Boobook owl	WPB	WPB							

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
Barn owl		U						N	
Masked owl		R							
Sooty owl	LR								
Tawny frogmouth		F							
Owlet nightjar		U							
White-throated nightjar		U							
Spine-tailed swift	C	C	C	C	C	C	C	C	C
Fork-tailed swift	U	U	U						
Azure kingfisher				FB					
Laughing kookaburra	WFB	WCB						WC	
Sacred kingfisher		WCB							
Rainbow bee-eater		LF							
Dollar bird		NR							
Superb lyrebird	WCB	F							
Skylark							WCB	WCB	
Welcome swallow			F	C				CB	
Tree-martin		WCB	C						
Fairy martin								LCB	
Australian pipit			WCB				WFB	WFB	
Black-faced cuckoo-shrike	WCB	WCB	WCB					F	
Little cuckoo-shrike		U					U		
Cicada-bird		NR							
White-winged triller		NF							
Australian ground-thrush	LU	LU							
Blackbird	WFB								
Spotted quail-thrush		WFB							
Golden-headed fantail-warbler				WCB	F				
Little grassbird				WCB	WCB				
Reed-warbler				WCB					
Brown songlark								WFB	
Rufous songlark		NU							
Superb blue wren	U	WCB	WCB	WCB			WCB	WCB	
Southern emu-wren			LCB						
White-throated warbler		LU							
Brown warbler	WCB								
Weebill		LR					LR		
Striated thornbill	WC	WC							
Little thornbill	LR								
Brown thornbill	WCB	WCB							
Buff-rumped thornbill		U							
Yellow-rumped thornbill		FB						WCB	

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
White-browed scrub wren	CB	CB	CB					CB	
Large-billed scrub wren	R								
Heath wren			LU						
Field-wren			LU						
Pilot-bird	LU								
Bristle-bird			LR						
White-fronted chat			WCB				WCB	FB	
Jacky winter		WFB						WCB	
Scarlet robin	WCB	WCB	WFB					F	
Flame robin		LCB						WL	
Pink robin	R								
Rose robin	LFB	LFB							
Hooded robin		LRB							
Southern yellow robin	WCB	WCB							
Grey fantail	WCB	WCB		WCB				WCB	
Rufous fantail	WCB								
Willie wagtail		WFB						WCB	
Leaden flycatcher	WFB	WFB							
Satin flycatcher	LUB	LUB							
Restless flycatcher		LUB						LUB	
Black-faced flycatcher	LFB								
Golden whistler	WCB	WCB		WFB				WFB	
Rufous whistler	WFB	WFB						WFB	
Olive whistler	LU								
Grey shrike-thrush	WCB	WCB	WCB					WCB	
Shrike-tit		WFB							
Eastern whipbird	WCB						FB		
Orange-winged sittella		F							
Brown tree-creeper		LFB							
White-throated tree-creeper	WCB	WCB							
Red-browed tree-creeper	LFB	LFB							
Mistletoe bird	N	N							
Spotted pardalote		WCB						WFB	
Yellow-tipped pardalote		R					R		
Eastern striated pardalote		NU							
Grey-breasted silvereye	WCB	WCB	WCB				WCB	WCB	
Scarlet honeyeater	LU								
Lewin honeyeater	LFB								
Fuscous honeyeater		LCB							
Yellow-faced honeyeater	WCB	WCB	WCB				WFB		
White plumed honeyeater		R							
White-eared honeyeater		LR							
Yellow-tufted honeyeater	WFB	WFB							
Brown-headed honeyeater	WN	WN							
White-naped honeyeater	WFB	WFB							
Black-chinned honeyeater		R							

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
Noisy friar-bird		NR							
Crescent honeyeater	WU								
New Holland honeyeater			WCB				WCB		
Tawny-crowned honeyeater			WPB						
Regent honeyeater		R							
Eastern spinebill	WCB	WCB	WCB					WC	
Bell miner	LCB								
Little wattle-bird			WCB				WCB		
Red wattle-bird	WCB	WCB	WCB						
Beautiful firetail			LU						
Diamond firetail		LUB							
Red-browed finch		WCB		WFB					
House sparrow								WCB	
Goldfinch							WCB	WCB	
Greenfinch								LU	
Starling		WCB						WCB	

Common Name	Habitat								
	WF	DF	H	W	IES	O	CD	AL	OI
Olive-backed oriole		WFB							
Spangled drongo	NU								
Magpie lark		WF						WCB	
White-winged chough		LFB							
Masked wood-swallow			NR						
White-browed wood-swallow			NB						
Dusky wood-swallow		WCB	WFB						
Pied currawong	WCB	WCB						WC	
Grey currawong		U							
Grey butcher-bird		F							
White-backed magpie		WFB						WCB	
Satin bower-bird	WCB	WCB							
Australian raven	WFB	WCB					WF	WC	
Little raven		LC							

B. MAMMAL LIST

This list has been prepared from information supplied by the Zoology Department of Monash University, National Museum - Melbourne, and Fisheries and Wildlife Division.

Habitats - as defined for the Bird List (Appendix 3 A) and in Chapter 9.

Introduced species occurring wild on public land include:

Rabbit	*Oryctolagus cuniculus*
Sewer rat	*Rattus norvegicus*
Black rat	*Rattus rattus*
House mouse	*Mus musculus*
Domestic dog	*Canis familiaris*
Cat	*Felis catus*
Horse	*Equus caballus*

Common name	Scientific name	Habitat							
		WF	DF	H	W	IES	O	CD	AL
Echidna	*Tachyglossus aculeatus*	X	X	X				X	
Platypus	*Ornithorhynchus anatinus*				X				
Tiger cat	*Dasyurus maculatus*	X	X						
Brown antechinus	*Antechinus stuartii*	X	X	X				X	
Swainson antechinus	*A. swainsonii*	X	X	X					
White-footed dunnart	*Sminthopsis leucopus*		X						
Long-nosed bandicoot	*Perameles nasuta*	X	X						
Short-nosed bandicoot	*Isoodon obesulus*		X	X					
Brush-tailed possum	*Trichosurus vulpecula*	X	X						X
Bobuck	*T. caninus*	X							
Eastern pigmy possum	*Cercaetus nanus*		X	X					
Yellow-bellied glider	*Petaurus australis*	X	X						
Sugar glider	*P. breviceps*	X	X						
Feather-tailed glider	*Acrobates pygmaeus*	X	X						
Common ringtail	*Pseudocheirus peregrinus*	X	X					X	X
Greater glider	*Schoinobates volans*	X	X						
Wombat	*Vombatus ursinus*	X	X	X				X	
Great grey kangaroo	*Macropus giganteus*	X	X	X					
Wallaroo	*M. robustus*		X						
Red-necked wallaby	*M. rufogriseus*		X	X					
Black wallaby	*Wallabia bicolor*	X	X	X					
Brush-tailed rock wallaby	*Petrogale penicillata*		X						
Potoroo	*Potorous tridactylus*	X	X						
Potoroo	*P. apicalis*		X	X					
Bush rat	*Rattus fuscipes*	X	X	X				X	X
Swamp rat	*R. lutreolus*		X	X					
Smokey mouse	*Pseudomys fumeus*		X						
Eastern water rat	*Hydromys chrysogaster*				X	X			
Grey-headed fruit bat	*Pteropus poliocephalus*		X						X
Little bat	*Eptesicus pumilus*	X	X						
Gould wattled bat	*Chalinolobus gouldii*	X	X						
Bent-winged bat	*Miniopterus schreibersii*	X	X						
Lesser long-eared bat	*Nyctophilis geoffroyi*	X	X	X					X
Greater long-eared bat	*N. timoriensis*	X	X	X					X
Australian fur seal	*Arctocephalus pusillus*						X		
Dingo	*Canis familiaris dingo*	X	X	X				X	

C. REPTILE LIST

This list has been prepared from information supplied by the Zoology Department of Monash University, National Museum - Melbourne, and Fisheries and Wildlife Division.

Habitats - as defined for the Bird List (Appendix 3 A) and in Chapter 9.

Common name	Scientific name	Habitat							
		WF	DF	H	W	IES	O	CD	AL
Snake-necked tortoise	*Chelodina longicollis*				X				
Mountain dragon	*Amphibolurus diemensis*	X	X						
Tree dragon	*A. muricatus*	X	X	X				X	
Gippsland water dragon	*Physignathus lesueuri*				X				
Delicate skink	*Leiolopisma delicata*		X	X					
Garden skink	*L. guichenoti*	X	X	X					X
Weasel skink	*L. mustelinum*	X	X	X				X	
Three-lined skink	*L. trilineata*	X	X	X				X	
Grass skink	*L. entrecasteauxi*		X					X	X
Skink	*L. sp.*	X	X						
McCoy skink	*Anotis maccoyi*	X	X						
Three-toed skink	*Hemiergis decresiensis*		X						
Water skink	*Sphenomorphus tympanum*	X	X	X	X				
Cunningham skink	*Egernia cunninghami*		X						
Mourning skink	*E. luctuosa*			X	X				
Black rock skink	*E. saxatilis*	X	X						
White's skink	*E. whitei*		X	X				X	
Spencer skink	*Pseudemoia spenceri*	X							
She-oak skink	*Tiliqua casuarinae*		X						
Common blue-tongue	*T. scincoides*		X					X	X
Southern blue-tongue	*T. nigrolutea*	X	X	X				X	X
Tree goanna	*Varanus varius*	X	X						
Diamond python	*Morelia argus argus*		X	X				X	
Brown snake	*Pseudonaja textilis*		X	X					X
White-lipped snake	*Drysdalia coronoides*	X	X	X				X	X
Red-bellied black snake	*Pseudechis porphyriacus*		X		X			X	X
Tiger snake	*Notechis scutatus*	X	X	X	X			X	X
Small-eyed snake	*Cryptophis nigrescens*	X	X						
Copperhead	*Austrelaps superba*	X	X	X	X				X

D. AMPHIBIAN LIST

This list has been prepared from information supplied by Mr. A. Brook, the Zoology Department of Monash University, National Museum - Melbourne, and Fisheries and Wildlife Division.

Habitats - as defined for the Bird List (Appendix 3 A) and in Chapter 9.

Common name	Scientific name	Habitat							
		WF	DF	H	W	IES	O	CD	AL
Golden bell frog	*Litoria aurea*		X	X	X				X
Blue Mountains tree frog	*L. citropa*	X							
Ewing frog	*L. ewingi*	X	X	X	X			X	X
Jervis Bay tree frog	*L. jervisiensis*								
Rocky River frog	*L. lesueuri*	X	X		X				X
Peron tree frog	*L. peroni*		X		X				
Leaf green tree frog	*L. phyllochroa*	X	X						
Verreaux tree frog	*L. verreauxi*	X	X	X	X				X
Haswell froglet	*Crinia haswelli*			X				X	
Froglet	*Geocrinia victoriana*	X	X		X				X
Giant burrowing frog	*Helioporus australiacus*	X	X						
Bullfrog	*Limnodynastes dumerili*		X	X	X			X	X
Striped marsh frog	*L. peroni*		X	X	X				X
Spotted marsh frog	*L. tasmaniensis*		X	X	X			X	X
Barred frog	*Mixophyes balbus*								
Toadlet	*Pseudophryne dendyi*	X	X						
Toadlet	*P. semimarmorata*		X	X	X				X
Brown froglet	*Ranidella signifera*	X	X	X	X			X	X
Toadlet	*Uperoleia marmorata*							X	

APPENDIX 4

AGRICULTURAL POTENTIAL

HARTLAND AREA

This area occupies about 20,500 ha in the parishes of Tildesley West, Tildesley East, Waygara, and Newmerella. It has a reasonably reliable annual average rainfall of between 750 and 900 mm, with generally mild temperatures. It adjoins the Princes Highway between Nowa Nowa and Orbost, and is served by a railway line.

Soils

In a reconnaissance survey, seven main landscape units could be recognized. Three of these units occur only near the coastline, and are not suited for agriculture. The remaining four comprise nearly 17,000 ha, or 83% of the total area, and contain six soil types, which were all classed as sand, sandy loam, or loam.

The soils are described in detail in "Soils and Vegetation in the Hartland Area" by Newell and Woodruff, *Soil Survey Report* No. 34, 1962.

Development and potential

A pilot farm was established in the early 1960s to assess the likely costs of development of farms there. The site of the Tostaree Pilot Farm was selected after a soil survey of the whole Hartland area, because it contains representatives of the major soils of the area.

All clearing and development work was done by contract and supervised by an inter-departmental committee.

An article "Transformation at Tostaree" by A.G. Volum, published in the *Victorian Journal of Agriculture*, January 1969, gave details of the methods adopted and estimates of expenditure.

The article quoted costs applying at the time the operations were carried out. If a 125-ha area were to be cleared and developed today to the same stage as the Pilot Farm, the following costs (per ha) based on current contract operations would be more likely to apply:

	per ha $
Clearing, windrowing, and burning	175
Ploughing and cultivation	50
Sowing, seed, fertilizer, spreading	70
Fencing, water supply, shed	30
	$ 325

Development of large areas at the one time would benefit from economies of scale and could reduce the costs by up to $50 a hectare. Similarly, if all operations except clearing, windrowing, and the initial ploughing were carried out by an owner-operator using his own labour, cash costs may be reduced.

To fully equip the property, the following items would be necessary:

House and yards	$15,000
Basic plant and equipment	7,000
Stock (150 cows @ $175)	26,000
	$48,000

These cost estimates are a guide only - actual costs vary widely according to existing conditions.

APPENDIX 5

CONVERSION TABLE FOR UNITS OF MEASUREMENT USED IN THE REPORT

Common application	Metric unit		Common Imperial unit equivalent	
Rainfall	1 mm:	millimetre	0.0394	inch
Elevation	1 m:	metre	3.281	feet
Distance	1 km:	kilometre	0.6214	mile
Area	1 ha:	hectare	2.471	acres
	1 km^2:	square kilometre (100 ha)	0.3861	square mile
Water yield	1 l:	litre	0.220	gallon
	1 Ml:	megalitre	0.8098	acre-foot
Timber production	1 m^3:	cubic metre	35.31	cubic feet
			423.7	super feet true
			332.6	super feet Hoppus log volume
			0.3531	cunit (100 cubic feet)
	1 m^3/ha:	cubic metre per hectare	14.29	cubic feet per acre
Agriculture	1 kg:	kilogram	2.205	pounds
	1 t:	tonne	0.9842	ton

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