WINGECARRIBEE, OUR HOME:

A Geographical Interpretation of the Southern Highlands of New South Wales

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U3A – Southern Highlands, Incorporated

2006

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ACRONYMNS

For reasons of space a number of acronyms will be used in this book in place of certain terms and the full names of certain agencies to which repeated references will be made:

ABS	Australian Bureau of Statistics (www.abs.gov.au)
BL	ABS-defined 'Bounded Locality', ie village
BOM	Australian Bureau of meteorology (www.bom.gov.au)
CBCS	Commonwealth Bureau of Census and Statistics
CD	ABS-defined Census 'Collectors District'
Council	Wingecarribee Shire Council (www.wsc.nsw.gov.au)
DIPNR	NSW Department of Infrastructure, Planning and Natural Resources (now the Department of Planning and Department of Natural Resources)
ERP	Estimated Residential Population [ABS]
EVAO	Estimated value of agricultural operations [ABS]
Ha	hectares
km^2	square kilometres
LEP	Local Environmental Plan
LGA	Local Government Area
MA	millions of years before the present
masl	elevation in metres above sea level
NPWS	NSW National Parks and Wildlife Service (www.dec.nsw.gov.au)
NSW	New South Wales
psk	persons per square kilometre
RTA	NSW Roads and Traffic Authority (www.rta.nsw.gov.au)
SCA	Sydney Catchment Authority (www.sca.nsw.gov.au)
STP	sewage treatment plant
UC	ABS-defined 'Urban Centre', ie urban area
WSC	Wingecarribee Shire Council

PREFACE

Wingecarribee, Our Home: A geographical Interpretation of the Southern Highlands of New South Wales is based on materials prepared for a course offered by U3A – Southern Highlands, Inc in 2005. It offers an overview of the Southern Highlands of NSW that draws on a wide range of statistical data as well as the limited available literature on the area. The book not only looks at the diversity within 'the Wingecarribee' but also considers the area in the wider geographical context of Sydney and NSW.

U3A (University of the Third Age) is an international network of people in retirement or semi-retirement who wish to study and to share their knowledge through further education, mainly in courses which its tutors teach for no charge and for which its members pay nominal fees. Because the material in *Wingecarribee, Our Home* is of interest to its wider community, U3A – Southern Highlands Inc believes that it has a responsibility in this case to make this material more widely available through this book.

The author is a former academic and consultant planner who has retired to Bowral in the Southern Highlands. After graduating from the University of Canterbury (New Zealand) he held academic positions in the Universities of Melbourne and Edinburgh and Charles Sturt University (Bathurst, NSW) over more than thirty years, where he taught Geography, Town and Country Planning and Environmental Management. He has taught at other universities in Australia and New Zealand. He spent eight years consulting, particularly on regional planning and heritage planning, to local councils, the NSW Government and private clients in NSW, prior to his retirement in 2003.

ACKNOWLEDGMENTS

A book such as this could not be prepared without a great deal of help from other people and organisations. I cannot list all the individuals, particularly former colleagues and people in government agencies, who have given freely of their time to provide information and to offer encouragement, but I will note the help of staff in Wingecarribee Council's Central Library in Bowral. I have been fortunate also in having access to the Australian Bureau of Statistics' Sydney library.

I must acknowledge financial assistance from Wingecarribee Shire Council in the form of a Community Grant that has enabled fifty free copies to be made available to libraries, educational institutions and government agencies with particular interests in the shire.

I have been greatly helped by having the confidence and backing of the Management Committee of U3A – Southern Highlands, Inc and the help of U3A members and other people in preparing this book for publication and helping with its sales. I must acknowledge especially the efforts of those who reviewed the contents of the book, as to both substance and expression. Any remaining errors or omissions are entirely my own work!

Above all I have had the constant support of my wife, Beatrice, in all of the efforts that have gone into the preparation of this book and the course before it, over nearly two years.

I offer my sincere thanks to everyone who has made the book possible.

Ian Bowie
Bowral

1 Introduction

U3A (University of the Third Age) is an international, independent, non-political, non-sectarian and non-profit movement that seeks through its affiliates to bring together people in retirement or semi-retirement who wish to study and to share their knowledge through further education. Currently, there are more than 180 U3A affiliates and 60,000 members in Australia alone. U3A – Southern Highlands, Inc was established in 1995 to serve the people in the Southern Highlands of NSW. It now has more than 450 members.

This book began as a course on the geography of the Southern Highlands that was first presented to U3A members in 2005. The title of that course, *Wingecarribee our Home*, took its inspiration from a strategic plan published by Wingecarribee Shire Council under the title *Wingecarribe Our Future* (WSC, 2002a). The intention was that the course should complement the content of that plan and its supporting papers by providing perspectives that would be heavily based on fact.

Unfortunately, little has been published that tries to interpret contemporary or historical statistical and other information on 'the Wingecarribee'. Sources that might have been anticipated, such as secondary compendia and certain statistical collections, have not been published. The only secondary compendium on the area other than the strategic plan and its supporting papers, which have become dated, is an old study from the University of NSW School of Town Planning (UNSW, 1975). Also, the Australian Bureau of Statistics (ABS) no longer publishes much free local economic data.

However, the rise of electronic resources has enabled immediate access to reports and data sets that were not available until quite recently, certainly within the Shire. Much information on the Wingecarribee, particularly of an official nature, is now available on the Internet. Other sources of information such as the ABS 2001 Census of Population and Housing and Council's Strategic Plan are on CD-ROM in Council's Central Library.

The response to the course was that the materials should be more widely available to educational institutions, government agencies and professionals with interests in the shire. So, with a Community Grant from Wingecarribee Shire Council to enable free distribution of copies to libraries, educational institutions and government agencies, this book is published in what happens to be the centenary year of the original Wingecarribee Shire and the twenty-sixth year of the present shire.

Wingecarribee, Our Home is intended to be used as an authoritative work of reference rather than to be read as a narrative. It draws heavily on official data sets but it is not a statistical compendium. For this reason numerical data will often be generalised as percentages or fractions. The book does give guidance on sources of statistical and other data. Generally however it will refer to sources in concise terms, such as '2001 census' which refers to the many reports of the 2001 Census of Population and Housing, rather than by giving full bibliographic details or references to internet pages. Full bibliographic details for publications specifically cited in the text will be given in the list of references at the end of the book.

The book has four objectives:

- to describe biophysical and socio-economic patterns across the shire;
- to put these patterns into perspectives, such as through comparisons with New South Wales;
- to explain these patterns using descriptive analyses and conclusions from other studies;
- to suggest some issues that arise for planning and management.

Most of what is described and explained in the book is based on data that was current around the beginning of the twenty-first century and other material published within the last decade. In the nature of things these will date, particularly after 2007 when the first results of the next round of ABS demographic and economic censuses (2006) start to become available. There is a challenge for people to update the interpretations presented in this book and to carry out the further research that is sorely needed about Wingecarribee.

The information presented in the book and the manner in which it has been described and analysed reflect inevitably the interests and experience of the author. The book is not a textbook on Geography and few concessions are made to a reader who has no background in 'physical' or 'human' Geography or associated disciplines. Most of the material in the book should be self-explanatory. Where it is not, it is hoped that readers will accept the challenge to find out more.

Finally, this book generalises on vast amounts of detail from data sets and published maps in order to establish broad patterns. The maps in particular, which are much smaller than the scales at which they were drawn, should be used cautiously when applied to individual localities.

2 The Wingecarribee

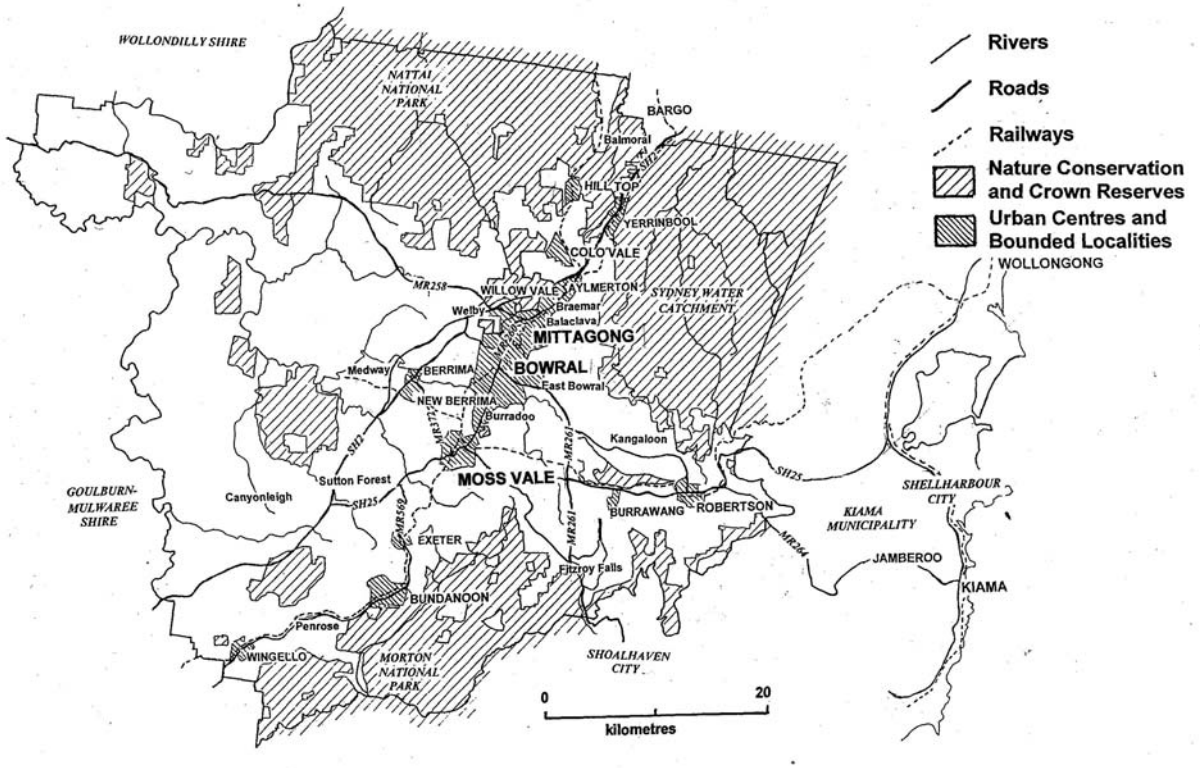

Figure 1: Wingecarribee Shire, *with the towns of Mittagong, Bowral and Moss Vale at its centre. Sources: AUSLIG,* Wollongong Special (S156-13) 1:250,000 topographic map; *ABS,* SLA 18350 (Wingecarribee Shire) 2001 census maps.

There is no official definition of the 'Southern Highlands of New South Wales' and the term has been used in the literature for areas as far south as the Victorian border. In this book it will be used to describe what was known as the 'Berrima District' in the nineteenth century and sometimes as the 'Southern Tablelands' in the twentieth (PEC 1976).

In order to put a boundary around it the Southern Highlands will be taken to be synonymous with the present area of Wingecarribee Shire (*Figure 1*). In the text it will be referred to variously as 'the shire', 'the Wingecarribee' or 'the region'. This shire has existed in its present boundaries only since 1981 when the existing Wingecaribee Shire was merged with Mittagong Shire and Bowral Municipality. It has a combined area of 2688.8 km^2, 56 per cent of which is north of the Wingecarribee River. Its area is comparable in size to that of urban Sydney or of the Central Coast of NSW.

In making comparisons with the past it should be noted that the area of the Wingecarribee has not been constant. The combined areas of the shires of Wingecarribee and Nattai, formed in 1906, the tiny municipalities of Bowral (1886) and Mittagong (1889) and the somewhat larger Moss Vale (1888) amounted to nearly 200 km^2 more than at present. Land has since been transferred to adjacent shires (LGAs) to the west and north.

The shire is about 100 km from the City of Sydney (*Figure 2*). It is more or less a rectangle, averaging about 55 km west to east and 45 km south to north,

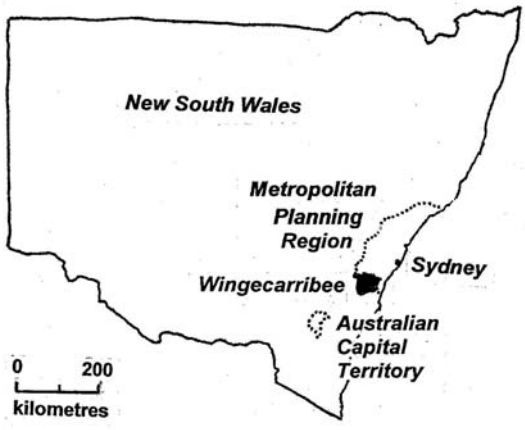

Figure 2: Location

with its geographic centre northwest of Berrima and demographic centre just north of where Old South Road meets Kangaloon Road in Bowral.

The shire is separated from neighbouring LGAs, except to the west, by large tracts of National Parks and Water Reserves. Over half of the shire is in nature conservation and other Crown reserves. Because of these separations the Wingecarribee has long been perceived as an area that is distinct from its neighbours. Even in the nineteenth century a 'Berrima' district was recognised in the Berrima Registry and Berrima Police Districts whose boundaries were substantially the same as those of today's Wingecarribee Shire.

Despite the separations, some parts seem to have more in common with parts of neighbouring LGAs than with each other. The fact that nearly sixty per cent of its people live in the centrally located three main towns, Bowral, Mittagong and Moss Vale, is one of the few things that gives the shire unity.

This diversity makes it difficult to fit the shire into larger regions for administrative purposes. Its area was in the Sydney region for regional planning purposes until 1960 and, although it is not now in the Metropolitan Planning Region, it is in the Greater Metropolitan Region for transport planning(TDC, 2004) and its northern parts may in time become affected by Sydney's Metropolitan Development Programme (Parsons Brinkerhoff, 2004, 3:19). For strategic planning the shire is in the Sydney-Canberra Corridor and for local planning and statistical purposes it is currently part of the Illawarra region.

In its interactions with the outside world the shire is clearly part of a greater Sydney region. Most of its drainage is into the Hawkesbury and Nepean Rivers. Most of its human interactions also are with Sydney, demonstrated by telephone traffic (Holmes, 1983), road traffic (RTA, 2004) and sources of migrants (WSC, 2002b:147).

The shire generates little rail freight other than limestone and cement and the whole Southern Highlands rail line carries an average of only 1500 passengers daily. Road traffic volumes, to Sydney rather than to the coast or inland, are heavier. Along the Hume Highway there is no data for the Church Street intersection but traffic volumes both to the south (see *Figure 3*) and just north of the shire suggest that possibly forty percent of the 30,000 daily traffic movements north of the shire are to or from the shire. Traffic generated by the shire to and from the south and east is very much less.

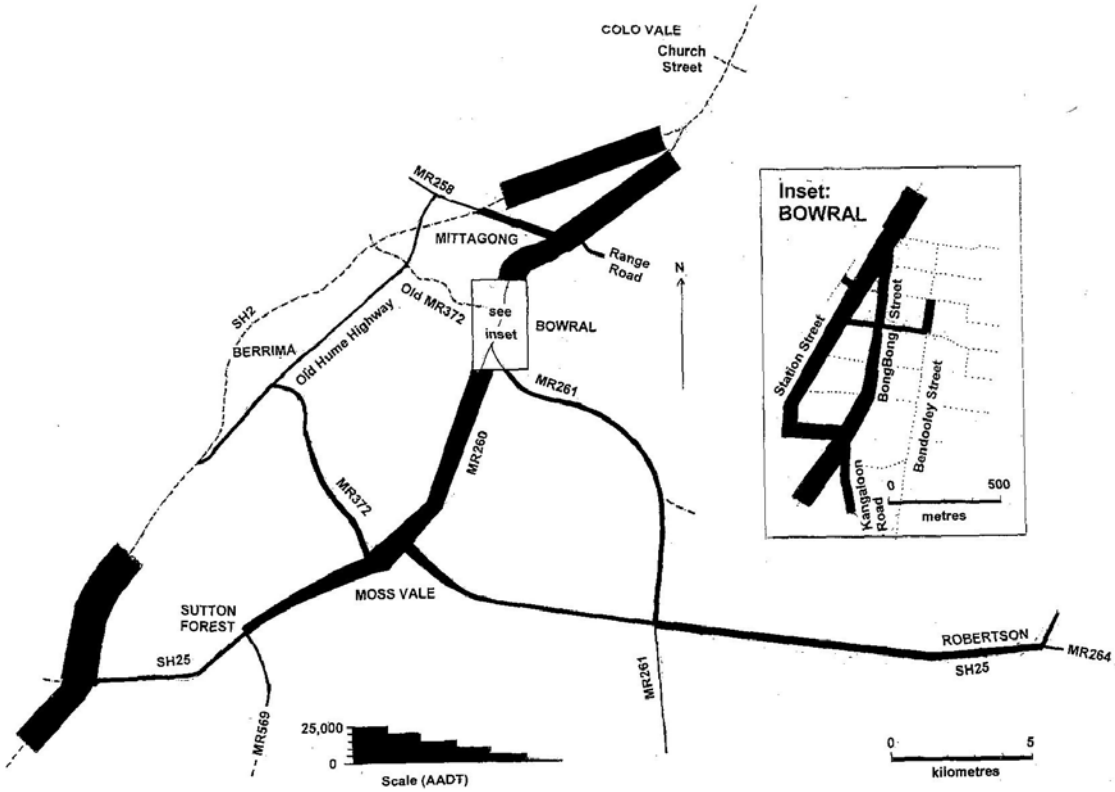

Figure 3: Road Traffic, 2003. *Shown as annual average daily traffic (axle pairs). Data from RTA (*2004).

Biophysical Patterns

3 Physical Geography

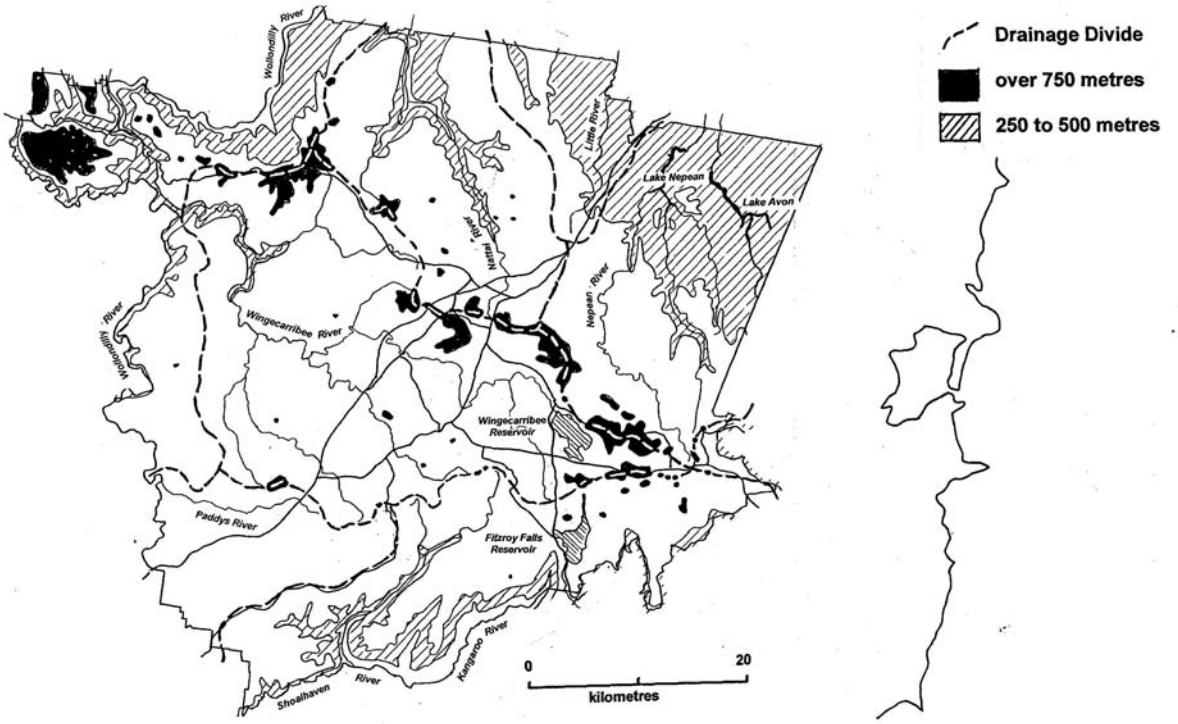

Figure 4: Relief and Drainage. *Sources: SCA (2004) and AUSLIG,* Wollongong Special (S156-13) 1:250,000 topographic map.

The Wingecarribee region is a plateau, shaped somewhat like an upturned soup bowl (*Figure 4* and the cross sections in *Figure 8*).

Along the western and southern boundaries of the shire, the rivers that separate the Wingecarribee plateau from other plateaux to the west and south are below 250 metres above sea level (masl). Lake Yarrunga on the Shoalhaven River is about 150 masl. In the northeast the land to the east is similarly low, falling away to a coastline that is only twenty kilometres away from the eastern boundary of the shire.

Above these, the land rises by more than 300 metres to a plateau surface that is generally between 600 and 700 masl. There are scattered higher hills above this, as high as 899 masl in the case of the Devil's Staircase in the northwest. There is also a number of low ridges, which are important because they divide the main drainage catchments of the shire one from another.

Only one drainage catchment is contained entirely within the shire, that of the Wingecarribee River, which drains about a quarter of the shire's area. To its north the Wingecarribee catchment is separated from the catchments of the Upper Nepean River (including Little River) and Wollondilly River (including the Nattai) by a ridge that runs roughly northwest to southeast across the shire. This ridge includes hills such as Mounts Wanganderry (836 masl) and Jellore (834 masl) to the west, the peaks of Mount Gibraltar (868 and 851masl) between Bowral and Mittagong, and Kangaloon Trig Hill further east (849 masl).

A somewhat lower set of ridges separates the Wingecarribee catchment from the catchments of the lower Shoalhaven (including Kangaroo River) and upper Wollondilly (including Paddys River) to the south and west. There is little drainage directly to the east.

The Wingecaribee is not a major river, but the Wingecarribee Reservoir in its upper reaches plays a major role in a system that transfers water from the Shoalhaven into the rivers and dams that supply Sydney (see www.sca.nsw.gov.au). In 2003, 71.5 gigalitres (GL) of water was released from the reservoir into the Wingecarribee River, 38.5 GL was fed into the Nepean River via the Glenquarry

Cut and 3.48 GL was supplied to Wincarribee Council. A nett of 100 GL was pumped from Lake Yarrunga on the Shoalhaven River via the Bendeela pondage and Fitzroy Falls reservoir into the Wingecarribee reservoir, which is equivalent to nearly one fifth of the water supplied to the Sydney Water Corporation in 2003/4.

On the face of it the upper Wingecarribee catchment provided 13.5 GL of water flowing into the reservoir but this does not take account of evaporation losses, which are substantial because of the large surface areas (1150 hectares) of the Fitzroy Falls and Wingecarribee reservoirs. Both of these are shallow, man-made lakes developed partly over areas that were swamps and they are the only significant water bodies in the shire.

By comparison, other Council-operated reservoirs supplied only 2.07 GL to the shire in 2003/4 and licences for water extraction allowed for up to a mere 9.61 megalitres annually to be taken from groundwater (WSC, 2004a).

Locally, terrain broadly reflects landforms. There is little truly flat land and most of this is in the poorly drained upper reaches of the Wingecarribee River system. However, there are extensive tracts of undulating land on the surface of the plateau in the centre and east of the shire (*Figure 5*).

Steeper land is found on the ridges and occasional hills that rise above the general level of the plateau but truly rugged terrain is largely confined to areas towards the shire's boundaries where rivers descend from the plateau surface to lower land beyond the boundary of the shire.

Along the Wollondilly, Wingecarribee and Shoalhaven Rivers and their tributaries there are extensive areas of spectacularly steep scenery where gorges and canyons are several hundred metres deep. In the upper reaches of the Nattai and Nepan Rivers relief is less spectacular but slopes above the rivers are no less steep.

In the northwest and in the Illawarra section of the Great Eastern Escarpment (which includes above the Shoalhaven and Kangaroo Rivers) in the east and south suites of cliffs fall from the edges of the plateau. Fitzroy Falls, which drains into Kangaroo Valley, is 300 metres high with one of its two drops being 110 metres high. Belmore Falls, which has three drops is also amongst the ten highest waterfalls in NSW. Carrington Falls a bit to the east ia also over 200 metres high.

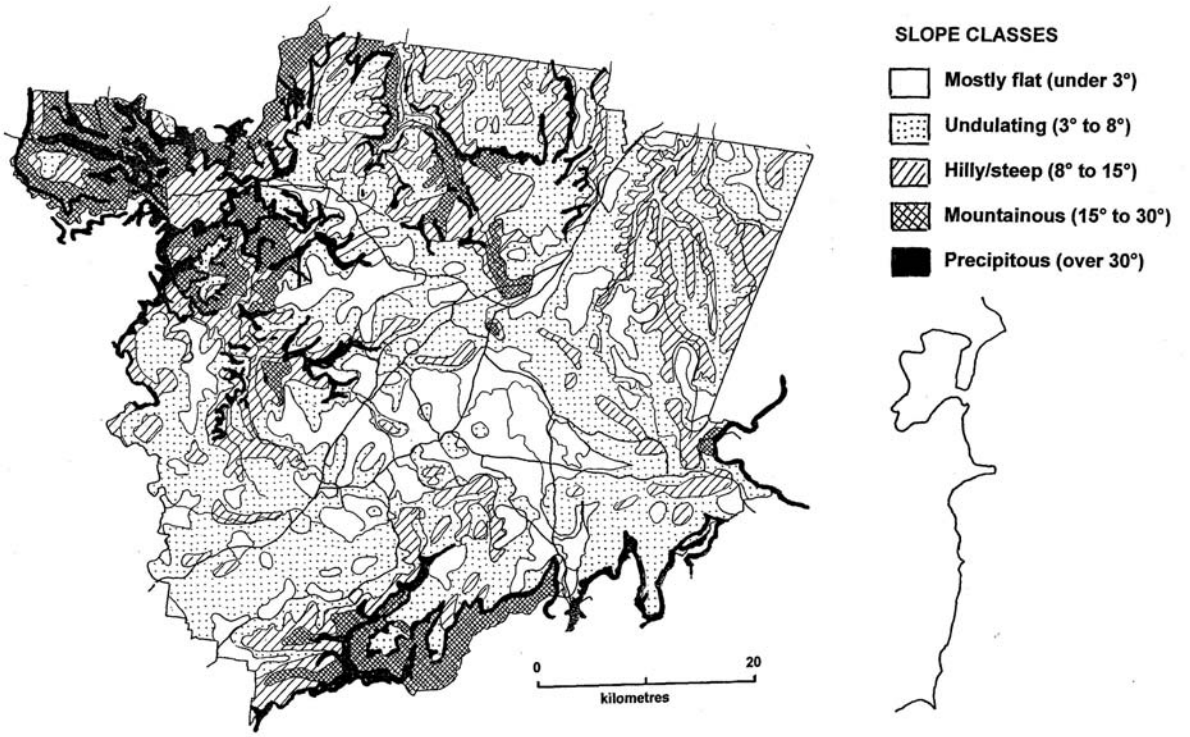

Figure 5: Terrain. *Data from AUSLIG, 1:100,000 topographic maps and* Wollongong Special (S156-13) 1:250,000 topographic map *and NSW Premier' s Department Regional Planning Section,* Sydney region 1:253,440 terrain map *of 1946.*

4 Geological Evolution

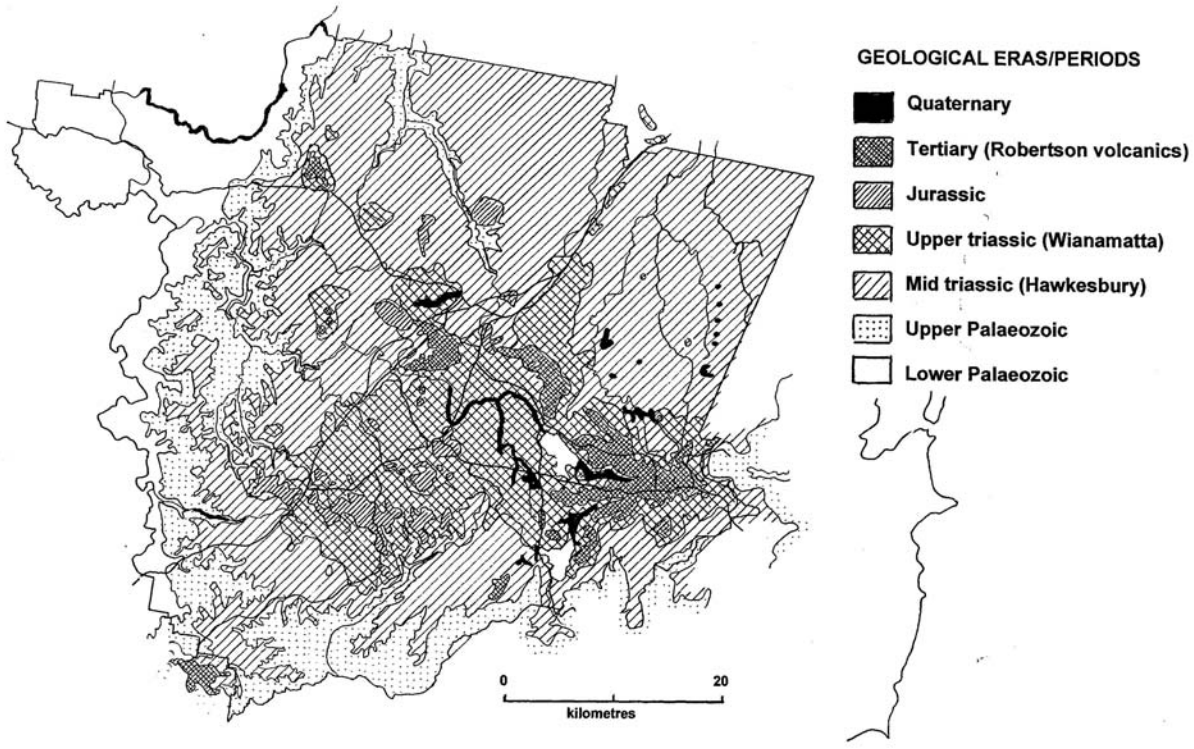

***Figure 6: Geology**. Source: Mineral Resources NSW (1999).*

The geology of the Wingecarribee has been described in Moffitt (1999), with aspects being covered in field guides by both Nasher (1967:89-96) and Branagan and Packham (2000:136-40). Johnson (2004) and material on the website of the Geological Survey of NSW provide contexts within which to view the geological evolution of the region.

The Wingecarribee is in the southern end of the Sydney Basin, part of a larger Sydney-Gunnedah-Bowen Basin. This 'basin', which extends far to the east and north of the Wingecarribee, was formed by extension (or spreading) of underlying basement rocks, followed by prolonged deposition of sediments, over vast aeons of time. Its broad geology is shown in *Figure 6*.

The underlying basement rocks date from the lower Palaeozoic era of geological time when Australia was a warm northern extension of Gondwanaland. During the Devonian (410-354 MA[1]) these basement rocks were subjected firstly to tectonic and volcanic activity and later to peneplanation. From the late Carboniferous (330-298 MA) the basement began to sag and spread to form a shallow offshore shelf that extended eastward at least as far as what is now Lord Howe Island.

During the Permian and Triassic periods huge volumes of sediment from the west and north were deposited onto this shelf. The initial sediments (rocks of the Shoalhaven Group) were deposited into a marine environment during the Permian (298-251 MA). These were followed by the Illawarra coal measures, which were deposited across the basin into what had become freshwater environments (*Figure 7a*).

In the early Triassic, tectonic uplift to the west with sagging to the north produced freshwater environments onto which further freshwater deposition took place from the west, forming the Narrabeen Group which is up to 700 metres thick around Wyong but quite thin under the Wingecarribee (*Figure 7b*). Further uplift followed

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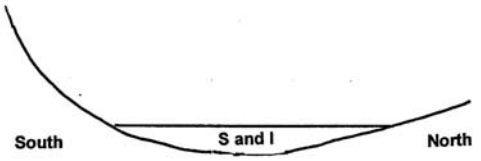
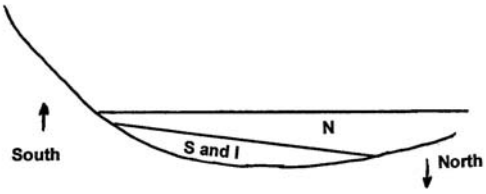
[1] Conventionally, geological time is divided into eras and periods, most of which occurred over lengths of time that are hard for humans to comprehend. Conventionally, geological time is expressed in millions of years (MA) before the present. The names and dating of eras and periods used here follows that used by Geosciences Australia.

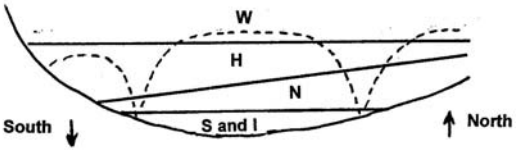
to the north and west (the New England orogeny). This yielded more sediments, locally from the west, the Hawkesbury sandstones that can be up to 300 metres thick (though more like 120 metres locally) and the Wiannamatta Group which is up to 300 metres thick at Picton but in the Wingecarribee is more in the order of 15 metres (*Figure 7c).*



(a) Shoalhaven Group sediments [S] and Illawarra Coal Measures [I] deposit into the newly formed Sydney Basin (Permian)



(b) sagging to the north and deposition of Narrabeen Group sediments (Permian/Triassic)



(c) uplift to the north and deposition of Hawkesbury sandstones and Wiannamatta Group sediments (mid and upper Triassic). The broken line represents today's eroded surface

Figure 7: Sedimentation in the Sydney Basin.

Sedimentation continued into the Jurassic (205-141 MA) and Cretaceous (141-65 MA). Branagan and Packham (2000:56) estimate that as much as 5000 metres of sediments were deposited in the Sydney basin from the Permian onwards, including 1200 metres during the Triassic. Most of this was eroded away during the tectonic events of the late Mesozoic and Cenozoic, exposing older rocks such as the microsyenite intrusion (dated to 178 MA) of Mount Gibraltar.

The later Mesozoic era saw the start before 130 MA of the break-up of Gondwanaland as Australia split first from the Indian subcontinent, then from Africa and later from Antarctica. The Jurassic and Cretaceous were periods of vulcanism, which produced the Sutton Forest volcanics, and of regional uplift (the Kosciusko orogeny) but as sea levels rose into the Cenozoic era (65 MA to the present) erosion slowed dramatically, limiting subsequent reduction of the land surface

During the Cenozoic, continental spreading led to rifting and sagging which opened up the Tasman Sea and led to the detachment of New Zealand from the Sydney basin between 84 and 36 MA. By this time Australia was moving north from Antarctica. After it met the Indian plate about 43 MA buckling produced 'hot spots' under the continental plate, such as along the Mount Murray monocline which runs roughly northwest from Mount Murray in the east to Mount Wanganderry.

Further vulcanism was associated with this buckling between 55 and 30 MA giving rise to the Robertson volcanics. These resulted from flood vulcanism from fissures in these hot spots, with lava up to 100 metres thick spreading widely over earlier sediments and filling their eroded valleys.

At this time Australia was becoming warmer but the earth was cooling. Declining rainfalls further slowed the processes of erosion and weathering but sea levels started to fall, initiating processes of westward coastal retreat, down-cutting by rivers and the collapse and back wearing of slopes to form cliffs. These accelerated briefly during a wetter interlude between five and two million years before the present.

Coastal retreat, down-cutting and slope retreat have all accelerated further during the Ice Ages of the Pleistocene period (the last 1.8 million years) when sea levels fell to as much as 100 metres lower than at present. While the gorges draining the plateau deepened, their rivers have not transported much eroded material from the plateau and most deposition has occurred in the upper reaches of rivers. In the very recent geological past this has been associated with the formation of peat bogs.

The arrival of human beings and particularly their clearing of much natural vegetation over the past two centuries has accelerated erosion and deposition, giving rise to problems of river-bank management and silting-up of dams.

More dramatically, on a scale comparable with the impacts of an earthquake or tsunami, was the collapse in 1998 of the Wingecarribee Swamp. This was the largest upland peat-swamp in Australia until, weakened by years of peat-mining, much of its peat was washed into Wingecarribee reservoir after a single night of intensive storm runoff.

5 Rocks and strata

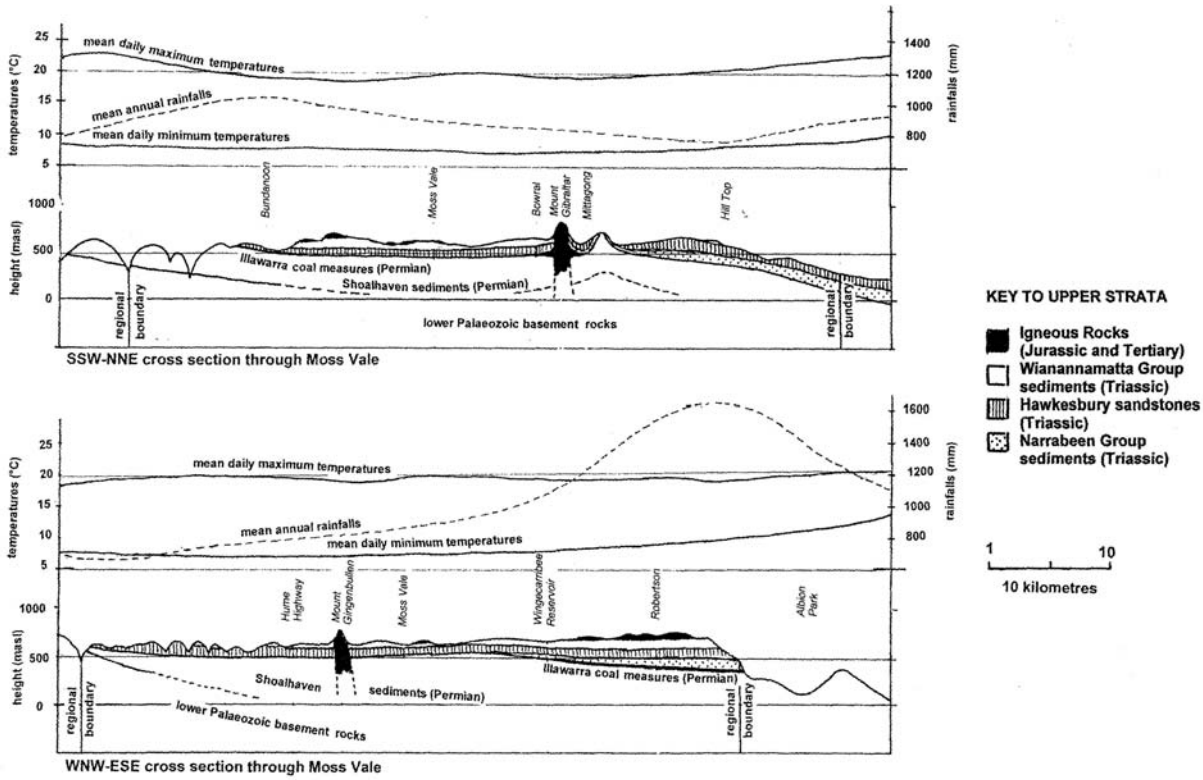


Figure 8: Geology, Rainfalls and Temperatures. *Data from AUSLIG* Wollongong Special (S156-13) 1:250,000 topographic map*, Mineral Resources NSW (1999) and BOM. Vertical exaggeration is x5.*

In the two cross-sections in *Figure 8*, the edges of the Sydney basin can be seen in the west and south where the eroded surface of lower Palaeozoic basement rocks dips down to the north and east. This dip has been described as the Yalwal 'ramp'. A similar 'ramp' where the lower Palaeozoic rocks dip further down occurs northeast of the shire in what has been called the Nepean ramp.

Above this basement the metamorphosed sediments and volcanic rocks of the Shoalhaven Group, and a generally thin band (except in the east) of Illawarra coal measures, dip down to the north and east. This dip is disturbed in places by warping along the Mount Murray monocline, which runs roughly northwest from Mount Murray in the east to Mount Wanganderry in the west and is associated with the igneous intrusions that have helped form hills such as Mounts Gibraltar and Alexandra.

Triassic sediments lie conformably above these Permian strata. The Narrabeen Group forms only a thin layer (which is thicker to the north and east) under the Wingecarribee. The Hawkesbury sandstones above this are much thicker. The Wiannamatta Group sediments are exposed above these in the centre and east of the shire, with remains of the Sutton Forest and later Robertson volcanics above them.

The surface petrology of the shire, shown in *Figure 9* reflects the way in which Triassic and later sediments have been removed over 250 million years of erosion. The youngest rocks – those of the Robertson and Sutton Forest volcanics and of Wiannamatta 'shales' – are largely confined to the centre of the Wingecarribee plateau.

The Robertson volcanics are uniformly olivine-basalt rocks, basic and coarse textured. The much older Sutton Forest volcanics east of Moss Vale are similar. They have some economic importance as sources of hard aggregate but their greatest importance is that they give rise to nutrient-rich soil parent materials.

The Wiannamatta Group is mostly of rocks of lacustrine origins, which are generally shaley in character (compacted mudstones with well-defined bedding planes) though they include sandstones as well as finer-grained siltstones and claystones. They are important for the Wingecarribee as the

parent material of most of its better soils and as sources of shale and white clays for use in cement production and brick-making.

The Hawkesbury sandstones are another varied series of sediments that are exposed around the edges of the plateau often quite extensively. While most of these rocks are coarse-grained, quartz-cemented sandstones, they include other fluvial sediments from conglomerates to fine clays. Generally massive in formation the sandstones are strongly jointed and bedded, and often are folded or faulted. They are significant sources of, and represent an important reserve of, construction sand. They are quarried also for dimension (building) stone. They are important also as sources of bore and spring water that has been trapped above impervious strata within the sandstones.

The Narrabeen Group is a series of generally finer and softer sediments of varied freshwater origins. They are rarely exposed in the Wingecarribee but are exposed around Mount Alexandra west of Mittagong where a limonite formed by precipitation of iron oxides was the source of iron ore for the nineteenth century Fitzroy Iron Works.

The Illawarra coal measures are exposed only along the margins of the plateau where down-cutting by rivers has exposed seams of coal inter-bedded with a great variety of other sedimentary rocks between the sandstones above and metamorphosed sediments below. The economic importance of the coal measures is in the coal that occurs in seams of various thicknesses under the whole of the shire.

Historically, the Wongawilli seam has been and remains the most important. It is the seam from which high-grade coals are currently mined near Medway (where the seam is between six and ten metres thick) and from the east. The Bulli seam above it is also mined, for coking coal, from Bargo outside the shire. Two other significant seams, as well as the American Creek seam, which was mined at Joadja Creek for torbanite – a source of kerosene – lie further down in the geological column at depths of between 200 and 400 metres below the surface. They are not currently mined.

Below the coal measures, the Shoalhaven Group and basement rocks are exposed in the valley sides and bottoms at the edge of the shire. These rocks, except the Bindook porphyries in the northwest, are mostly sedimentary in origin and generally have been metamorphosed.

The plutonic magmas that have intruded into the geological column have formed medium to coarse-grained hard rocks. These are quarried for aggregate and have been quarried (for example, the microsyenites of Mount Gibraltar) for dimension stone.

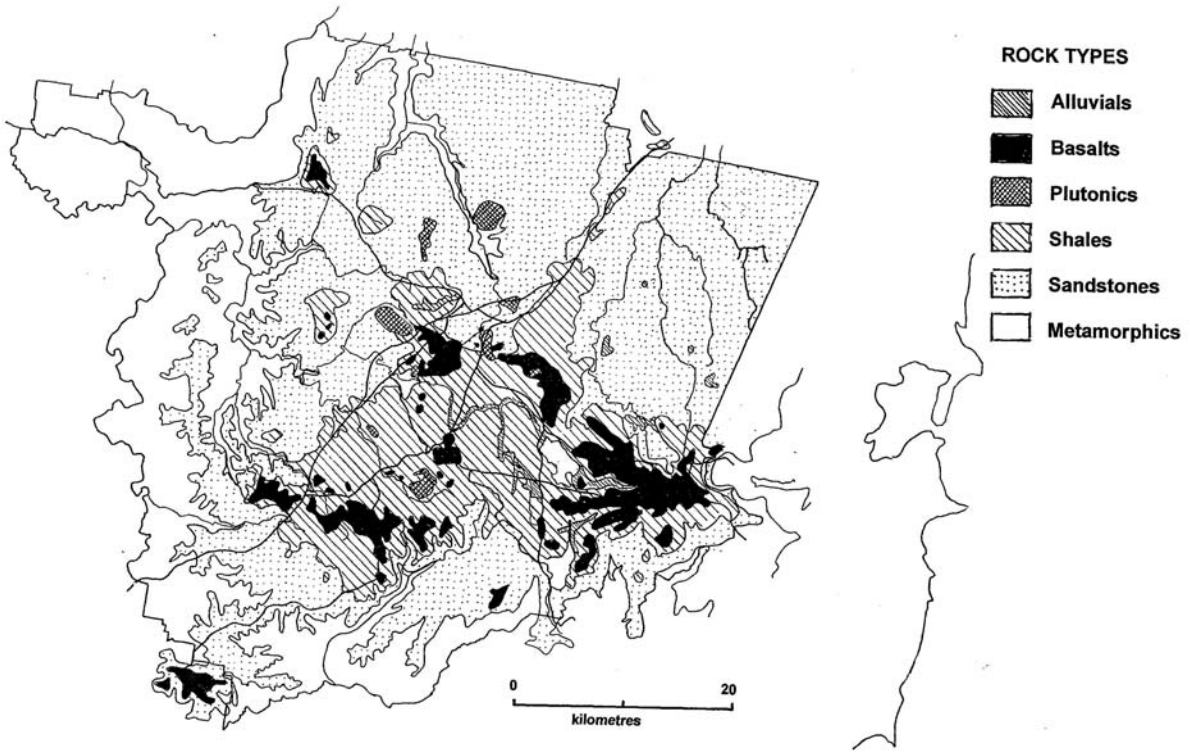


Figure 9: Petrology *(rock types). Source: Mineral Resources NSW (1999)*

6 Landforms

The generally subdued relief of the Wingecarribee is the result of the long periods during which sediments laid down in the late Palaeozoic and early Mesozoic were slowly weathered, eroded and transported away. This landscape is geologically old, mostly predating the Pleistocene epoch (since 1.8 MA).

The more dramatic of the landforms of the shire are ones that have been caused either by the down-cutting and back-wearing which have accompanied relatively recent periods of lower sea levels or by processes associated with igneous intrusions and volcanic extrusions.

Around the margins of the Wingecarribee plateau spectacular gorges and the incised meanders of the lower Wingecarribee and Wollondilly Rivers are products of down-cutting by rivers, as are the steep-sided valleys of the Nattai, Nepean and tributary rivers.

Upstream on the plateau lower river gradients have restricted down-cutting and there has been little development either of flood plain landforms or of river terraces. There has been some incision in the upper reaches of the Wingecarribee River where low gradients have enabled formation over the last 15,000 years of peat fens that have fed on alkaline nutrients transported from the weathered Robertson volcanics in the east.

In the south overlooking the Shoalhaven and in the east overlooking the coastal lowlands there are precipitous cliffs. These have developed through slope retreat caused by a progressive undermining and collapse of the sandstone strata. Talus below the cliffs overlooking the Shoalhaven and to the east of the shire is testimony to these processes. There is a particularly large area of talus (more than four km^2) in the vicinity of Macquarie Pass that is considered to be a relic of higher rainfalls during the Pleistocene. Another large area (more than one km^2) lies a little to the south. Some valley widening also by slope retreat is in evidence in the vicinity of Canyonleigh.

Volcanic landforms occur widely in the shire, associated with a regional ‘hot spot’ that is marked by the Mount Murray monocline, which runs northwest from Mount Murray to Mount Wanganderry. These landforms have formed on the superficial remains of extensive Tertiary lava flows around Robertson, with patches that extend as far west as Mount Wanganderry, and Jurassic lava flows that occur mainly to the south of Moss Vale. These volcanic flows were of basic (alkaline) magmas, which spread widely because of their low melting temperatures. They are highly susceptible to weathering and most of the landforms associated with them are products of weathering and erosion rather than of vulcanism directly.

The more recent lava sheets and probably the earlier ones were formed by floods of basaltic lava out of linear fracture fissures in the underlying sediments that appear to be associated with the Mount Murray monocline. The vents for these, which must have occurred in swarms to enable such extensive outpourings, have not been found and they are probably buried under the lavas, though Budderoo in the southeast may be the stock of an ancient volcano. The form of Mount Murray, which looks like a volcanic cone, is likely to have resulted from weathering and erosion.

The lava sheets are widely characterised by extensive landforms associated with lava flows, such as mesas and flat-topped ridges. They are characterised also by smaller features that reflect their basic volcanic rocks, such as hexagonal columnar weathering and terracettes formed by mass-movement.

Plutonic landforms also occur widely, associated with intrusions of magma into overlying sediments. These include a myriad of dykes that have been exposed under-ground by coal mining or that are found at the land surface exposed by erosion. Many of the latter are so small as to be virtually undetectable in the soils around them.

The larger plutonic landforms are associated with domes (laccoliths) in the general area of the Mount Murray monocline. Here, magma intrusions have pushed overlying sediments up to form dome-like landforms such as those in *Figure 8*.

Sometimes the magma has remained unexposed because strata above have been indurated by compression from below during the intrusion and tend to resist erosion. This has given rise to hills such as Gibbergunyah, which sits over the Mittagong dome.

Elsewhere, erosion of overlying strata has exposed the magma as relatively hard igneous rocks that have been more resistant to erosion than their overlying sediments. This has resulted in hills such as Mounts Misery, Jellore, Flora, Alexandra and

Gibraltar, all of which are near Mittagong, and Mount Gingebullen west of Moss Vale. *Figure 10* summarises the evolution of Mounts Alexandra and Gibraltar.

In the case of Mount Alexandra sediments deposited during the Triassic *(a)* have been pushed up by a subsequent intrusion of microsyenite magma and have since been eroded over many millions of years to give the present-day land surface *(b).* Mount Alexandra itself is formed from sandstones that may be of the Narrabeen group (which are not widely found in the Wingecarribee). Microsyenite, which is faulted, occurs to the northweast and northeast between exposures of anthracite that is coal from the Illawarra coal measures metamorphosed during the uplift.

Mount Gibraltar, as described by Branagan and Packham (2000:140) and by Nasher (1967:95), began similarly with sediments deposited during the Triassic *(c*) being pushed up by an intrusion of microsyenite *(d).* Here, vertical faulting during the igneous intrusion caused displacement of the microsyenite *(e),* which after erosion has become the fault scarp of the western and southern faces of today's Mount Gibraltar. Many dykes that are associated with the intrusion have also been exposed in the vicinity by erosion. The Tertiary basalt to the east of Mount Gibraltar is not related geologically to the formation of the mountain. Interestingly in the case of Mount Gibraltar, considering that Mount Alexandra is nearby, neither coal measures nor Narrabeen sandstones are exposed around Mount Gibraltar.

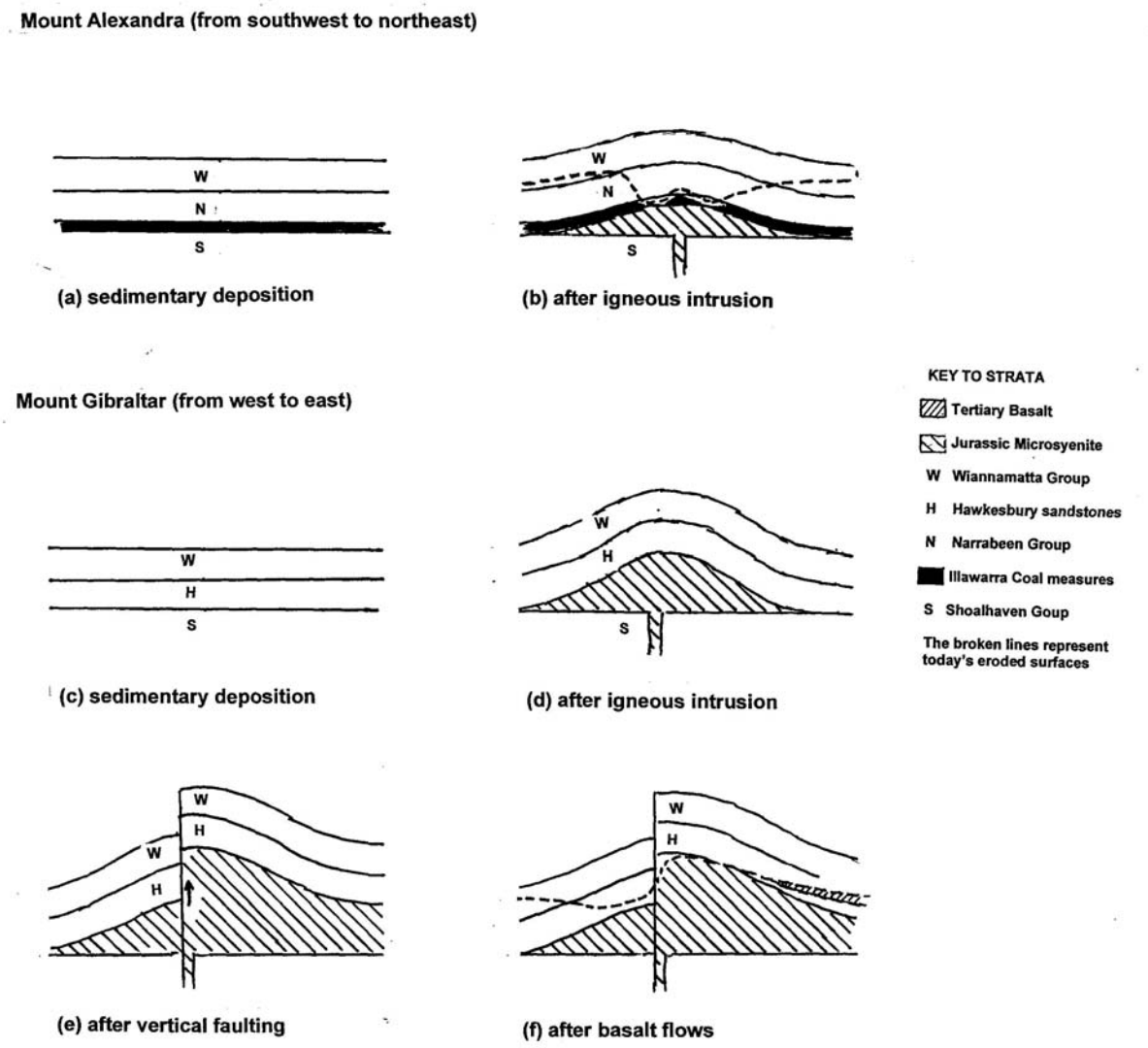


Figure 10: The evolution of Mounts Alexandra and Gibraltar*. Derived from Mineral Resources NSW (1999), AUSLIG 1:100,000 topographic maps and (for Mount Gibraltar) Nasher (1967: 93) and Branagan and Packham (2000:140).*

7 Soil Patterns

Descriptions of soil patterns are available from sources such as Forestry Commission (1986) but they are both general and dated. More detailed information is held by what is now the NSW Department of Natural Resources but it is not yet publicly available.

Although soils are popularly thought of as no more than the surface layers of the rocks below them this oversimplifies the matter. In the Wingecarribee where weathering and erosion have taken place over long periods of time, underlying rocks do provide parent material for soils but when time is involved their properties may be altered significantly. Factors involved in this include relocation of parent material, leaching of nutrients, eluviation and illuviation of particles, temperature and moisture regimes, plants and animal behaviour and the activities of human beings.

Because of the ways in which these factors influence soil formation there is remarkable diversity in soils within local places. Soil formation describes the processes – particularly upward and downward movements in a soil of water, nutrients and particles – by which 'horizons ' are developed in soil profiles.

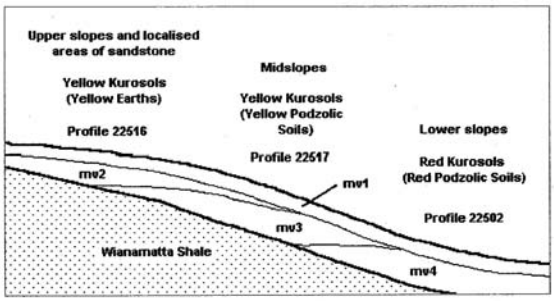
Traditionally, soil profiles have been thought of as simple sequences downward, from organic horizons through topsoils and subsoils to weathered parent material.

In Australia, few soils demonstrate these sequences (see *Figures 11(a) and (b)*). Soil landscape mapping has been developed as a way of comprehending this diversity through understanding the conditions under which soil formation takes place. Soil landscape mapping was done in the Wingecarribee in 2002 by what was then the NSW Department of Water and Land Resources and this mapping is generalised in *Figure 12.*

Residual soils are ones in which weathering of parent material without significant erosion has occurred over long periods of time, allowing well-developed soil profiles to form. They are found commonly on higher sections of the plateau. When they have been subject to some erosion and have shallower profiles they are referred to as vestigial soils, which do not occur widely in the shire.

Colluvial soils are ones in which the processes of soil formation are retarded by mass movement,

(a) Moss vale (erosional) soils



(b) Kangaloon (transferral) soils

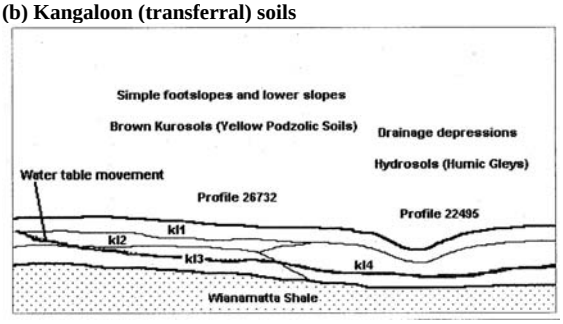


Figure 11: Soil profiles *from two soil landscapes found widely in agricultural areas of the Wingecarribee. Source: NSW Department of Infrastructure, Planning and Natural Resources.*

which prevents development of clear soil profiles. Typically, they are associated with the steep and precipitous slopes that occur around the margins of the plateau.

Erosional soils are ones in which soil formation is affected by the removal of weathered parent material, which tends to produce shallow and often truncated soil profiles. The sandy soils especially of the Wingecarribee are often erosional, though serious erosion is not considered to be a widespread problem in the shire. Data in WSC 2004a:18 suggests that perhaps a third of the shire is affected by moderate or severe erosion, most of which is sheet rather than gully erosion.

Transferral soils have formed on parent materials in the course of their transportation from elsewhere and have soil profiles that are generally deep but often without well-differentiated horizons. They are common in the clayey soils developed in the shallow valleys of the Wingecarribee catchment on Wiannamatta shales. These have high shrink-swell propensities and tendencies towards soil creep. Transferral soils are similar to alluvial soils that have formed by deposition along rivers and streams but alluvial soils are not extensive in the shire.

Although soil landscape mapping provides a framework within which to understand the processes at work it doesn't diminish the importance of parent material for the chemical and physical properties of soils at a regional scale. In the Wingecarribee the association between soil properties and surface geology is particularly strong (compare *Figure 8* and *Figure 13* overleaf).

Soils developed on the Robertson and Sutton Forest volcanics are kraznozems, which have developed under rainforest and related vegetation on basaltic rocks that are typically dark in colour, fine-grained and strongly bedded. Under conditions of moderate to high rainfalls these rocks have weathered to soils that typically are reddish in colour, clayey in texture with clearly defined horizons, deep (around a metre) and with neutral soil chemical reactions (ie pHs of 6.0 to 7.0).

Soils developed on the Wingecaribee shales of the plateau are podzols, which have developed over long periods of time under conditions of higher rainfalls than at present and under dry forest covers. Their parent materials are commonly light in colour, fine-grained and moderately bedded. The soils are described as 'red/yellow' in colour (although they often appear as grey or brown), typically with mixed sands, silts and clays and clearly differentiated horizons, including organic horizons. These soils are moderately deep to deep (0.3 to 1.2 metres) and slightly acidic (with pHs of 5.5 to 6.0).

The soils that have developed on Hawkesbury and Shoalhaven sediments are podzols also. Because they have developed under a variety of environmental conditions they exhibit considerable diversity. Their parent materials are quartzic sediments, light coloured, generally coarse-grained and strongly bedded, which have given rise to soils generally yellow in colour, sandy in texture and often with no obvious structure. Where they are residual soils they can be of moderate depth but generally they are shallow and strongly acidic (pHs of 5.0-5.5

On the metamorphosed sediments and Bindook porphyries in the west podzolic soils have developed over long periods of time. Where these are affected by mass movement or erosion their horizonation is often 'skeletal'. Despite a variety of parent materials they are generally yellow in colour, silty in texture with well-developed horizonation. They are usually shallow with extremely acidic soil reactions (pHs of 4.5-5.0).

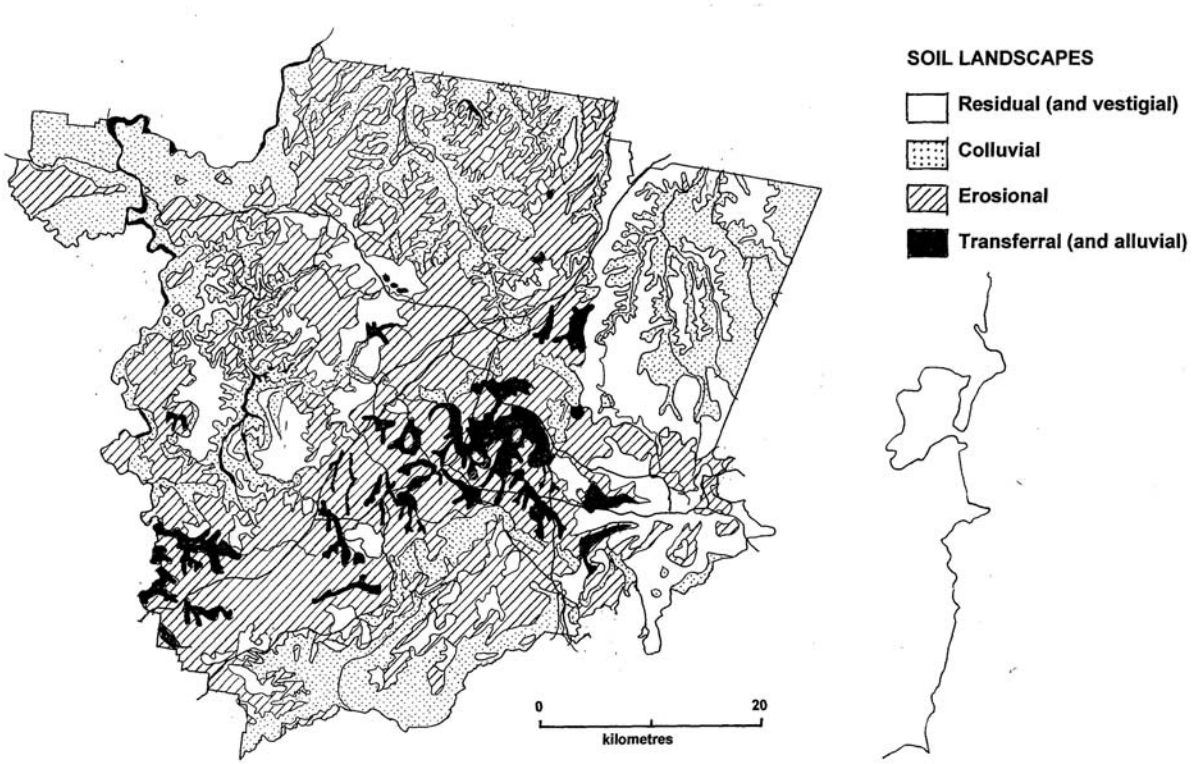


Figure 12: Soil landscapes*. Source: NSW Department of Infrastructure, Planning and Natural Resources 1:100,000 soil landscapes maps.*

8 Soil Potentials

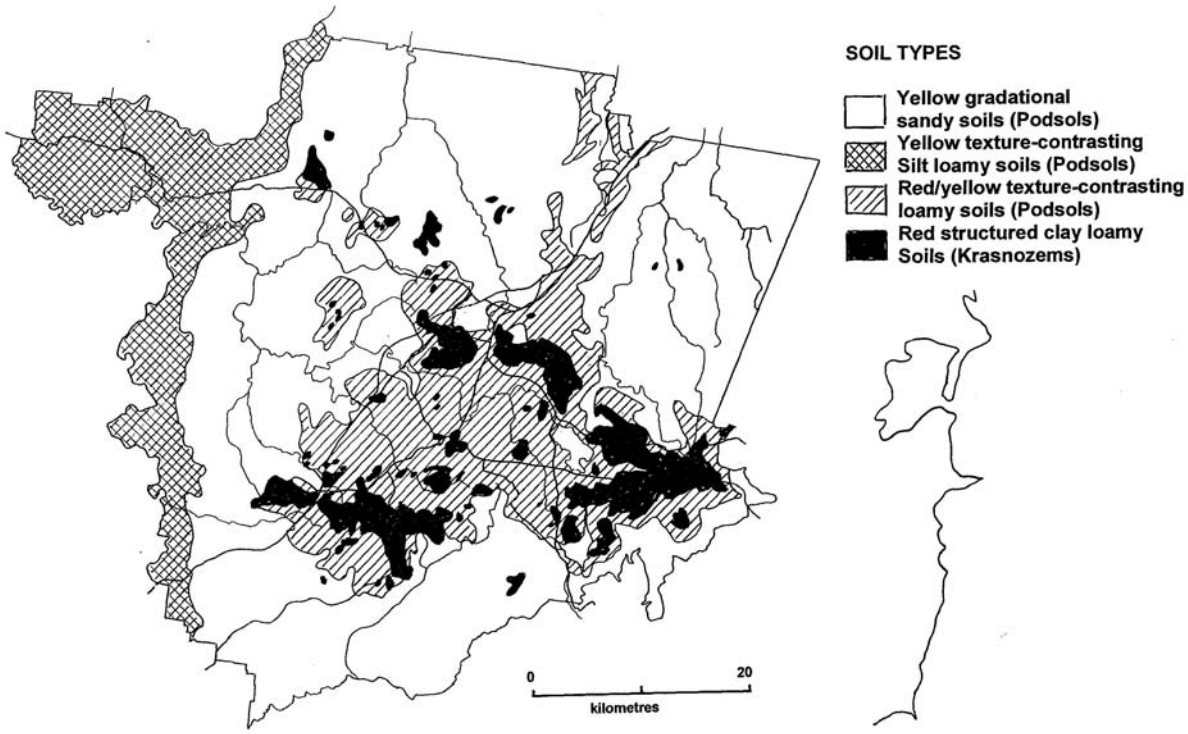


***Figure 13: Soil types**. Sources: Forestry Commission (1986)* and *UNSW (1975)*

Soils provide the foundations for built developments. Soil landscape mapping helps to understand the limitations of sites for different kinds of structures. Because of factors such as slope these limitations tend to be very site-specific, which makes it impossible to discuss these limitations in any general way in a book such as the present.

Soils also set conditions under which vegetation growth and rural land uses can take place. It is easier to make generalisations about these at regional scale than about suitability of soils for built structures.

Assessing the physical and biological capabilities of soils involves more than just a consideration of soil types. A range of environmental conditions, not least of which are moisture availability, slope, erosivity and erodibility, must be taken into account. This was done in 1980s mapping of soil capability by what then was the Soil Conservation Service of NSW (*Figure 15*).

As shown in the map little of the Wingecarribee can support regular cultivation. There is no class I

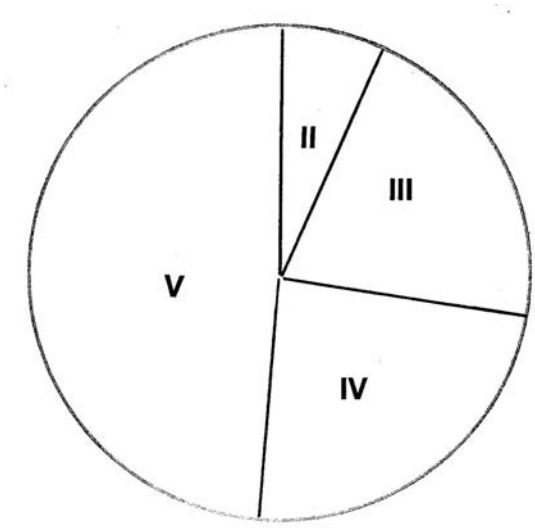


***Figure 14: Agricultural land quality.** Source WSC (1988), after NSW Agriculture.*

Class II	*(suitable for cropping, but not for continuous or intensive cropping)*
Class III	*(suitable for grazing and for occasional cash and forage crops)*
Class IV	*(suitable for grazing on native or minimally improved pastures)*
Class V	*(suitable for rough grazing or no agriculture at all)*

land (capable of continuous or intensive cropping) because of slope limitations. The fairly small area of Classes II and III land (capable of rotational rather than continuous cropping) is confined to the eastern half of the shire.

A larger area, also mostly in the centre and east of the shire, is Class IV and V land that can support occasional cultivation but should be kept essentially for grazing because it is moderately susceptible to erosion. Here, occasional cultivation for feed crops and pasture renewal is possible, particularly on the better grazing land of Class IV.

Of the remainder, some can support grazing with no cultivation (Class VI). Most is best left in green timber (Class VII) or for nature conservation reserves (Class VIII). Most of these lands occur towards the margins of the shire.

The suitability of land for particular uses reflects more than just physical capabilities. In particular, it reflects factors such as land-holding structures, soil 'improvements' and the availability of services and infrastructure. NSW Agriculture (WSC, 1988) has taken account of these other factors in its classification of the lands of the shire in terms of their agricultural quality. Although its assessments are more generous than those of the Soil Conservation Service, it nevertheless considers that barely a quarter of the shire is 'prime agricultural land' (ie its Classes II and III; it too considers that there is no land suitable for continuous cropping or intensive agriculture) (see *Figure 14*).

These patterns of land capability and suitability reflect the generally shallow and often infertile soils in the shire. Only the deeper, clayey soils of the Robertson basalts and of the Wingecarribee shales are suitable at all for regular cropping or intensive grazing, because most of their physical limitations can be overcome. The shallow sandy and granitic soils elsewhere, with nutrient deficiencies that may not respond to fertilisers, limited capacities to hold moisture and moderate to high erodibility, are suited at best for extensive grazing. A large part of the shire is simply not suited for any kind of cropping or grazing and is best be left under some kind of native vegetation, or plantation forest in more favoured locations.

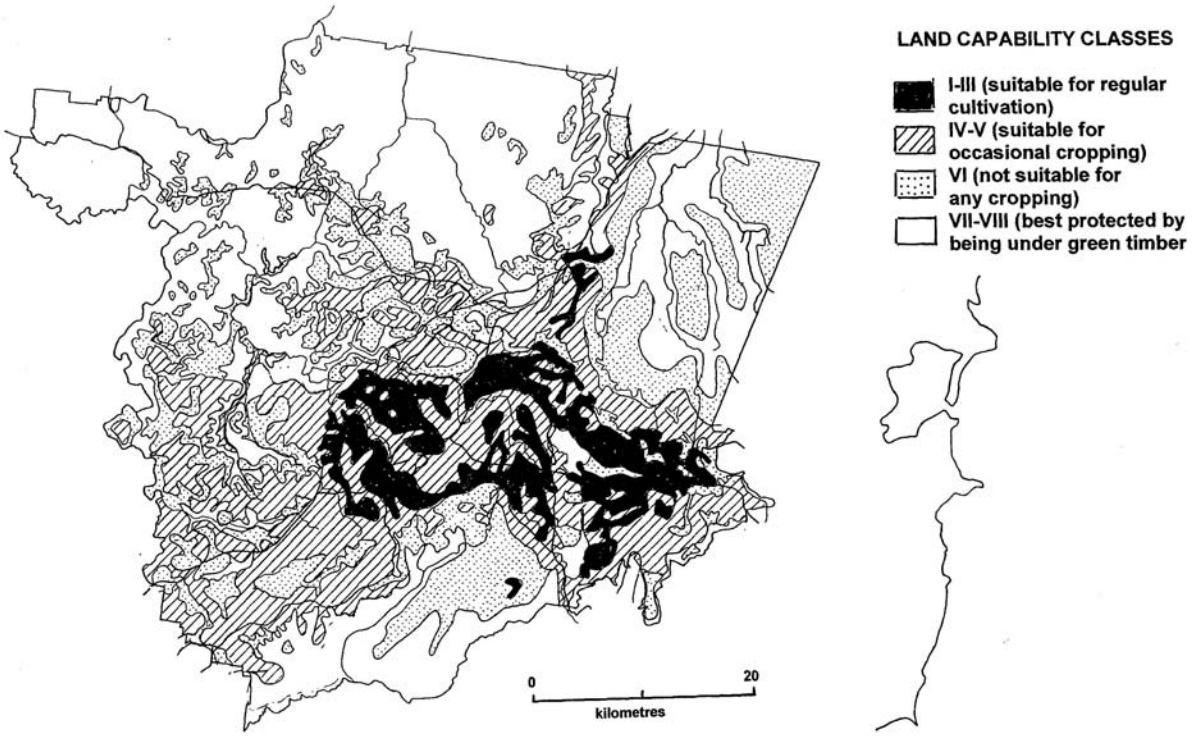


Figure 15: Land capability. *Source: NSW Soil Conservation Service, 1:100,000 land capability maps.*

9 Weather and Climate

'Climate' summarises the weather of a place. Weather – particularly in its effects on ambient temperatures, moisture availability and hazardous conditions – is a major influence on soil formation and on plant growth.

Climatically, the Wingecarribee is transitional between the coastal climates of Sydney including the Illawarra and the inland areas of the Southern Tablelands. Its internal climatic diversity reflects this. However, it is included in the Sydney region for meteorological purposes, where it is covered in comprehensive studies of climate (BOM, 1979 and 1991), in official records on the www.bom.gov.au website and in vast quantities of unpublished data that are available for purchase from the BOM.

Globally, the driver of weather is the solar energy received by the earth, which is greatest at the heat equator (which is wherever the sun is overhead at midday at different times of the year) and least around the poles. Solar energy is redistributed across the earth by surface and upper-atmosphere air movements. As air masses pass over the surface of the earth their temperatures and moisture content may be modified by the temperatures and moisture of the land or sea they pass over as well as by local conditions such as elevation, distance from the sea and relief.

Air masses and winds are central to understanding the temperature and moisture regimes of the places they pass over. In southeastern Australia weather and climate are dictated by interactions between:

- descending (warming) subtropical anticyclones (high pressure cells), which draw moist or dry air from the north;
- ascending (cooling) mid-latitude cyclonic systems ('lows'), which draw in generally moist air from the west; and
- ascending (rapidly cooling) cyclonic air associated with atmospheric movements in 'lows' in the tropical Pacific.

At latitude 34º30'S the Wingecaribee is under the influence of an easterly-moving succession of anticyclones for much of the year, with frequent incursions of easterly-moving mid-latitude cyclonic systems in troughs between the anticyclones and occasional incursions of air from the north into these troughs. This gives rise to equinoctial patterns of surface air movement shown in *Figure 16*.

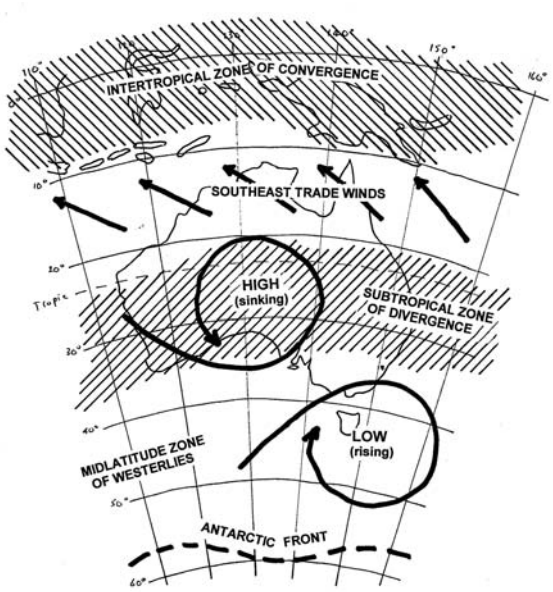


Figure 16: equinoctial patterns of air masses and winds that influence weather and climate in the Wingecarribee.

Under equinoctial conditions the weather of the shire may be described broadly as a sequence of winds changing:

- from northerly to westerly, associated with lows, with cold fronts and dry conditions;
- from westerly to southerly, warming as they move east in a föhn effect;
- from southerly to easterly, as anticyclones advance, often accompanied by rain; and
- from easterly to northerly, sometimes with storms, though this is the stable part of an anticyclone

This sequence gets modified as the heat equator oscillates north and south of the actual equator. When the sun is overhead in the northern hemisphere, mid-latitude cyclonic systems and westerly winds become more prevalent in the Wingecarribee. Cold fronts at the leading edge of cyclonic systems may bring rain and even snow when the westerlies are sufficiently strong or moisture-laden to carry moisture 800 kilometres or so from the southern ocean.

When the heat equator is south of the equator the subtropical anticyclones migrate southwards making the shire more likely to experience easterly winds that can bring rain. The shire may also

experience spells of calm fine weather then and, occasionally, incursions from the north of tropical cyclonic air that is generally moist and rain-generating (especially in periods of La Niña) but which can be dry (in periods of El Niño).

These broad atmospheric movements are reflected in the seasonal pattern of winds. In Bowral as shown in *Figure 17* winds tend to be westerly rather than easterly. This is less true in summer when easterlies are common. It is the case from autumn through to spring, particularly for stronger breezes and gales (here shown as over 18 kph).

This westerly-dominated pattern of winds varies across the shire, both spatially and temporally. Easterlies are more common throughout the year in the east, which is open to the coast and has some shelter from the west. Further inland, where there is some shelter from easterlies, westerlies are dominant though easterlies do come with the migrating wind systems and on occasion in summer when inland heat lows develop to the north and west. Local relief often modifies wind patterns and this can be seen in a higher frequency of southerlies in the south and west.

It may be said that most of the Wingecarribee's weather comes from the west but its rain comes from the east. As a generalisation temperatures in the shire are more extreme in the west than the east, while rainfalls in the shire decline from east to west. A notable feature of the weather of the shire is its variability, unreliability indeed, which results from the constant interaction between the atmospheric systems discussed above.

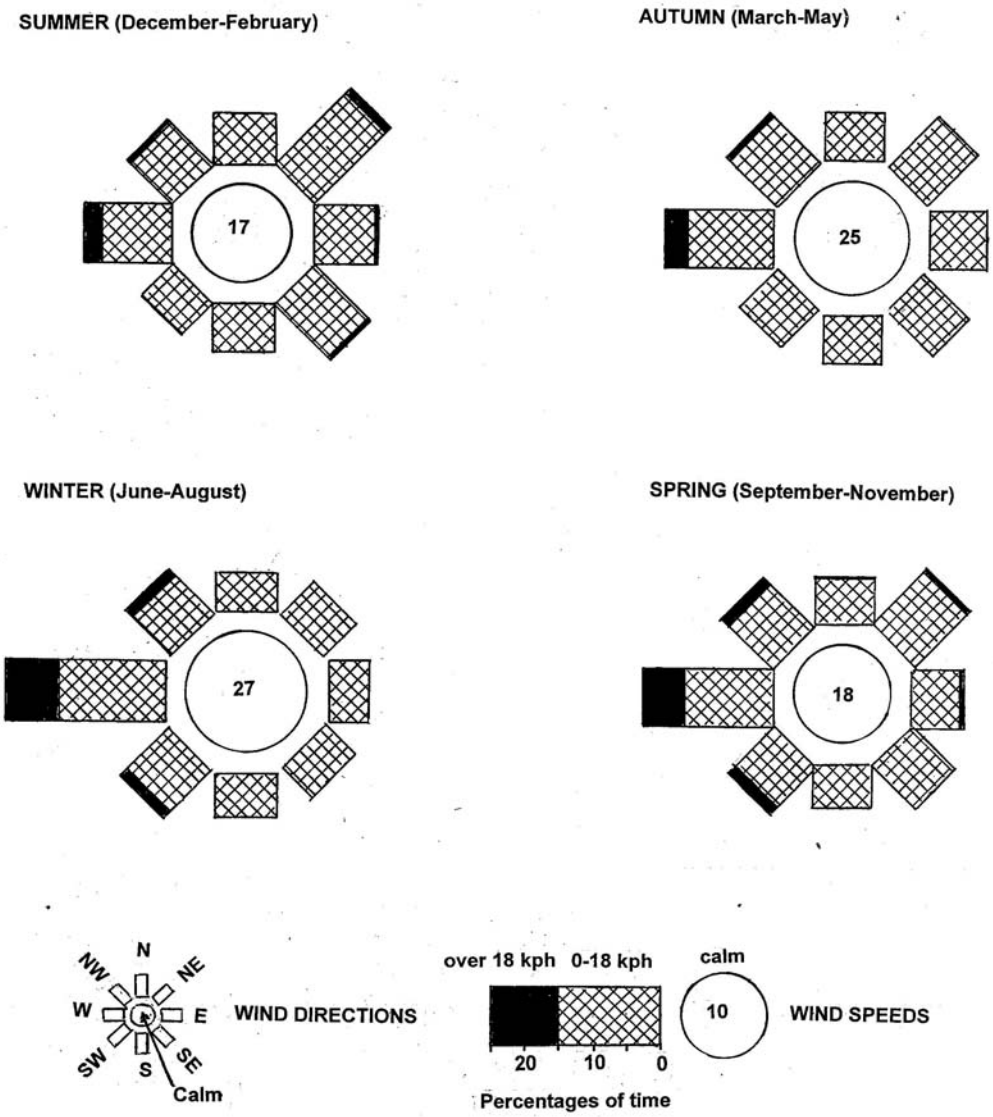


Figure 17: Seasonal winds in Bowral *(averages of 9 am and 3 pm readings, 1961-2004). The circles in the centre of each wind rose show percentages of times when it is calm. Data from BOM.*

10 Temperatures

Official weather records for the Wingecarribee have been kept only in the three main towns, though rainfalls have been more widely recorded. Sometimes weather records have been summarised as 'normals', usually for thirty-year periods during the second half of the twentieth century. More often summaries are available as long-term averages. For the three towns data has been recorded more or less continuously at four stations for over a 100 years. Because each station is unique and it is likely that climate has changed, generalisations from them for the region should be made with caution.

Regionally, surface temperatures are dictated by the amount of energy received from solar radiation, the rate at which temperatures change with altitude and the amount of energy in air moving over the region.

No sunshine records are available for the shire. The main towns, especially Bowral, experience fewer clear days and more cloudy days than both Goulburn and more especially the coast, especially in winter. This means that the region experiences considerably fewer sun hours than at Sydney's Observatory Hill (which has an annual average of 2482 hours), certainly in winter.

Lower insolation (sunshine) than on the coast may mean lower temperatures for the Wingecarribee, but temperatures are affected also by relative humidity. Drier air is more easily heated than moist, which raises day temperatures, but drier air loses energy more easily than moister air, which leads to lower night temperatures.

When air is still its temperature declines normally by 6.4º per 1000 metres of elevation because of lower air pressures (this is the 'normal adiabatic lapse rate'). Thus at around 650 metres above sea level temperatures on the plateau normally should be 4º below those on the coast.

However, the actual decline with height in still air is affected by humidity and by radiation gains and losses of energy. These mean that in still conditions the plateau tends to be warmer than otherwise in summers and cooler in winter. Similarly, daytime temperatures are likely to be warmer than otherwise and night temperatures cooler. Temperatures in dry air may decline by up to 10° per 1000 metres and in saturated air by less than 6°.

The effects of these lapse rates are modified by movements of air, which bring energy and moisture into a region, warming or cooling its surfaces as they pass over the region (winds may also acquire a region's characteristics of energy and moisture). Thus, in the Wingecarribee, cooling of surface temperatures is associated with cold winter westerlies and warming with summer easterlies. In the east and south of the shire, some surface warming can take place also after air has passed over higher land and lost moisture through rain (the 'föhn' effect).

These processes are reflected in the pattern of temperatures shown in *Figure 18*. There are no great differences in monthly median and mean temperatures between Moss Vale and Bowral (or Mittagong), whose temperature regimes are very similar to that of Goulburn to the west. There are significant differences between the temperatures of these three towns and those of Kiama on the coast.

Median and mean temperatures in the main towns of the shire are rather lower than can be explained solely in terms of elevation, except during the daytime in summer when they are not dissimilar to those on the coast. Lower winter temperatures away from the coast, particularly at night, reflect the fact that air is drier inland.

Diurnal temperature ranges within the region are greater than on the coast throughout the year. In the main towns, diurnal temperatures typically range from minima of 13° in mid-summer and 1.5° in mid-winter to maximums of 25° and 12° respectively, with diurnal temperatures falling quite rapidly after March and rising more steadily from winter to summer in the second half of the year. Both maximum and minimum temperatures fluctuate considerably from day to day throughout the year, reflecting the interplay of westerly and easterly air.

Temperatures in the main towns are more variable from year to year than on the coast, particularly at night and in winter. Unlike the coast, shade temperatures over 40° have never been recorded officially in the shire. Frosts of more than –11° have been recorded in Bowral, which being in a valley experiences gravity drainage of cold air and frosts that are more frequent and heavier than in Moss Vale or Mittagong. Typically, the towns experience over sixty frosts annually but screen temperatures below 2.2º (which is regarded as equivalent to a grass temperature of 0º) are unusual outside the April to October period.

Within the shire and even within the towns there are likely to be considerable departures from the temperature regimes recorded at the climatic stations. It is possible only to guess at most of this microclimatic variation.

Generally variations will reflect relief or aspect. North-facing slopes will be significantly warmer than south-facing ones during the day. Relief certainly will affect the manner in which winds draw cool, or warm, air into valleys. Exposed ridges will experience colder winter daytime temperatures. Valleys throughout the shire experience frosts because of gravity drainage (sinking of cold air), which are likely to be heavier in the west. Winter temperatures may be colder and more extreme in the valleys of the west.

The variations within the region reflect also distances from the coast. Modelling by the Bureau of Meteorology (BOM, 1979:53-57; 60-64) suggests that in summer mean daily maximum temperatures are up to 3½º warmer in the west than in the east and mean daily minimum temperatures up to 3½º cooler, reflecting the drier air in the west. Over most of the rest of the year both daily maximums and minima tend to be cooler in the inland towns than toward the edges of the shire, by as much as 2½º in the day and 3 ½º at night. Some of this variation is reflected in the ranges of annual mean daily temperatures shown in *Figure 18*.

From the modelling it appears that Robertson in the east, though it is around 100 metres higher than the shire's main towns and other areas in the drier centre and west of the shire, is marginally warmer during days and definitely warmer at night than the main towns, in winter. It is also marginally cooler in days and marginally warmer at night, in summer. Bundanoon appears to have a temperature regime similar to that of Robertson, except that it may experience considerably warmer summer days.

Since weather records have been kept, there appear to have been subtle changes in temperature regimes. Long-term data suggest that mean annual temperatures may have declined slightly in Moss Vale during the twentieth century to 1975, though variations from year to year are so great that this conclusion is uncertain. Fluctuations around a mean temperature of 13.2° in Bowral suggest that temperatures there have risen by nearly 1°C overall since 1965. Again, variations from year to year make it difficult to see the trend and closer analysis of the data is required, though the same trends have been widely observed elsewhere in NSW.

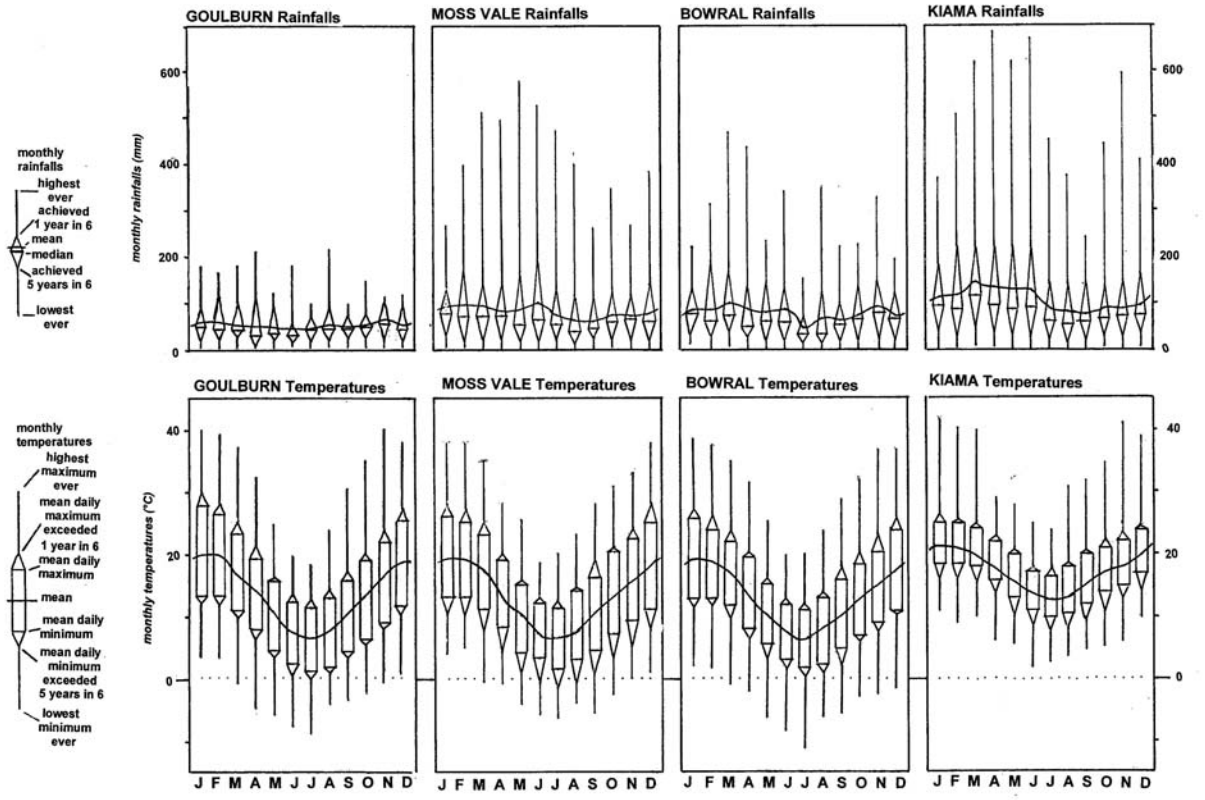


Figure 18: Long term monthly temperatures and rainfalls in Bowral and Moss Vale, Goulburn (to the west) and Kiama (on the coast to the east). *Data from BOM.*

11 Moisture

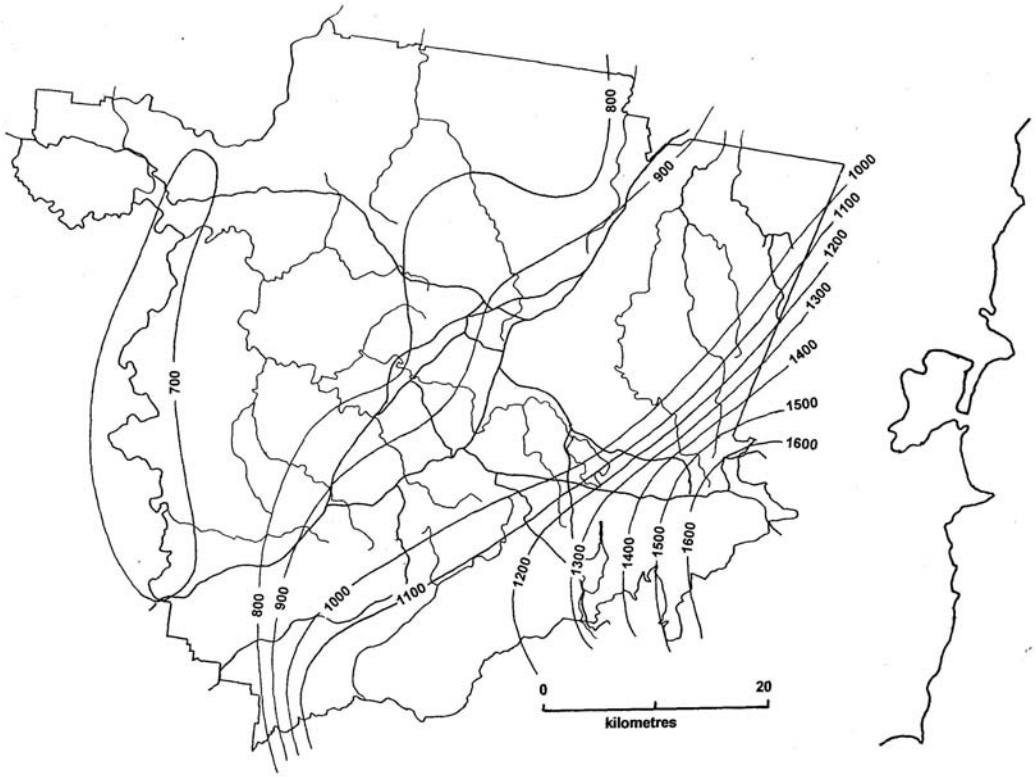


Figure 19: Median annual rainfalls*. The isohyets are in mm per annum. Source: Forestry Commission (1986) and long-term data from BOM.*

Relative humidity in Bowral and more so in Moss Vale tends to be lower than on the coast, particularly in summer. For this humidity to precipitate as rain, hail, snow or fog, air must be cooled to the point (dew point) where it can no longer hold its moisture. When relative humidity is low and temperatures are relatively high, air is not readily cooled to dew point. This commonly is the case in the Wingecarribee, more so in the west than in the east.

In the shire, cooling of moist air happens when air rises behind fronts, or by convection or orographic uplift. It happens more rarely when warmer air passes over cooler surfaces (advection), to produce ground fogs, and when warmer air comes in contact with cooler air below in a temperature inversion, causing low cloud.

Most of the moist air that passes over the shire comes from the east. This is reflected in median annual rainfalls (*Figure 19*), which decline from the southeast, firstly quite sharply then less, with a further sharp decline northwest of the Hume Highway (medians are used here because a few extreme falls can distort monthly mean rainfalls).

Annual median rainfalls are particularly high along the Illawarra Escarpment and over the Budderoo National Park, where the association of relief and rainfall is strong. They are much lower in the main towns where, although cloudless days are uncommon especially in summer, cloudy days seldom yield more than a trace of precipitation.

Most of the shire's rain is cold-frontal rain that is associated either with the advance of anticyclones and wind changes from south to east or, in the winter semester, with the advance of lows and associated westerly and southerly winds. These rainfalls are boosted by orographic uplift in the east. Precipitation events such as snow are unusual and fogs occur less frequently than at Sydney Airport except above the Illawarra Escarpment.

In the summer semester, precipitation occurs also as a result of convectional uplift of air and, in the east, as a result of orographic uplift. Convectional uplift gives rise to thunder, hail and heavy falls that are often very localised. There are only 21 days of thunder each year in Bowral and extreme rainfalls are not common, though Moss Vale did record 333.0 mm of rain on one March day in 1893!

Across the shire annual rainfalls are not especially low, even in the west, but they are highly variable both from season to season and from year to year.

Seasonally, both mean and median rainfalls in *Figure 18* are similar for Moss Vale and Bowral, where monthly rainfalls are higher in summer semesters than the winter ones and rainfalls fall off markedly in the early spring. The pattern of higher summer rainfalls is found at every long-term rainfall recording station in the shire but is most prominent in the east and south and least toward the west. In this the shire is similar to Kiama, though the coast has much higher rainfalls throughout the year. By contrast median rainfalls in Goulburn are more or less the same in winter and summer semesters.

Although rainfall variability needs further study it appears that it is highest in the summer months when the easterlies are strongest. The heaviest daily rainfalls and the highest monthly rainfalls have all been in the summer and autumn months, such as Moss Vale's 410.7 mm in March 1893 and 491.2mm in June 1891.

This seasonal and annual variability has serious implications for plant growth that is significantly limited in the shire by the availability of moisture.

Moisture availability, particularly for plants, is as much a function of temperature as it is of rainfall in a climate such as that of the shire. Temperature affects the amount of moisture in the soil and on surfaces, through evaporation. When potential evaporation exceeds rainfalls, as is widely the case in the Wingecarribee (see *Figure 20*), soil and surface moisture reservoirs may be constantly depleted

The consequences of this vary from species to species but mean generally that plant growth in the Wingecarribee is less than it would be under ideal conditions (*Figure 21*). Temperatures can be limiting for plant growth as they affect the onset and end of growing seasons, which for pasture grasses may make the growing season on the plateau as much as six weeks shorter than on the coast. However, it is moisture deficits that are the main limiting factor on plant growth throughout the shire.

An important effect of moisture deficits is to make most of the shire vulnerable to rainfalls that are lower than 'normal'. Generally rainfalls below normal are an expression of wind patterns that have tended to stay westerly, rather than changing with the seasons. Fortunately, semesters of low rainfall tend to be followed by ones of higher rainfalls.

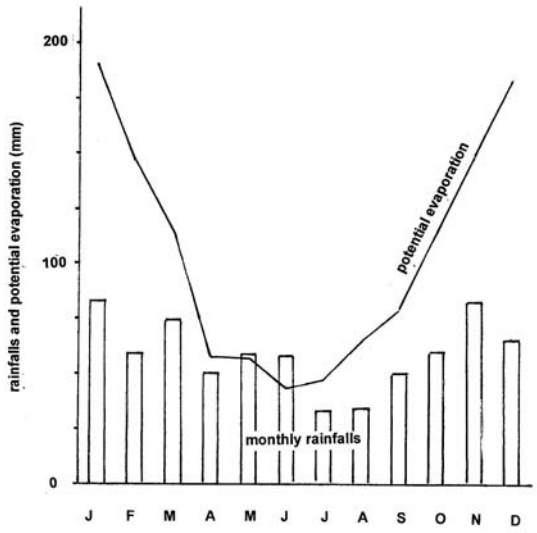


Figure 20: Mean monthly rainfalls and potential monthly evaporation in Bowral. *Data from BOM. Potential evaporations are based on actual evaporations in Goulburn.*

This does not always happen. The winter of 2004, a semester that technically was in drought (ie in the lowest decile of rainfalls recorded), followed an earlier winter of drought in 2002 and three semesters of lower than normal rainfall in between. Similar sequences of low rainfall were recorded in the early 1940s, and in the early 1900s when the winter of 1906 had the lowest semester rainfall on record.

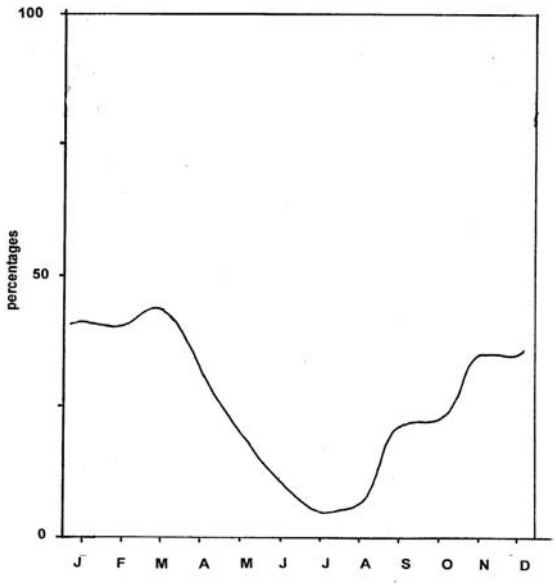


Figure 21: Monthly growth indices for Bowral *Percentages of potential growth in temperate grasses and legumes, estimated by the method of Fitzpatrick and Nix (1981). Data from BOM*

12 Vegetation

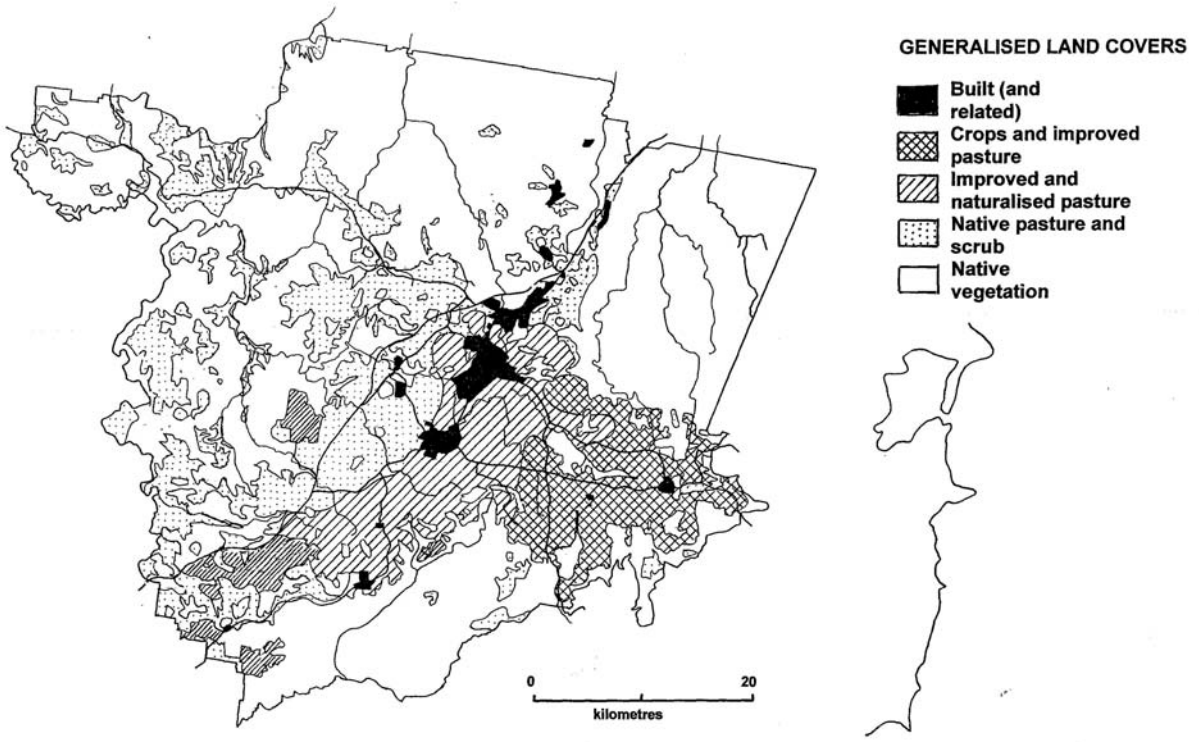


Figure 22: Land cover. *Sources: AUSLIG,* Wollongong Special (156-13) 1:250,000 topographic map, *Ecological Australia (2003), www.canri.nsw.gov.au and www.iplan,nsw.gov.au.*

Apart from relatively small areas under built surfaces, quarries and disturbed soils the shire is covered by some kind of vegetation. 63.5% of the shire is under [native] 'vegetation' (Ecological Australia, 2003:9-10). This is mainly in the outer parts of the shire (*Figure 22*). The balance comprises covers now used for commercial or essentially residential purposes.

It is a matter for debate as to how much of the native vegetation cover is 'natural', ie pre-1750 or pre-European. Natural vegetation is of interest both as indicator of local soil and climatic conditions and because it provides habitat for plants and animals. Unfortunately most of what is 'known' about natural vegetation is based on what can be can be inferred from the native vegetation of today.

The natural vegetation cover of the shire evolved over many millions of years and is still evolving at the hands of human beings.

A few species such as the common bracken fern (*Pteridium acquilinum*) are relics of a period before the Mesozoic (251 MA) when Australia and Gondwanaland were still attached to land that is now in the northern hemisphere, where this species was universal. Others such as species of *Callitris* are related to the coniferous flora (*Gymnosperms)* that became dominant during the Mesozoic era.

Most of the natural vegetation of the shire is made up of flowering plants (*Angiosperms*) that have evolved independently in Australia during the Cenozoic era. Because Australia has been relatively isolated from other land masses since the end of the Mesozoic (65 MA) its flora has a high degree of endemism, although many genera and even a few species were developed in common before separation. These include she-oaks (*Casuarina*, common with India before 130 MA), wattles, beeches and oat grasses (*Acacia, Nothofagus* and *Danthonia*, common with South America and Africa before 100 MA) and tea trees (*Leptospermum*) and sedges (*Carex*), common with New Zealand before 65 MA).

A large part of the shire's flora is 'scleromorphic', with hard leaves evolved to survive conditions that were becoming drier and nutrient deficient throughout the Cenozoic. This includes *Eucalyptus* and other members of the *Myrtacae* family, which, while they are dominant across most of the shire, may not be perfect adaptations to current

conditions. This is suggested by the manner in which *Callitris* and exotic species invade land that has been cleared of natural vegetation.

In corners of the shire there are pockets dominated by heath or swamp species, which are adapted to current conditions, and others dominated by rainforest species, which are not. The rainforest species are of particular interest as survivors from the early Cenozoic, promoted during a brief return to wetter conditions between 5 and 2 million years ago and rather vulnerable under the current conditions that have prevailed for the last 6000 years.

This natural vegetation widely occupied areas that were seen by Europeans to be attractive for agriculture and in some cases contained trees that had commercial value. It has been extensively modified. Exactly how much is 'natural' is contentious. Wells *et al* (1984) have estimated that 60.4% of the shire's natural vegetation has been 'modified', a figure that is similar to percentages of the shire that were in rural holdings during their First World War and 1960s peaks.

This suggests that less than forty percent of the shire's pre-European vegetation remains essentially undisturbed (*Figures 23* and *24*), mostly in less accessible areas in national parks and Sydney Water reserves along the northern and southern edges of the shire.

A further quarter of the shire is under degraded native vegetation, which occurs in national parks and water reserves as well as on private land. The extent of its degradation is unknown but much may be degraded to the point where it does not give a good guide as to pre-European vegetation. Causes include burning, clearing that has since reverted to native vegetation, logging for sawn hardwood and mine props and extensive grazing, browsing and trampling by livestock.

Of 36.5% of the shire that is not under native vegetation only about half can be accounted for by areas that are under built-and-related covers or crops-and-pastures as reported in the agricultural census of 2001. The other half includes small areas under planted exotic forests and small areas of land disturbed by quarrying and the like, but little is known about the rest. It is likely that much of the rest has been retired, more or less, from grazing. If so, it may be subject to both secondary successions (including invasive natives such as *Callitris*, as well as introduced vegetation species such as the noxious weeds, blackberry in the east and serrated tussock in the west) and planned planting of native and exotic species.

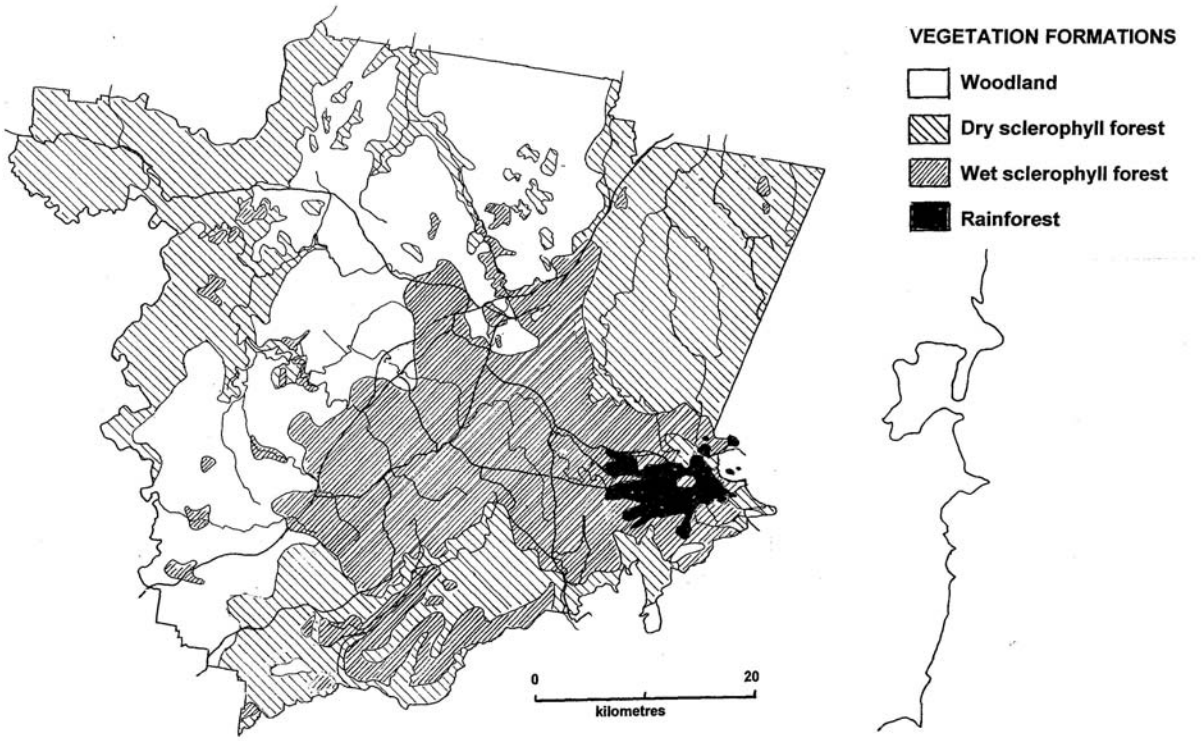


Figure 23: Pre-1750 vegetation. *Sources: Tindall,* et al *(2004)* and *Ecological Australia (2003).*

13 Natural Vegetation

Figure 24: present-day land covers. *Sources of data: ABS* agricultural census, 2001; *Ecological Australia (2003), Forestry Commission (1986); Wells at al (1986) WSC,* State of Environment *reports.*

In the absence of historical records, geographical patterns of natural vegetation are mapped on the basis of the broad structure (formations) and floristic composition (communities) of pre-European vegetation, inferred from present-day patterns of native vegetation.

The native vegetation of the Wingecarribee has been mapped by Tindall *et al* (2004) and Ecological Australia (2003), with parts also mapped by Fisher *et al* (1995). There have been other studies of particular areas and individual communities such as the Wingecarribee peats and Robertson rainforests. Many of these are referred to in management plans such as for the Morton and Nattai National Parks.

Useful overviews have been published by the Robertson Environmental Protection Society (1993 and 1995). Howell and Benson (2000) offer insights that can be usefully applied to the shire.

It is unsurprising that there is general agreement only in the patterns of communities mapped by Tindall *et al*, Ecological Australia and Fisher *et al*. Detailed vegetation mapping is not easy. Most is done on the basis of air photo interpretation with some ground-truthing and is open to errors. Even with large-scale air photos it may be difficult to determine the structure of closed vegetation, while the small number of sample sites in an area makes it difficult to establish floristic composition.

In the Wingecarribee the problems of mapping are magnified by often-subtle changes from place to place in temperature regimes, moisture availability and nutrient status. This makes it difficult to produce a generalised map of native vegetation. Imagining the natural vegetation of areas now cleared from current patterns of native vegetation is even more difficult because it relies extensively on extrapolations from what sometimes can be seen only in disturbed roadside and other remnants.

The map in *Figure 23* is based mainly on the mapping by Tindall *et al* of native vegetation and on data in community profiles included in Ecological Australia's report. Inferences about pre-European vegetation in areas that have been cleared follow those of Ecological Australia but the formations into which communities have been mapped are based on community descriptions rather than names.

Of the formations in the shire, rainforests are of particular interest as examples of *refugia* or 'islands', remnants of a formation that was more widespread many thousands of years ago. In the vicinity of Robertson relatively heavy and reliable rainfalls are complemented by soils with high nutrient status and moisture-holding capacities, which have enabled rainforests to survive.

Rainforest vegetation has four layers of vegetation, (synusia) often intertwined by lianas. In the Robertson Rainforests closed canopies are dominated by tall (30 metres) broad-leafed tree species. These include blackwood (*Acacia melanoxylon*), lillipilly (*Acmena smithii*), sassafras (*Doryphora sassafras*) and coachwood (*Ceratopetalum apetalum*) in warm temperate rainforest. They include pinkwood (*Eucryphia moorei*) and possibly-invasive brown barrel (*Eucalyptus fastigata*) in the more common cool temperate rainforests. Sub-canopy, shrub and ground layers include tree ferns, palms and a range of distinctive generally broad-leafed flowering plants largely endemic to rainforests. Because the dominant species were useful for sawn timber, the rainforests have been decimated since European occupation.

Sclerophyll forests may be classified according to their structure (eg with open or closed canopies) or

by the composition of their flora (eg adapted to wet or dry conditions). Because of the often-subtle changes across the plateau of the Wingecarribee in relief, moisture and temperatures often associated with changes in nutrient status, and the human disturbance of natural vegetation it can be difficult to determine the kind of sclerophyll forest in a particular place.

Wet sclerophlyll forests are found across the Wingecarribee in a distribution closely matching the areas both of moderate rainfalls and of shales, particularly on the plateau. They include the Robertson Tall Open Forest community, which is transitional to rainforests, the Southern Highland Shale Woodland (actually a forest) that may have covered a fifth of the shire and a number of island communities on higher land to the west of the shire.

Typically, wet sclerophyll forests have three layers. Tall (30 metre) eucalypts dominate mature communities, including various peppermints (*E dives, elata, fastigata* and *piperita*) and mountain grey gums (*E cypellocarpa*). Shrub and ground layers are dense and may contain broadleafed species and ferns but generally are made up of narrow and hard leafed species more tolerant of variable rainfall conditions. Most of these forests have been cleared. Many of the dominant species were valued for sawn log and pole timber and hardwood timber, supporting a hardwood timber industry that was extensive towards the edges of the plateau well into the twentieth century.

Dry sclerophyll forests are found on the valley floors and hillsides of gorges and canyons on the margins of the plateau where lack of moisture limits growth but soils are reasonably fertile. They form parts of transitions in which the distinction between forest and woodland is controlled by the existence of seepages from exposed sandstone in the Shoalhaven, Wingecarribee and Wollondilly gorges and in the gallery forests of the Nattai and Nepean River systems. On the valley floors of the Wollondilly, Wingecarribee and Shoalhaven Rivers there are riparian *Casuarina* fringing forests.

Dry sclerophyll forests also have three layers but their canopies are generally lower (15 metres) and more open, often grading into woodland. Eucalypts are generally dominant, including gums (*E punctata and tereticornus*), yellow box (*E melliodora*) and stringybarks (*E eugenoides* and *globoidea*), but the Bindook Porphyry Woodlands are dominated by kurrajongs (*Brachychiton*) and sweet pittosporums (*P undulatum*) and the fringing forests by she-oaks (*Casuarina cunninghamana*). Open under-stories of shrubs and small trees may include broadleafed species. Ground covers may include bracken fern.

Woodlands occur in transitions between dry sclerophyll forests and exposed heaths mainly to the west of the plateau, often where communities have been degraded by grazing. These communities have canopies that are lower than in forests and very open, with ground covers of light-tolerant grasses and grass-like species. Eucalypts are dominant with gums (*E punctata and sclerophylla*) and Silvertop Ash (*E sieberii*) on better sites and peppermints (*E piperita*) and stringybarks (*E agglomerata*) on poorer ones.

Throughout the shire there are smaller areas of wetland with communities including the sedge-dominated (*Carex*) peat bogs of the Wingecarribee and west of Penrose. These upland swamps are dominated by scattered eucalypts and by shrubs that include tea-trees (*Leptospermum*) and bottlebrushes (*Melaleuca*). Grass-like species form more continuous ground covers. These peat bogs, which have developed only over the last 15,000 years, have been mined. This helped to bring about a collapse of the Wingecacribee peat in 1998, which has required considerable expenditure since to protect the Wingecarribee Dam downstream.

In many places the remnants of the shire's natural vegetation are now rare and considered to be endangered by natural and human processes. Often they provide habitat for faunal species that are also endangered. Problems of weed invasions and lack of regeneration present particular problems for managers.

Even where natural vegetation has remained relatively undisturbed as in much of the Morton and Nattai national parks and Sydney Water catchment reserves, natural processes are being inhibited by human activities. An example is the way in which altered fire regimes are affecting the regeneration of native species. In nature, cool burning cycles of thirty years in the case of moist forest and fifteen for dry forest and woodland (but never for rainforest) were necessary for regeneration of many species. These cycles no longer happen.

The remnants of five plant communities - the Southern Highlands Shale Woodlands, the Robertson Basalt Rainforest and Robertson Basalt Tall Forest, the Mount Gibraltar (wet sclerophyll) Forest and the Montane Peatlands – have been gazetted as 'endangered ecological communities'. A number of individual plant (and animal also) species have also been gazetted as threatened or endangered.

Social Patterns

14 Population

The main sources of information about the human populations of Australia are censuses of population and housing taken now by the ABS every five years and until 1971 by the Commonwealth Bureau of Census and Statistics and Commonwealth (CBCS) and Colonial Statisticians less frequently.

These censuses are *enumerations* of the people in the places they were at on census nights. They do not report the total *residential populations* of these places, although unpublished information about people based on their places of residence has been available (at a price) from recent censuses.

Estimates of residential population (ERP), which use information about births and deaths and overseas and domestic migration as well as data from censuses, have been published annually for LGAs only since the 1940s. Enumerations for the Wingecarribee have been available since 1841.

For the Wingecarribee the distinction between enumerated and residential populations has become important in recent decades. Increasing percentages of people have been absent from their places of residence on census nights, leading to significant numbers of residents being overseas or counted elsewhere on census nights. Also, significant numbers of visitors have been counted in the shire.

In the Wingecarribee, the ERP in mid-2001 was 42,740. The census count in the shire in that year was 40,840, of whom 39,323 (96.3%) were residents. 1640 shire residents (3.8% of the ERP) were counted elsewhere in Australia, giving a total of 40,963 residents in Australia on census night (95.8% of ERP). The remaining 1777 (4.2% of ERP) was either overseas on census night or else accounted for by under-enumeration in the census.

It is known that there is some under-enumeration in censuses. There is also currently some debate about whether ERPs are being overestimated. So, while they are the best available sources of data on population, both censuses and ERP need to be used cautiously for what they tell about ‘small areas’ such as the shire and especially localities within it.

Little is known about the aboriginal occupation of the Wingecarribee over a period of some 19,000 years. Although the Gundungarra people left records on trees most of this ‘literature’ has been cleared (WSC, 2004a:111). By the time that Europeans came to make records the local aboriginals had been considerably disrupted. There are however many hundreds of former aboriginal sites. A quarter of the 402 registered sites are camp sites under rock overhangs and in woodlands near water courses. There is evidence also of a track between the coast and inland via a settlement near Sutton Forest (WSC, 2004: 113). Presumably this was used for trade and seasonal movement and it suggests some kind of permanent occupation.

The first European settlers arrived in 1821. By 1861 their numbers in the Berrima Registry District had grown to a mere 3237. At that time Berrima (with 384 people) was the only clustered settlement for which population was reported, although both Nattai (now Mittagong) and Sutton Forest had been established by then.

Over the next fifty years to the first Commonwealth census of 1911, the European population grew to 9763. There was a short growth spurt between 1861 and 1871when most of an increase of nearly 1300 was associated with the private establishment of three new towns and the government settlement of the Yarrawa Brush and Robertson in the 1860s. Otherwise, rates of growth during the nineteenth century were slow, even by comparison with the slow rates in the colony generally.

None of the early villages thrived. Most of the population growth was in the three towns of Bowral, Mittagong and Moss Vale, which grew after the opening of the Sydney-Goulburn railway in 1867. By 1911 forty per cent (4207 people) of the total population was in the three main towns. A further thirty per cent was in ten localities that contained villages, seven of whose populations had declined since 1891. There was slow growth overall in rural areas.

In the first fifty years after Federation, the population continued to grow, but still at rates slower than in New South Wales overall and, as *Figure 25* shows, at rates that slowed after the First World War. By 1954 the total population was still only 18,165. Bowral remained the pre-eminent town during this period but, even with the incorporation of Burradoo into Bowral in 1954, it grew at a rate slightly slower than Moss Vale. By the 1950s the populations of the three main towns had grown to fifty per cent of the total.

During this period, growth in rural areas stalled but in the villages there were divergent trends. Apart from Bundanoon and Robertson, where there was population growth after 1891, the older established

villages were in decline throughout the period. However a number of other villages in the north and southwest appeared in censuses as localities with small but growing populations. The percentage of the region's population in village localities overall fell to below twenty.

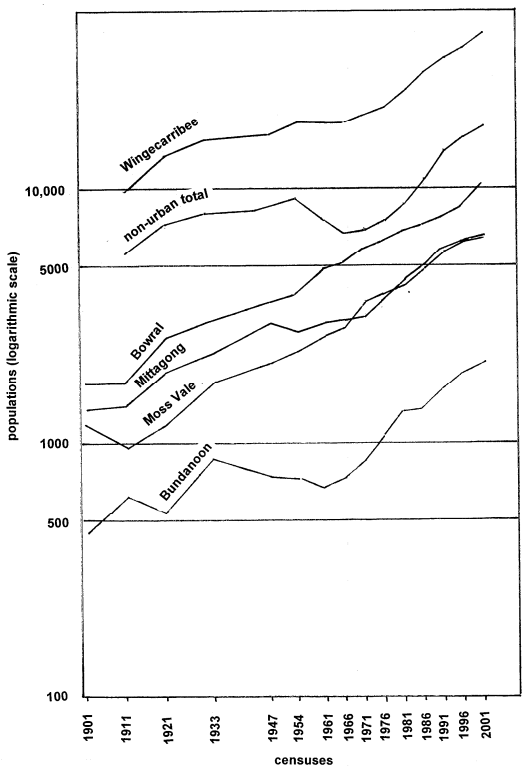


Figure 25: Enumerated populations, 1901-2001. *Data from CBCS and ABS.*

Since the 1950s long-term rates of growth have risen, particularly in recent decades. Population in rural areas declined sharply into the 1960s but has risen since then. The populations of the three towns have grown at rates rather faster than that of the shire overall, to nearly sixty per cent of the total. Village populations have grown steadily although their share of total population has remained at around twenty per cent (comparable to the percentage now of rural population).

Some notable changes in population have taken place during this period. Bowral remains the largest town although until the 1990s its growth rate was slower than its smaller rivals of Mittagong and Moss Vale. Bundanoon and Robertson have grown considerably but at rates slower than the three northern villages of Hill Top, Colo Vale and Yerrinbool. Growth in smaller villages has been slower, with population declines in several cases.

Although the trend in population throughout these fifty years has been upward actual rates of change have fluctuated from year to year. In the late 1960s and again in 1985-6 ERP actually fell (see *Figure 26*). Over other years in the early 1980s and in the late 1980s ERP has grown at rates exceeding four per cent annually. This volatility in growth rates continues: there was an increase of 3.2 per cent in 1999-2000 but growth since mid 2003 has been at only 1.0 per cent annually.

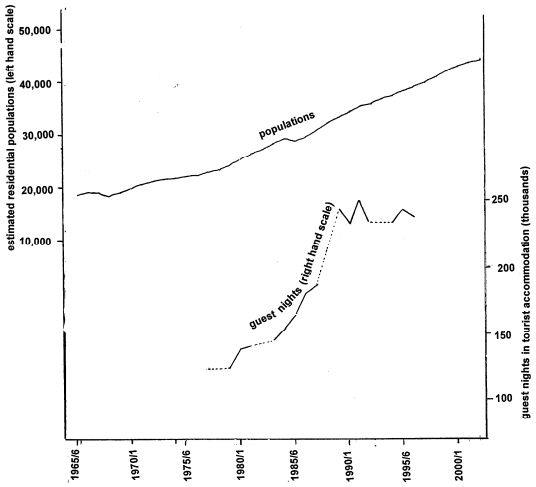


Figure 26: Estimated residential populations, 1966-2005, and annual tourist guest nights. 1977/8-1996/7. *Data from CBCS and ABS.*

Much of this volatility has stemmed from fluctuations in domestic migration. While rates of natural increase in ERP have declined steadily since the 1980s as births fell and deaths increased, net immigration has grown, to account for three-quarters of the increase in ERP, 1986-2001.

But migration is a fickle thing: it varies with economic conditions and in-migration may not always exceed out-migration. During 1991-6, a period of high net immigration, in-migration totalled 9869, exceeding out-migration which totalled 6192. More recently, rates of both in-migration and out-migration may have fallen.

Migration has been important in the composition of the shire's population. The total of net immigration during the years between 1986 and 2001 was equal to a quarter of ERP in 2001. As this net migration masks a relatively high turnover of people it is likely that relatively recent immigrants make up considerably more than a quarter of the shire's population. Natural increase (the excess of births over deaths) accounted for another fifteen per cent.

15 Settlement Patterns

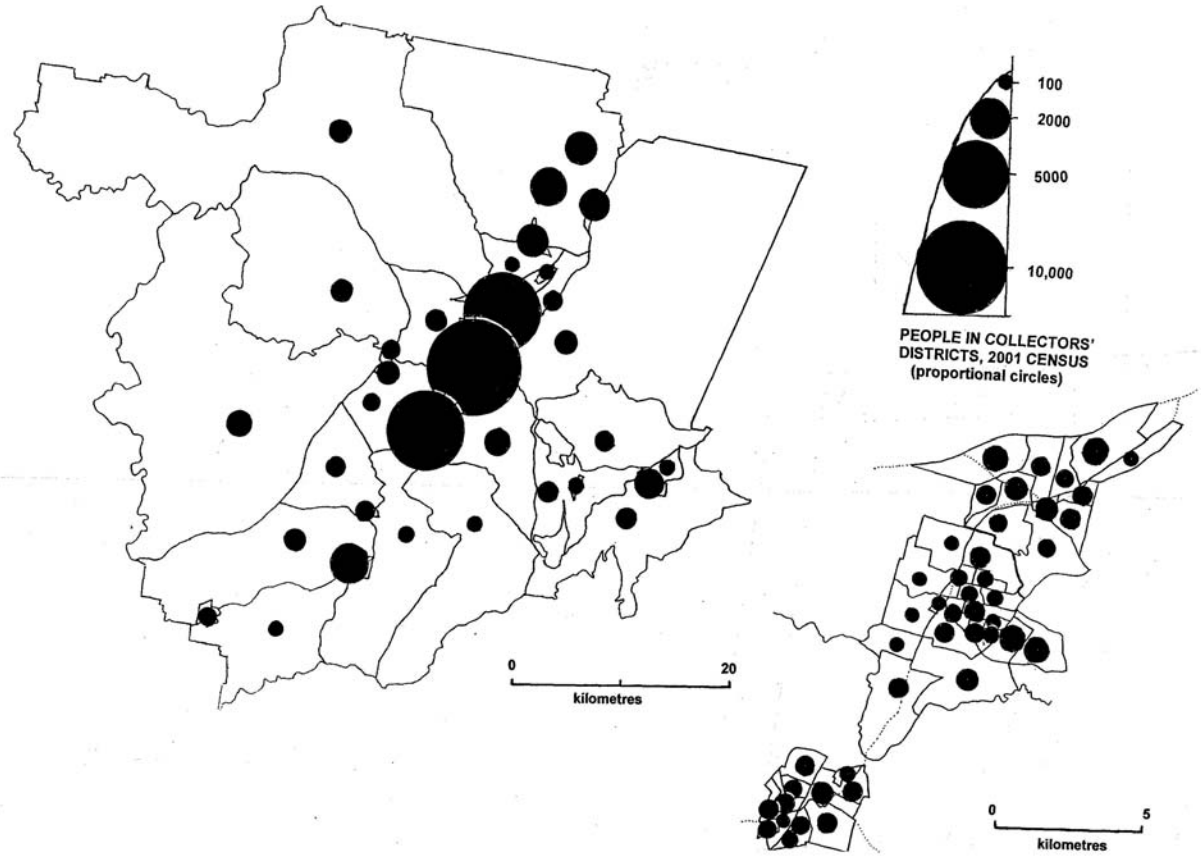


Figure 27: Enumerated population, 2001*. Data from ABS. Note: proportional circles in the left hand map represent Urban Centres, other Bounded Localities and rural Collector's Districts across the shire; in the right hand map they represent Collector's Districts in the Urban Centres of Mittagong (including Willow Vale) and Bowral (which are separated by a bold line) and Moss Vale.*[1]

The Wingecarribee in early 2006 had an ERP of about 45,000, a tiny 0.64% of the population of NSW. Most of this population is concentrated into clustered settlements (towns and villages) which are strung out along a roughly north-south axis that runs through the centre of the shire (see *Figure 27*).

More than 25,000 people (a larger population than Goulburn's) live in a more or less contiguous urban area in the centre of the shire, which comprises the urban centres[1] of Moss Vale and Mittagong, both with over 7,000, and Bowral with over 11,000. This urban area accounted for 57.0% of the shire's population at the 2001 census (*Figure 28)*, a degree of primacy within its region that is similar to that in other regions in advanced economies generally. The Sydney UC has 55.0% of NSW's population, for example. What is unusual is that the urban area comprises three separate UCs, none of which is clearly dominant within the urban area.

The Bowral UC as defined by the ABS (which includes one CD in what traditionally was Mittagong) had only 25.5% of the shire's enumerated population in 2001. Neither of the other towns had populations approaching this though if Willow Vale is treated as part of the Mittagong UC Mittagong's population gets closer to that of Bowral[2]. The combined population of all of the smaller towns and villages for which official

[1] For census purposes the ABS divides statistical local areas such as the shire into Collector's Districts (CDs). Where populations are clustered in towns and villages, CDs are aggregated into Urban Centres (UCs) which have populations of 1000 people or more and Bounded Localities (BLs) which have fewer than 1000 people. This 'statistical geography' gives the basis for *Figure 27* and many figures that follow. It is shown in more detail in *Figure 50*.

[2] For this reason the Willow Vale/Braemar CD is mapped in the insert in *Figure 27* and in all subsequent CD-based maps.

Table 1: Wingecarribee: Enumerated populations of clustered settlements, 2001[1]

Bowral	10,402	Robertson	1023	Wingello	295
Moss Vale	6623	Yerrinbool	973	Sutton Forest	218[2]
Mittagong	6270	Willow Vale/Baremar	872	Burrawang	191
Bundanoon	1950	New Berrima	559	Penrose	169[2]
Hilltop	1607	Exeter	359	Balmoral	165[2]
Colo Vale	1180	Berrima	320	Aylmerton	159

Notes: [1] Bowral includes Burradoo; Mittagong here includes Balaclava but not Willow Vale/Braemar
[2] These are 'equivalent person' estimates from SCA, 2003:17

Data from ABS 2001Census and SCA (2003)

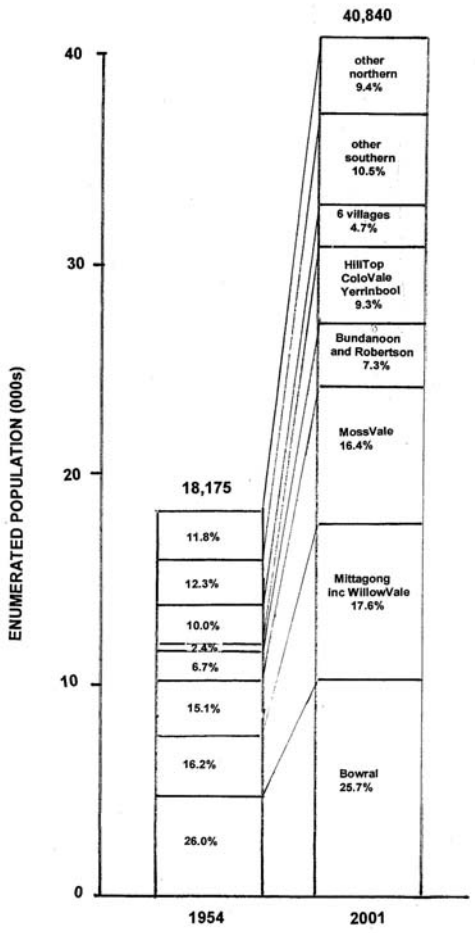


***Figure 28: Geographic composition of the enumerated populations in 1954 and 2001**. Data from CBCS and ABS censuses.*

numbers were available was less than that of Bowral (Table 1 and *Figure 28*).

Outside the towns and villages settlement densities are very low At the 2001 census the rural CDs of the shire averaged 3.1 persons per square kilometre (psk) in the rural CDs of the shire, falling to two in remote CDs. Even where rural living has replaced farming the highest population density was only 21.1 psk, in a CD just east of Mittagong.

In the villages, population densities based on the boundaries of BLs ranged from 1.03 per hectare in Wingello to 4.37 in Berrima. In the smaller towns they ranged from 2.49 per hectare in Robertson and 2.61 in Bundanoon to 7.20 in Hill Top. Population densities in the three main towns averaged 3.44 per hectare in Bowral, 3.55 in Mittagong and 7.59 in Moss Vale. Private dwelling densities were also low, at 1.55 per hectare in Bowral, 1.49 in Mittagong and 3.09 in Moss Vale.

In the main towns, densities are highest in the older and more central parts of the towns. Here, there are many people in non-private dwellings such as hospitals and school boarding establishments and private dwellings are closely spaced and sometimes attached (but even in Old Bowral detached houses accounted for more than the 70.9% of private dwellings, which was the average for the Sydney UC). The spate of medium density development[1] since 2001 (see Census Applications, 2004), has increased percentages of attached dwellings here but population densities may not have been much affected by this as household sizes tend to be smaller in medium density dwellings.

Only one CD – in western Moss Vale, with 18.7 people per hectare in 2001 – was even close to Sydney's average density of 20.3 per hectare. Only one – in Old East Bowral, with 8.49 private dwellings per hectare – had dwelling densities as high as Sydney's average of 7.8 per hectare, though two others, in western Moss Vale and central Bowral, went close.

On the outskirts, settlement densities in parts of West Bowral, Burradoo and Mount Gibraltar are so low as to stretch the definition of what is 'urban'.

[1] 'Medium density' in a residential area is considered to be more than 15 dwellings per hectare. A residential area of 'quarter-acre' allotments might contain 8 dwellings per hectare after allowing for roads and reserves.

16 The towns

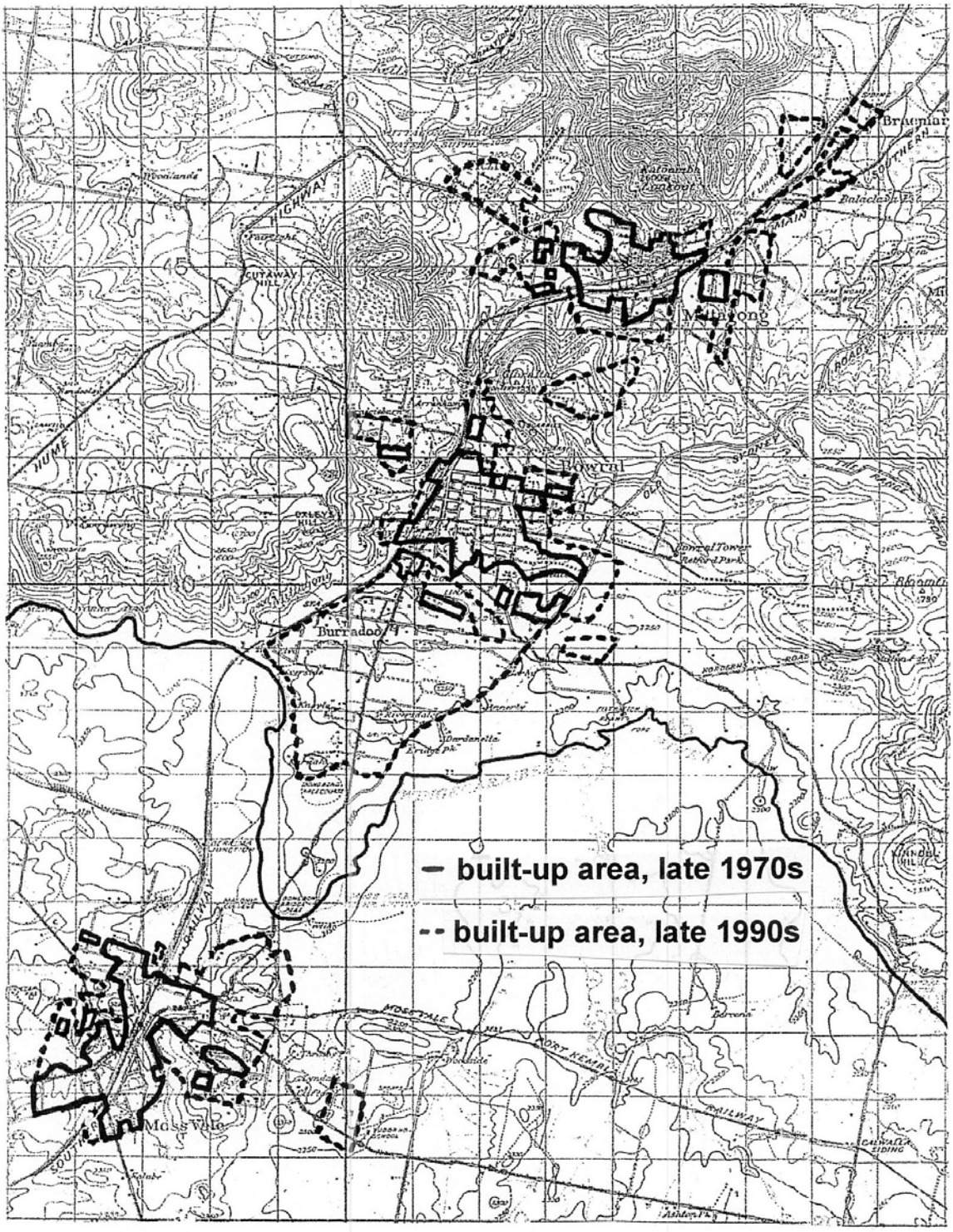


Figure 29: Built-up areas of the Wingecarribee towns in the 1930s, late 1970s and late 1990s. *The base map is from Australian Section Imperial General Staff,* Mittagong *and* Moss Vale 1:63,360 topographic sheets *(1933; surveyed in 1930). Later built up areas are from Central Mapping Authority*, Mittagong *and* Moss Vale 1:25,000 topographic maps *(1978 and 1982, field checked in 1976 and 1982); and AUSLIG*, Burragorang *and* Moss Vale 1:100,000 topographic sheets *(2000, revised in 1998). The gridlines are spaced 1000 yards apart.*

Although little has been written about the physical development of the towns except in heritage studies that cannot generally be accessed, broad patterns and their change can be seen in three series of topographic maps compiled respectively in 1930 (at 1:63,360), 1978-82 (at 1:25,000) and more recently (in several editions) at 1:100,000), as well as in the twelve editions of Crathie's *Visitor Map of the Southern Highlands.*

Other sources of relevant information include the website www.highlandsnsw.com.au and Jervis (1986). Statistical data on building completions and (later) approvals are available also, for the main towns from 1919-20 till 1944/5 and for the LGAs since 1944/5, and on private dwelling numbers from censuses.

The first attempt to establish a town in the Wingecaribee was a government settlement at Bong Bong where the cart road from Sydney completed in 1821 crossed the Wingecarribee River. This settlement had an indifferent water supply, which led to suggestions of its removal to Sutton Forest where the nucleus of a village was forming in the late 1820s. Bong Bong survived for a while but the only relics of the settlement today are Christ Church south of the river and a coaching inn, now The Briars, to the north both built in 1845.

The original line of the road to the south included a difficult section through the Mittagong Range. This was by-passed by a road built further west between 1830 and 1836. The site for a new town was surveyed at Berrima on this line of road in 1831. Government functions were soon transferred to Berrima but although the village acquired inns and other commercial establishments (as well as a jail and a courthouse) it failed to thrive, largely because it had no agricultural hinterland of consequence.

Coaching inns developed elsewhere along the new road notably at Nattai in 1832, which became the nucleus of what is now Mittagong. Another road was cut to link Nattai and Bong Bong in 1852 and, because of its easier grades, its route was followed broadly by the railway that was being planned to connect Sydney and Goulburn.

Private subdivisions anticipating the railway created villages at Wingecarribee (1858, now Bowral), Nattai (1863, as New Sheffield), and Moss Vale (1864). By the time the railway was completed (1867) each of these had their established inns and other commercial establishments and towns developed around these, rather than around markets or other meeting places. A government town was surveyed at Fitzroy in 1862 (now Welby) but it failed to develop.

The railway was central to the commercial development of what are now the main towns. The railway station at Mittagong served the Fitzroy Iron Works and railway stations in Bowral and Moss Vale handled produce from Kangaloon and Robertson respectively in the new farming areas opened up in the Yarrawa Brush from 1862. Other businesses depending on the railway for their supplies or markets tended to follow nearby.

Most of the early buildings were strung along what became Bong Bong Street (Bowral), the Old Hume Highway (Mittagong) and Argyle Street west of the railway (Moss Vale). As towns grew commercially the civic buildings that followed in the 1880s sometimes had to be accommodated along secondary streets behind the main streets. Beyond these were scattered cottages and as time passed a number of grander houses on large residential allotments that extended into the rural hinterlands.

The establishment of municipal government in the three main towns in the 1880s was followed by infrastructure. Reticulated electric power came to Moss Vale in 1889 and generally from 1924, gas to Bowral/ Mittagong in 1889, water to Moss Vale in 1894, Bowral 1907 and Mittagong 1909, telephony in 1905 and sewerage to Bowral in 1935, Moss Vale 1937 and Mittagong 1939. This infrastructure enabled closer development near the main streets and new residential subdivisions on the outskirts.

During a period of confidence that followed the First World War there was extensive construction of commercial and residential buildings in the three towns accompanied by widespread demolition of dwellings, particularly in Mittagong. More substantial commercial buildings replaced smaller ones in the main streets of Mittagong and Bowral and the commercial area of Moss Vale was extended to the east of the railway. Houses in more 'modern' styles replaced older ones especially in Mittagong and Moss Vale, as well as being built as infill developments and on the outskirts.

Despite this building boom, which lasted into the 1930s, topographic maps (*Figure 29*) and municipal sewerage diagrams show that even Bowral still consisted of little more than a main street and a few built-up residential blocks in the back streets, with a few hundred houses on larger suburban allotments further away. Other space-demanding land uses such as schools and golf courses extended as far as and beyond the municipal boundaries.

Another period of confidence following the second world war was accompanied by a further building boom. There was some demolition and replacement of commercial buildings more particularly in

Bowral but, mostly, new dwellings now were on subdivided allotments further away from the commercial centres. This was helped by the extension of infrastructure beyond what had been municipal boundaries in the 1930s (for example into Burradoo after 1954 and beyond Old Bowral after 1981) and by the growing use of motor vehicles from the early 1950s.

This building boom has continued since the 1960s as households have become smaller but people have become wealthier. Average household sizes have fallen from 4 persons per household in 1954 (they were 5 in 1901) to 2½ in 2001. The number of dwellings built each year in the shire has quadrupled (to well over 400).

Since the 1960s there has been some commercial expansion into residential areas but, with few demolitions and two thirds of all dwellings (more than seventy per cent in Bowral) having been built between 1971 and 2001, most new dwellings have been sited on the outskirts. Industrial estates have also developed on the outskirts of Mittagong and Moss Vale.

This has led to a remarkable spread of the built-up areas of all three towns. Mittagong has spread especially to the northeast and west, Bowral to the south and dramatically to the east and Moss Vale to the northwest and especially to the east. As suburban housing has spread so have the larger residential allotments moved still further away from the main streets, even into rural areas. The extent of this was such that Council has imposed controls on rural subdivision across the shire and established a landscape conservation zone over much of the plateau under its Local Environmental Plan.

In very recent years a tide has turned against greenfield developments in favour of demolitions to make way for large commercial developments and for medium density residential developments in more central locations. There has been a strong spate of this kind of development in the inner areas of all three towns (see Census Applications, 2004). This has implications for the traditional built characters of the three towns because it is in the inner areas where the towns have most of their older-era dwellings.

Because these older-era houses and their precincts are towards the centres of the towns and along main roads they are very visible and it is easy to assume that they are more extensive than they are. In fact, the demolitions of the 1920s and 1930s have left very few pre-First World War houses in the three towns (less than five per cent of dwelling stock in Bowral and Moss Vale, and fewer in Mittagong). Now, as demolitions proceed, there are threats to the diminishing stock of inter-war houses also (which now account for fewer than fifteen percent of dwellings, and less in Bowral).

There is now a very real threat to the survival of ordinary, older-era houses, which would compromise the built characters of whole inner areas of the towns. These built characters are important in making the Wingecarribee's towns different from other towns.

These demolitions raise interesting and difficult questions about conserving built heritage. There is now widespread support for conserving at least the 'characters' of individual older-era buildings that are of significance for particular communities. There is less understanding of how to conserve the characters of whole precincts

Most of the older-era dwellings that are formally protected in the Wingecarribee are grander ones on the outskirts of the towns and in rural areas. Few individual older-era commercial buildings in the towns have any sort of formal heritage protection. The shire has only two heritage conservation areas to conserve the characters of whole precincts. One is in Bowral, extending mainly along Bendooley Street where there are civic buildings and inter-war houses with large gardens. The other is the village of Berrima. There is however growing recognition of needs to protect the built characters of inner Moss Vale and Mittagong.

Away from the large towns, all of the smaller towns (except Robertson, a government town established in 1865) developed adjacent to stations on the railway of the 1860s. Bundanoon (after 1873), like Robertson, developed as a service centre for small farmers but acquired also the boarding and commercial establishments that are concomitant to tourism. Hill Top and Colo Vale were bypassed by a new line of the southern railway in 1919 and their growth since the 1980s has come with settlement by commuters working in Sydney.

In these smaller towns there is a mix of commercial and residential development along their main streets not unlike the mix in the main towns a hundred years ago. Residential development has spread from the main streets to the back streets only in the last few decades. The smaller towns and indeed the villages share some of the present development pressures in the main towns, particularly with the reticulation of water (since 1960, to most) and sewerage (Bundanoon since the 1960s and the northern towns since 2002).

17 Population changes

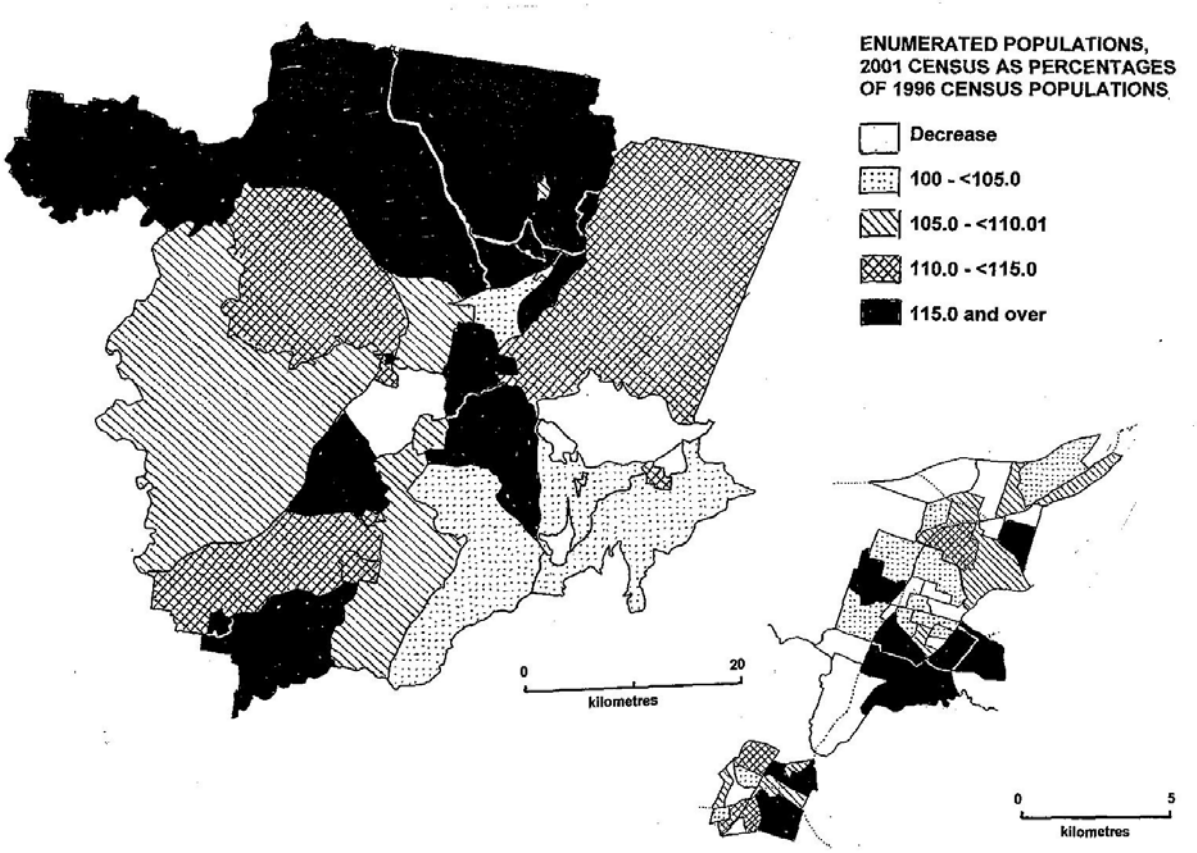


Figure 30: Population Change 1996-2001. *Data from ABS*

Censuses collect a vast amount of information about the people and dwellings in places on census nights, much of which is published by the ABS on CD-ROMs that may be accessed in public libraries.

The smallest areas for which census information is published are collector's districts (CDs). There were 81of these in Wingecaribee shire for the 2001 census, of which 44 were in the three main towns (including Willow Vale), 18 in eleven other urban centres (UCs) and bounded localities (BLs) and 19 were in rural areas. This statistical geography, which has been more or less in place since 1971 has allowed mapping of population patterns in considerable detail (see *Figure 27*).

In 2001 62.5% of the shire's people were enumerated north of the Wingecarribee River; in 1947 at its nadir 'the north' had only 56%). Over the past half century there has been a slow movement north of the demographic centre of the shire (which is now just north of the intersection of Old South and Kangaloon Roads in Bowral), which is reflected in *Figure 28.* However, the geographic pattern of change has been more complex than this.

Figure 30 shows recent changes in enumerated populations. Overall, there was an increase of 10.9% or 2.1% per annum during 1996-2001, twice that of NSW (5.5% over the period), but rates of change varied within the shire from a fall of 13.8% to an increase of 80.2%. These rates need to be treated with caution because of the influence of school boarding establishments on the populations of some CDs. Broadly the pattern of recent change has been one of high growth in parts of Bowral and much of the north and stagnation in the south.

This pattern of change reflects net migration both within the shire and from beyond. For the shire, changes between 1996 and 2001 to numbers in age cohorts suggest that as much as two thirds of net migration to the shire then was of younger adults and their children. Low median ages and high mobility in East Bowral and CDs in the north (*Figure 35*) suggest that these areas are attractive

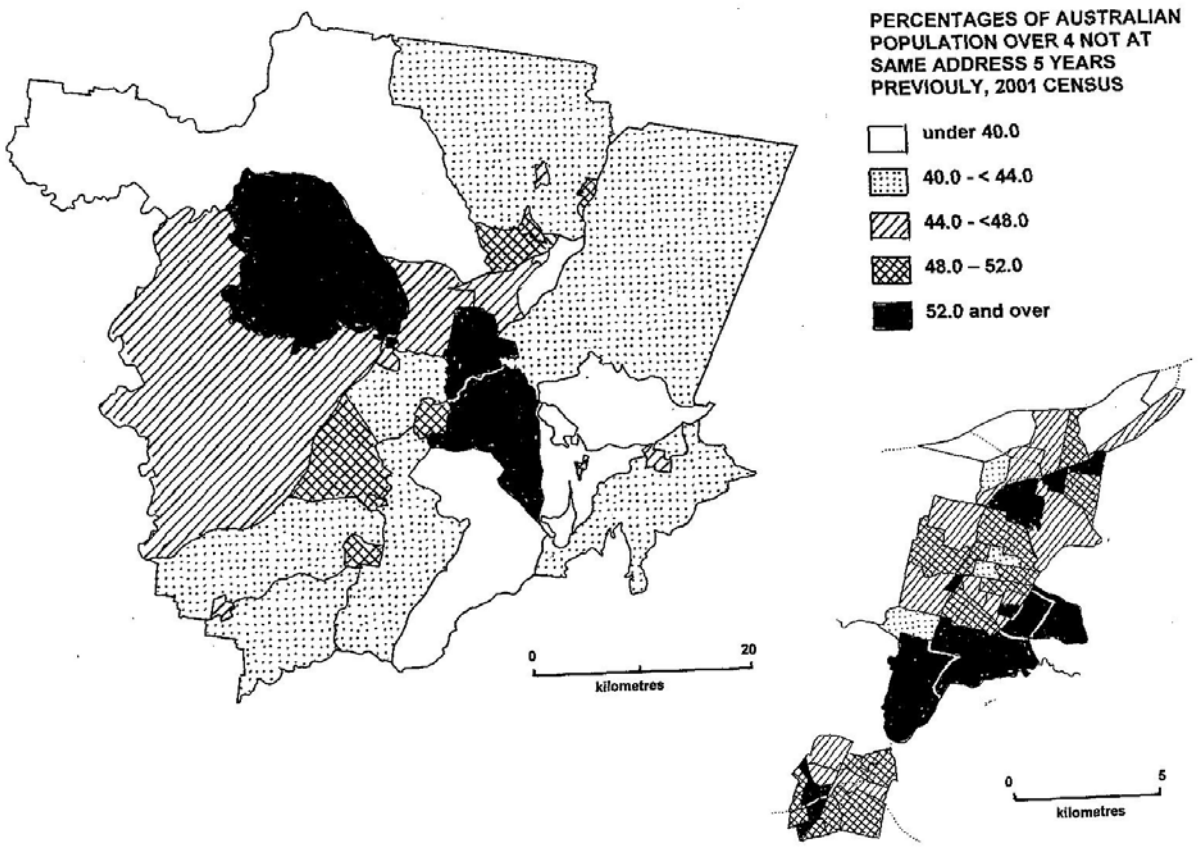


Figure 31: Population Mobility 1996-2001. *Data from ABS.*

for young adults and their children because of the relative ease of commuting from there to Sydney for work. Older median ages and high mobility in more central areas of Bowral and Mittagong reflect the attractions of these areas for older adults of pre-retirement ages.

Data on net migration and mobility may mask what is really happening because there is movement out of the shire as well as into it. Little is known about migration out of the shire but it seems that there may be strong movements, especially out the smaller towns and more remote rural areas, of younger adults for whom opportunities in the shire are limited. There may be some movements out of adults of post-retirement ages for whom services in the shire are limited. There are work-related movements, such as those of people employed in large organisation, which cannot be quantified.

Recent net migration into the shire is reflected in data on residential mobility, although high rates of residential mobility in the shire (49.3% compared with 44.1% in NSW) reflect also movement within the shire. The data mapped in *Figure 31* shows a tendency for people enumerated in some northern CDs, East Bowral and central areas in the main towns to have been more mobile than in the south, which has received fewer migrants.

The data on mobility embraces visitors to the shire. Overnight visitors from beyond the shire accounted for less than four per cent of the enumerated population in 2001 (lower than NSW) but there is considerable spatial variation within the shire (*Figure 32*). More than ten per cent of the population in six CDs were overnight visitors from outside the shire. There is information, none of it very recent (see *Figure 26*), which supports the suggestion in census numbers that numbers of people staying overnight in the shire have not changed much over recent years. Numbers of day-trippers (averaging maybe 2500 daily) have been similarly static for some years.

Of course, many residents were absent on census night. Data for 2001 in Census Applications (2004b) suggest that there may have been high percentages of absentees in the main towns and rural CDs adjacent to Bowral. This helps to explain the pattern of unoccupied dwellings shown in *Figure 33*, though many unoccupied dwellings will have been either untenanted or second homes often in rural areas or near golf courses in the towns.

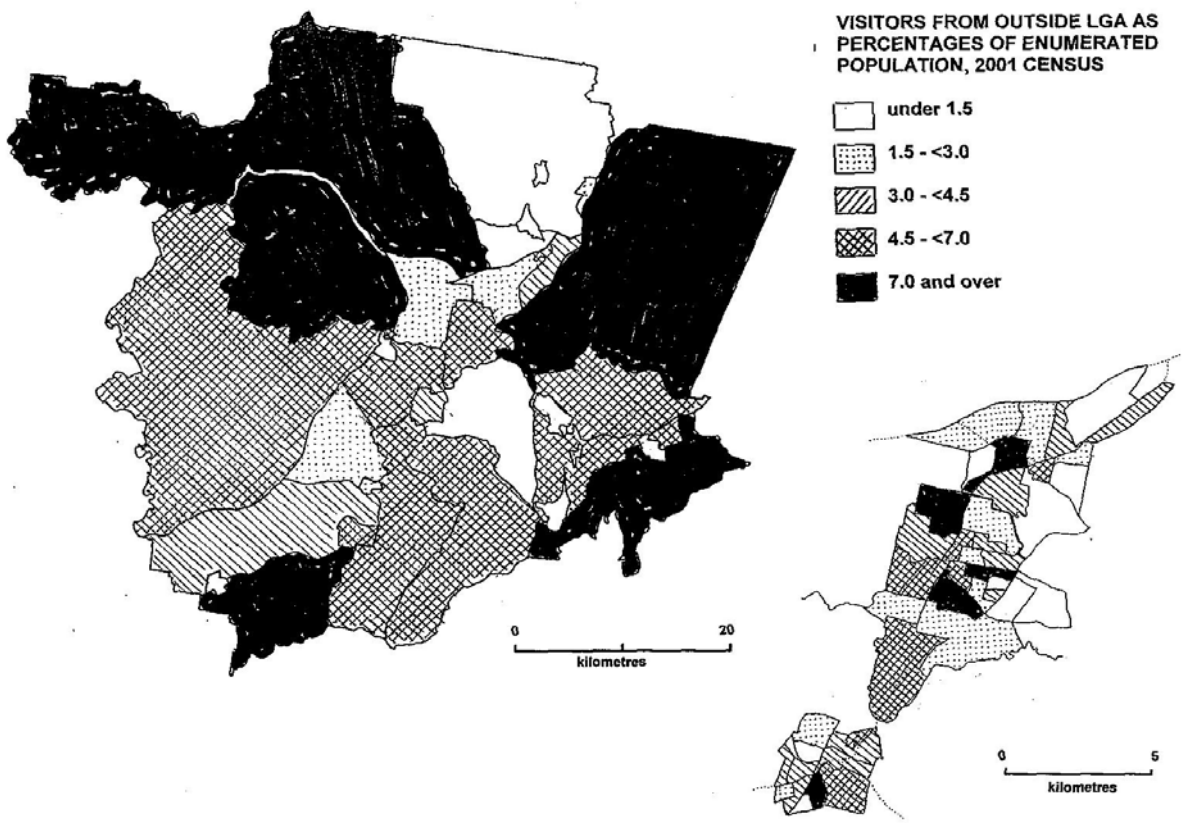


Figure 32: Visitors in the enumerated population, 2001. *Data from ABS*

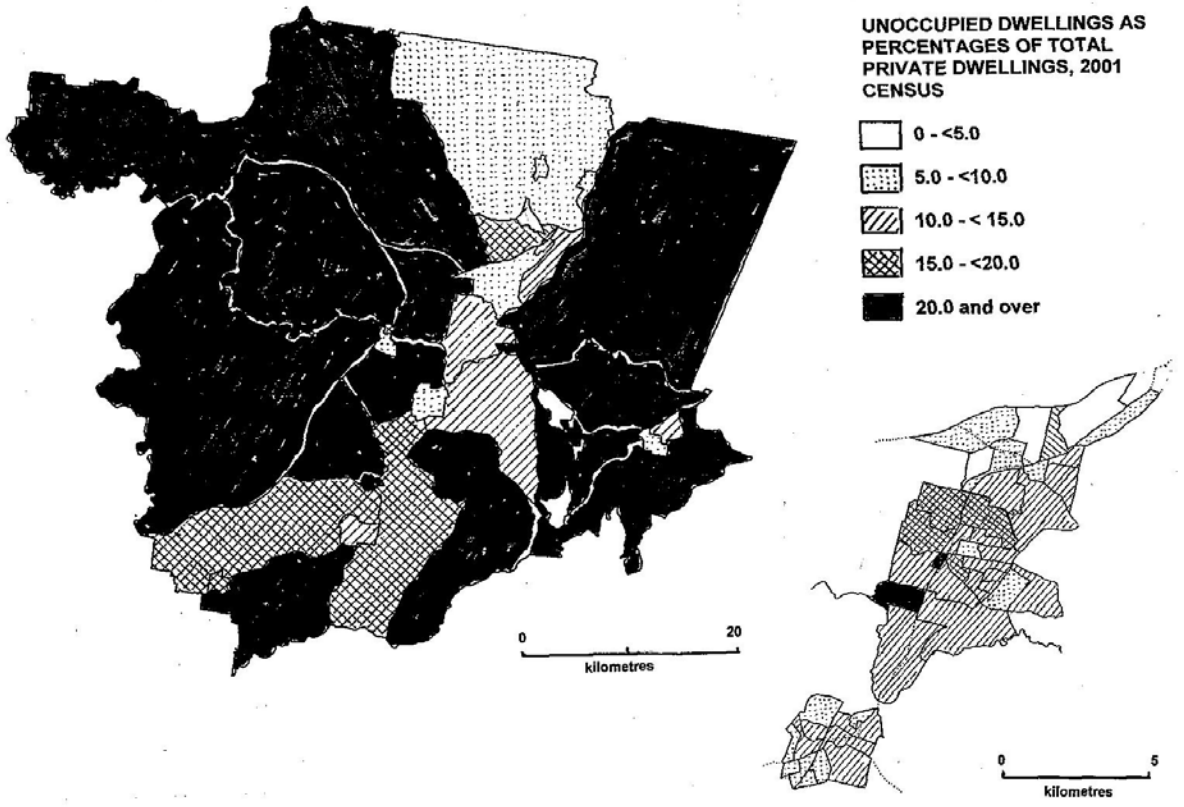


Figure 33: Unoccupied dwellings, 2001. *Data from ABS*

18 People and their households

Summaries of census data enumerated for the Wingecarribee in both 1996 and 2001 are available from Council. Of particular interest are data that have been aggregated into tables for 'localities'. These aggregations show that the shire is an area of great local diversity, even though some of the aggregations are of disparate CDs, which masks some of the diversity.

Table 2 shows some of this local diversity. For a number of attributes it shows values for Bowral (because it has a quarter of the shire's population), for the three main towns (which, combined, have nearly sixty per cent) and for the shire as an whole, which can be compared with values for NSW. It also shows ranges of values found across the shire's CDs (or sometimes localities).

The table reflects the fact that while the shire overall often is comparable to NSW, Bowral and to a lesser extent the other main towns tend to be more like Sydney.

In terms of some attributes, however, the people of the shire are anything but like Sydney. In their cultural and ethnic heritage they are both more 'Australian' and more 'anglo-celtic' than those of NSW (and indeed Australia). In terms of age they are older and ageing faster than the people of Sydney, like the populations of many 'sea-change', 'tree-change' and other inland LGAs. In terms of sex females are slightly more dominant than in either NSW or Sydney.

Birthplaces and the birthplaces of parents are more likely to have been in Australia. This is less so in some CDs in Bowral and Mittagong with people who are more affluent and more mobile. Here, most of the higher percentages of overseas birthplaces are accounted for by the United Kingdom (with few Scots) and New Zealand, which rank first and second after Australia on birthplaces.

Higher percentages in the shire than NSW claimed Australasian, British and (to a lesser degree) European ancestry and only 13.0% claimed ancestries not from Australasia or the British Isles, compared with 28.0% in NSW. The highest percentages claiming Australasian and British ancestries were in parts of Old Bowral and Burradoo. While it is possible to make too much of this there seem to be correlations in the shire between ancestry and religion. The shire is more 'Christian' and more 'Anglican' than NSW.

Age and sex at the 2001 census are compared with those of NSW in *Figure 34.* Pre-school and school age cohorts are more strongly represented in the shire than in the state, younger adults are under-represented and adults of pre-retirement and retirement ages are over-represented. There are also more males in most cohorts up to age 30 and more females in older age cohorts.

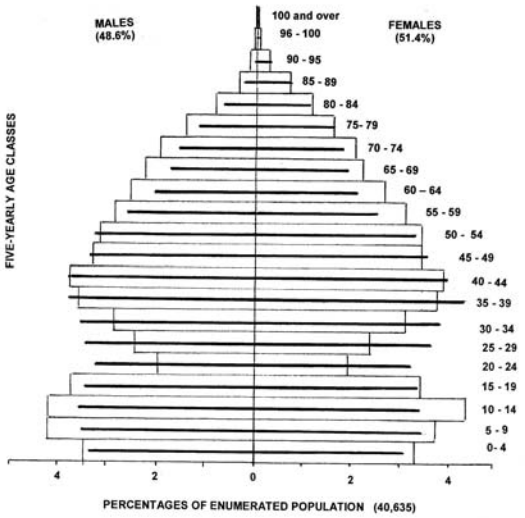


Figure 34: Age sex pyramid for the Wingecarribee and NSW, 2001 Census. *The bars represent the shire; the lines represent NSW. Data from ABS*

It should be noted that ERP data for 2001 shows a stronger representation of some older-age cohorts and a lesser representation of school age children than was suggested by the census (TPDC, 2005), a matter that will be discussed further below.

Age and sex composition changes over time. Both also vary from place to place, as is demonstrated for age in the median ages mapped in *Figure 35.* Variations over time and space reflect causal factors that include migration, family groupings and stages in life cycles. It is hard to generalise about these factors but broadly in the shire there are markedly older-aged populations in many urban CDs, notably in Burradoo, West Bowral and Old Bowral. Elsewhere, there are more young adults and their children and more working people. There

TABLE 2: WINGECARRIBEE: A SOCIOECONOMIC SNAPSHOT AT THE 2001 CENSUS

Attribute	Measurement[1]	Range[2]	Bowral	3 Towns[3]	Shire	NSW
1 Population	total enumerated	157-1191	10,402	23,295	40,840	6,371,745
2 Visitors	% from beyond shire	0-20.1	4.6	3.6	4.0	4.0
3 in non-private dwellings	% of enumerated	0-32.0	5.6	5.0	4.7	3.0
4 Population change	2001 as % of 1996	6.2-180.2	119.5	111.0	110.9	105.5
5 Population mobility	% >4 moved since 1996	28.6-89.8	54.5	51.7	49.2	44.1
6 Australian born	% of enumerated	66.5-92.5*	83.4	84.6	84.5	65.3
7 UK and NZ born	% of enumerated	3.5-11.7*	9.6	8.3	8.7	5.6
8 both parents born in Au	% of enumerated	58.8-73.6*	63.5	66.6	66.3	55.7
9 claimed British descent	% of non-Au descent	62.8-85.5*	79.5	77.3	77.0	56.8
10 claimed European descent	% of non-Au descent	86.3-100*	95.3	94.1	94.4	78.5
11 Median age	years	22-58	43	39	38	35
12 Dependency ratios	<15 + >65, as % of 15-65	44.3-97.9*	74.7	66.7	70.4	56.4
13 Now married	% of persons >15	nc	58.3	54.5	56.1	51.1
14 Never married	% of persons >15	nc	21.8	26.5	25.9	31.3
15 Mean household size	in private dwellings	1.5-3.4	2.4	2.5	2.6	2.6
16 in couple households	% in private dwellings	64.7-85.0*	72.8	68.5	72.7	67.8
17 in single households	% in private dwellings	9.5-35.3*	26.7	25.8	23.1	23.4
18 with tertiary qualification	% of persons >15	29.6-68.5*	47.8	44.2	44.1	41.3
19 with degrees and higher	% of persons >15	3.9-26.6*	19.4	14.4	13.7	15.5
20 Median individual income	$ per week	204-600	425	405	379	386
21 Median family income	$ per week	611-1454	1042	838	923	983
22 Median household income	$ per week	389-1271	820	744	766	828
23 in government schools	% of going to school	25.0-91.9*	42.9	51.7	57.5	67.7
24 Workforce participation	% of persons >15 in work	37.5-73.2	55.3	54.6	56.5	57.7
25 Older age workers	% of >65 in labour force	nc	7.1	7.7	10.0	7.1
26 Older age workers	% of >55 in labour force	nc	22.4	23.3	26.2	23.0
27 Part-time employment	% of employed persons	28.7-45.2*	39.7	38.6	38.2	32.2
28 Unemployment	% of labour force>15	0-11.4	4.3	5.1	5.0	5.1
29 Rural employment	% in rural industries	0-30.6	1.7	2.0	4.8	3.4
30 High status employment	% in Prof, Managerial	15.7-65.3*	48.3	39.2	40.5	41.1
31 Unoccupied dwellings	% of private dwellings	0-36.3	15.1	10.5	12.0	8.9
32 Detached dwellings	% occupied pte dwellings	79.0-100*	86.8	87.4	91.3	70.9
33 Homes owned/purchased	% occupied pte dwellings	64.9-94.5*	75.3	66.5	76.6	65.0

[1] Percentages are of totals enumerated, excluding overseas visitors (except for rows 1 to 4) and non-responses
[2] Ranges are from highest to lowest across 81 collectors district (CDs) or where asterisked (*) CDs aggregated into 34 planning localities
[3] Totals for Bowral, Mittagong and Moss Vale are for the 'urban centres' as defined by the Australian Bureau of Statistics

Au = Australia[n] nc = not calculated Prof = Professional pte = private

Data from Australian Bureau of Statistics and Wingecarribee Shire Council

are also strong tendencies for males to outnumber females in most remote or rural CDs, though females outnumber males in the shire by about five per cent. Females outnumber males in most urban and many village CDs

The demographic attributes of populations in small areas, especially CDs, can be greatly affected by locally unique features such as the location of retirement villages and the presence of 'non-private dwellings' such as school boarding establishments, hospitals, nursing homes, prisons and tourist accommodation. The presence of school boarding establishments markedly affects the demographics of six urban CDs (as well as probably unbalancing the ratio between numbers in government and non-government schools across the shire).

As an example, females outnumbered males by over 25 per cent in eleven CDs, in Old Bowral and Burradoo, Mittagong and Moss Vale, mainly where there were retirement villages and other medium density housing which is attractive to older and often widowed females or where there were school boarding establishments. There were relatively high percentages of older adults in CDs that had high percentages of visitors. Also, there were relatively

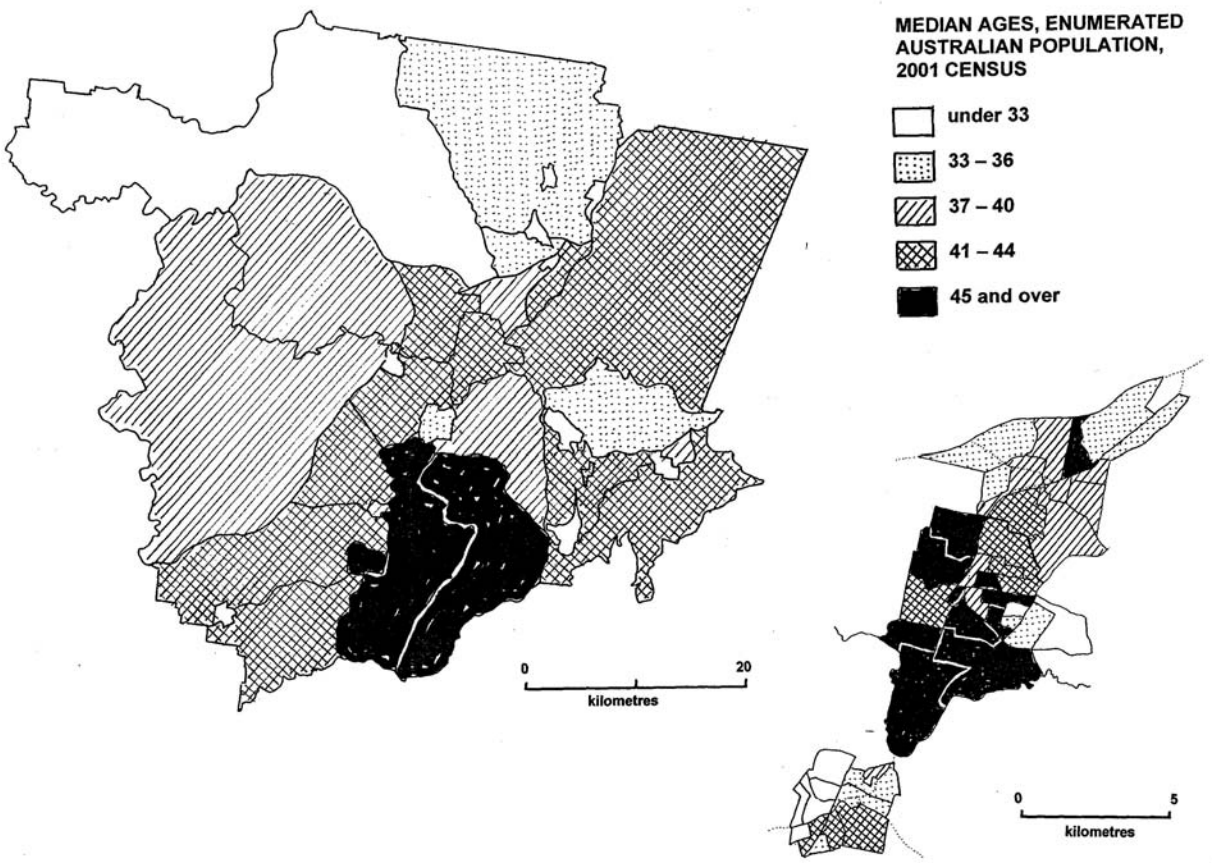


Figure 35 Median ages, 2001. *Data from ABS.*

high percentages of school-aged people especially males in CDs with school boarding establishments A further factor that makes it difficult to generalise about the demographic attributes of small areas is that published census enumerations include visitors from beyond the shire and exclude residents away from their homes on census nights. Bearing in mind that eight per cent of the resident population may not have been counted in the shire on census night in 2001, census data may give a somewhat misleading profile of the population of the shire.

A comparison of age/sex cohort data from the census and for ERP in 2001 suggests that the census under-enumerated younger adults (in the 20-39 age cohorts) who were absent for study or work and older adults (in the 50-74 age cohorts) who were travelling or in care elsewhere. It suggests also that the census enumerated slightly more females than are resident. The census may also have enumerated higher numbers of school-aged people than are resident. Censuses do not enumerate local students away from the shire in school and college boarding establishments, who are treated as usual-residents elsewhere. Their numbers may have been more than offset by those of children in school boarding establishments in the shire in 2001.

The great majority of the population of the shire (95.3% compared with 97.0% for NSW) was enumerated in private dwellings. There are no great differences from NSW in household types in these dwellings, other than a slightly higher percentage of households in the shire – and of people in them – that were couples without children on census night. There is an obvious correlation between the greater prevalence in the shire than NSW of couple families (with and without children), as shown in *Table 3* and the greater likelihood of people in the shire to be or have been married.

Census enumerations do not include family members who were temporarily absent on census night, including students away in school and college boarding establishments. Because of this family sizes may be underestimated but census data suggests that the average couple family with children has 2.0 children (compared with 1.9 for NSW) and the average single parent family has 1.7 children (compared with 1.9). It appears that families in the north of the shire may have more

children than ones in the south. Household sizes certainly are larger there (*Figure 36).*

TABLE 3: HOUSEHOLDS BY TYPE, 2001: WINGECARRIBEE SHIRE AND NSW[1,2]

	Shire % of hholds	Shire % of popn	NSW % of hholds	NSW % of popn
Couples and child(ren)	33.6	53.3	35.4	54.5
Couples without child(ren)	30.3	23.6	25.9	20.1
Single parents and child(ren)	10.8	11.1	11.5	11.8
Single persons	23.1	9.1	23.4	9.1
Group households	2.1	2.2	2.5	3.5
Other	0.7	0.6	1.3	1.1

[1]*Totals of households and of populations exclude unclassifiable households and visitor-only households*

[2] *Excludes family members temporarily absent on census night*

Data from ABS

That hints at a geography of households and families in the shire. For example, there is a pattern of larger mean household sizes in most rural areas and villages than in the main towns, especially in the north of the shire. Households are smaller in the more central CDs in the main towns.

There are clear relationships between household size and other attributes such as median age. CDs with higher median ages tend to have smaller average household sizes, higher percentages of couple families without children and higher percentages of single person households. These childless (on census night) families and households account for the majority of households in many urban, especially inner-urban, CDs.

Indeed, single person households are a majority of households in two CDs each in Old Bowral and Moss Vale. As most single persons are not in the workforce and as there are relatively large numbers of elderly females in these CDs it may well be that this pattern is an expression of a tendency for widowed women to live in retirement villages and other medium density housing.

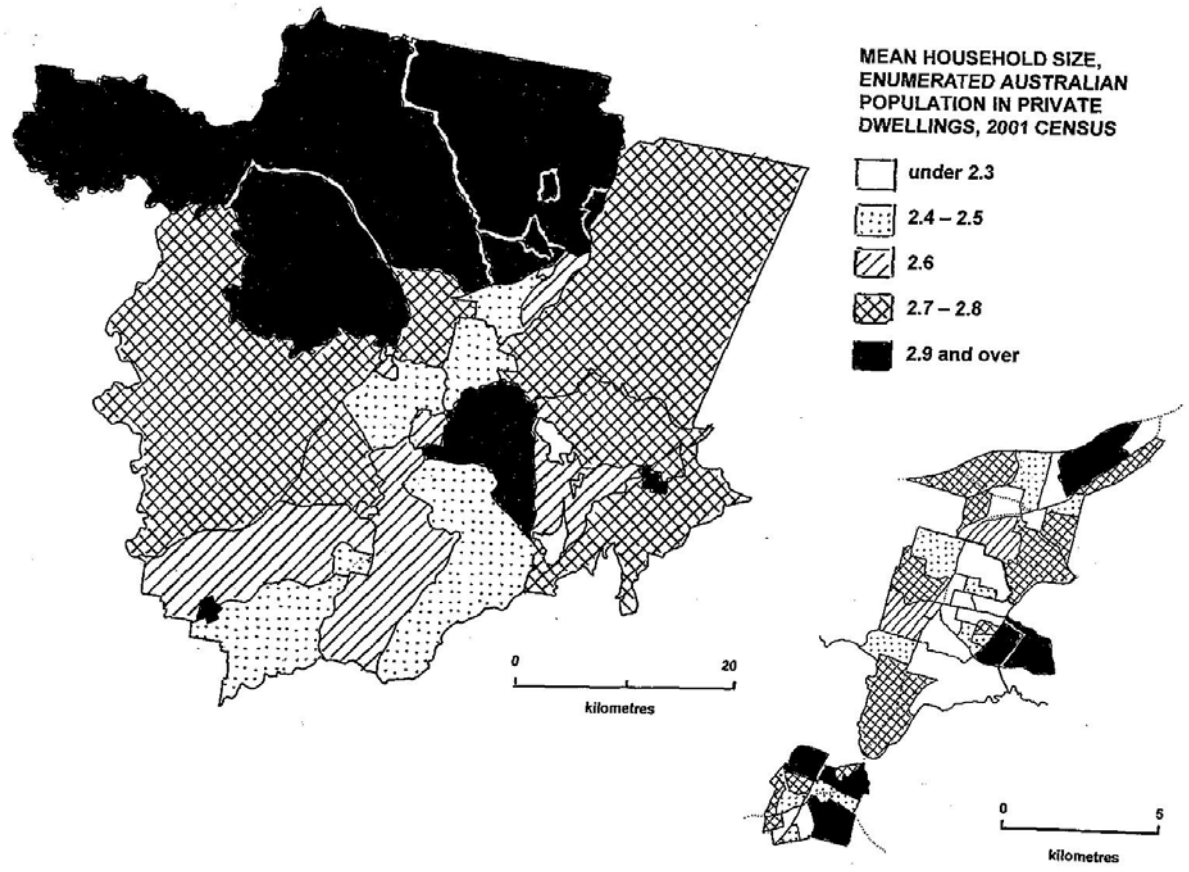


Figure 36: Mean household size, 2001*. Data from ABS.*

19 Work and Income

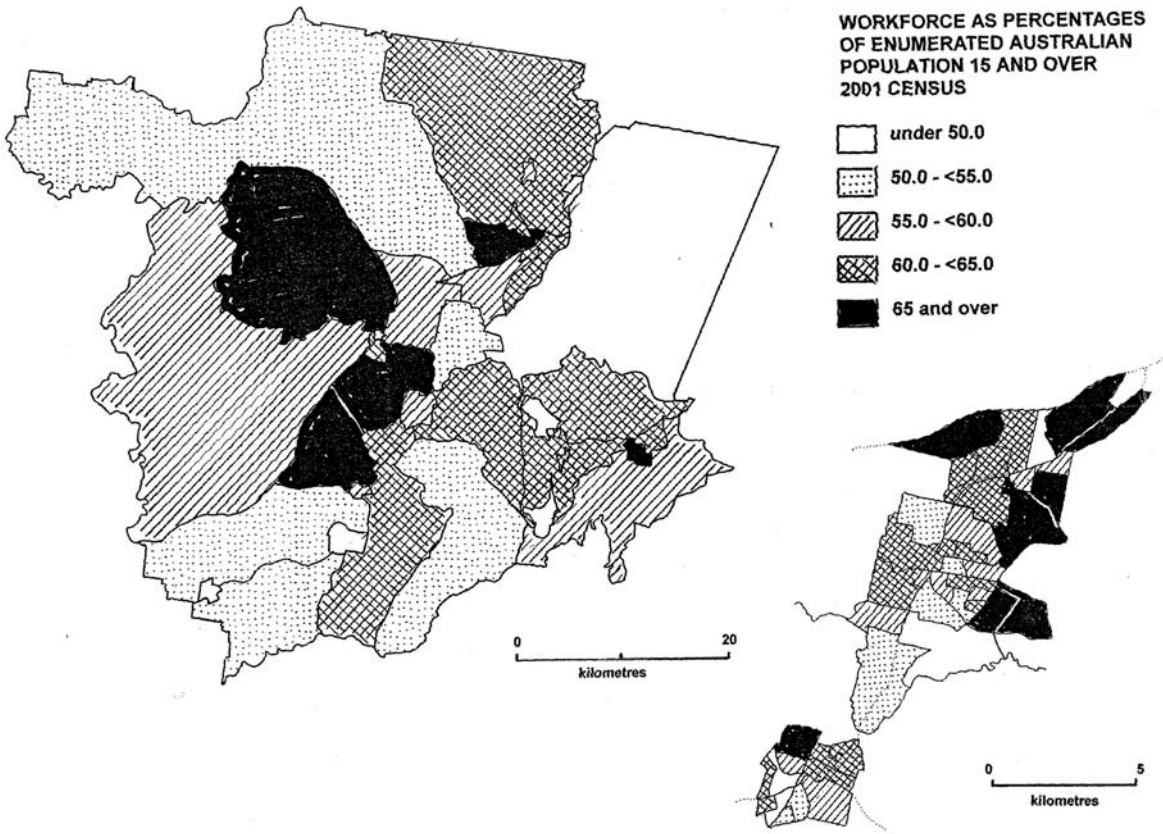


Figure 37: Workforce participation, 2001. *Data from ABS.*

The shire's percentage of its enumerated population aged 15 and over who were in the workforce in 2001 was much the same as that for NSW, but the percentage unemployed was lower. However, workforce participation in the residential population also may have been lower. Enumerated population appears to have included significant numbers of visitors still in the workforce, while significant numbers of students and retirees were absent.

A number of features distinguished the shire's workforce from that of NSW. Full-time participation was lower, female participation was lower, percentages of males as well as females working part time were both considerably higher and participation in both 'student' and older age groups was higher.

It is difficult to make sense of this. The likely explanation is that part-time work (less than 35 hours weekly) was preferred over fulltime by older-age workers, students and women with family responsibilities. Nevertheless, more than three-quarters of males and over forty per cent of females over 15 were in the workforce.

CD data on workforce participation (*Figure 37*) shows that participation was higher generally in and near the towns, where female participation and part-time participation also were higher. Participation was lower but part-time participation was higher in CDs where median ages (and median incomes) are higher, such as Burradoo, West Bowral, much of Old Bowral and other CDs closer to the towns. This suggests concentrations there of people who have fully or partly retired from the paid workforce. Female participation declined away from the towns.

The relatively high percentages of older people in the workforce in a few more remote CDs was probably a function of economic necessity or a reflection of the older ages of people working in rural industries.

Most people worked in service industries. While percentages employed in primary and secondary industries (such as agriculture, manufacturing and

construction) in the shire were somewhat higher than for NSW, percentages employed in consumer and community-oriented industries (such as retail trade, health and education) were considerably higher. Percentages in industries that support the functioning of the economy (such as financial services and government administration) were correspondingly lower.

The industrial distribution of the workforce has changed considerably in recent years as the service economy has grown. It has changed even more over the last fifty years during which numbers employed in rural and transport industries almost halved and employment in manufacturing has grown sluggishly *(Figure 38)*. During that time there has been rapid absolute and relative growth in consumer and community services and, more recently, in economic support services, all of which are industries that attract part-time and female employment.

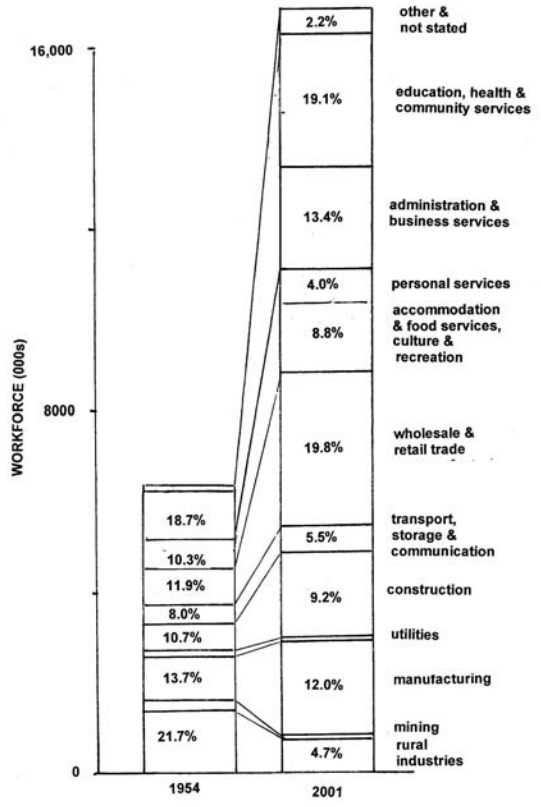


Figure 38: Industry of the workforce, 1954 and 2001. *Data from CBCS and ABS*

Most of the workforce growth between 1996 and 2001 was in part-time jobs, which is consistent with national trends. The number employed in full time jobs rose by 5.2%, which failed to keep pace with population growth. Part time employment rose by 29.0% but 'journey-to-work' data from the census (TDC, 1998 and 2004) suggests that this rise was entirely in jobs of less than 16 hours weekly, often amongst females and in older age groups.

With relatively high percentages of the employed being part-time, percentages of the workforce in managerial and professional occupations and in what might be described as 'promotion positions' were smaller than for NSW. Percentages of trades-people, paraprofessionals and labourers were higher. People in these lower-status occupations were geographically widespread throughout the shire whereas people in professional and managerial occupations were concentrated in CDs where median ages were older and incomes were higher.

The nature of the employment of the workforce may reflect the schooling and qualifications of the population over 15, which are lower than for NSW. Smaller percentages of the shire's adult population had degree qualifications (these were concentrated in older-aged and more affluent CDs) but larger percentages held diploma and certificate qualifications that appeared to be widely in trades and in consumer (rather than corporate) support.

The discussion so far refers to the workforce as enumerated in the shire (16,190 in 2001). This excluded residents working away from the shire on census night. It included working people who were either working in or simply visiting the shire on census night.

Journey-to-work data shows that a considerable percentage of the residential workforce – between 21.2 and 28.6 depending on how it is calculated – or about 4000 people had their main job in the previous week in places outside the shire. It suggests also a slight tendency for residents who commute out of the shire to have higher incomes and to be more in full-time employment and in professional, managerial and trades occupations than residents working in the shire.

In income, data from both the ATO and the census indicate that most of the people of the shire are not particularly affluent, when compared with NSW. There is considerable variation both between people and between places, however.

According to the census, median individual income across the shire was $379 weekly in 2001, a little lower than for NSW but comfortably above the Henderson Poverty Line, which stood at $299 for a single adult. This was not the case in a number of CDs, however. *Figure 39* shows a geography that suggests a concentration of more affluent people towards the northeast of the shire.

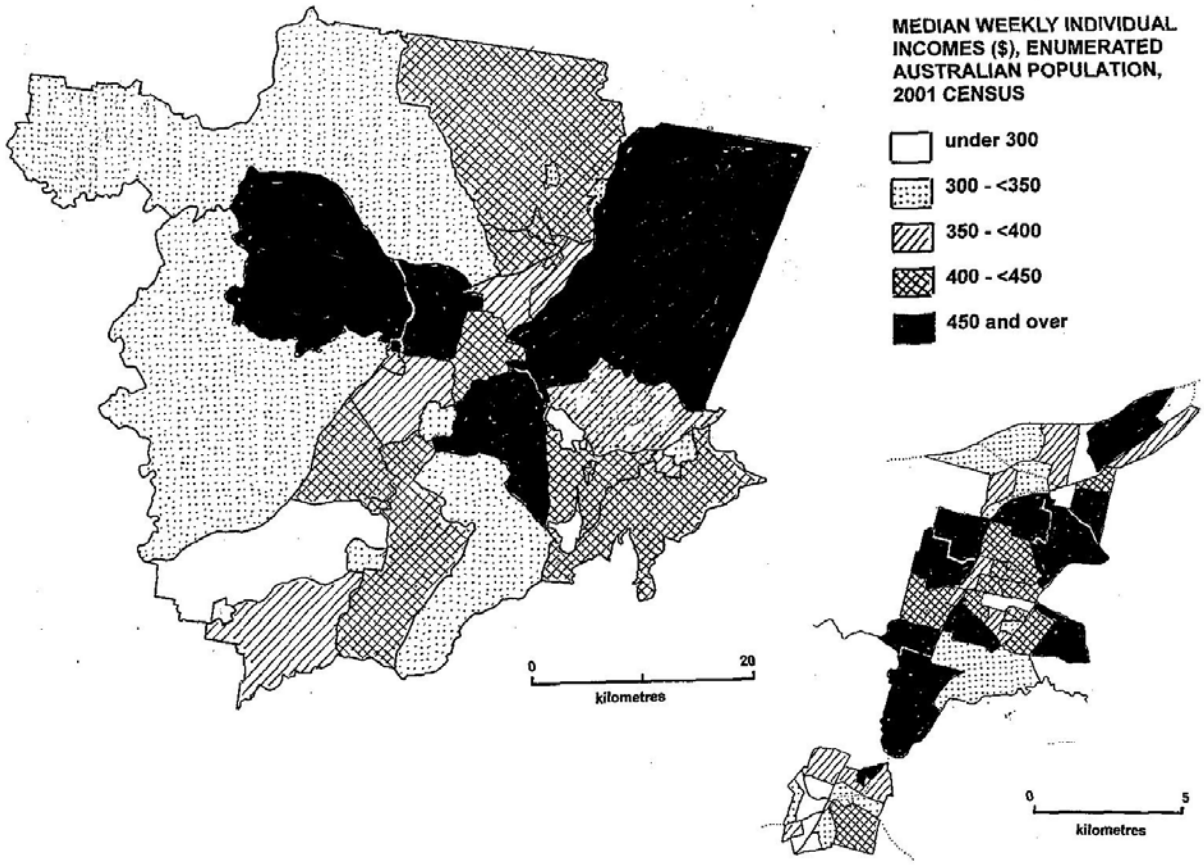


Figure 39. Median weekly individual incomes, 2001*. Data from ABS.*

In fact, there are very few people who can be regarded as truly affluent. Published census enumerations are not a good guide on this (because they include visitors and exclude absent residents) but the 2001 enumeration suggests that there may have been as few as 1250 people with incomes more than twice the Australian median of Average Weekly Ordinary Full-time Earnings (AWOFTE), which stood at $700 in mid 2001.

At the other end of the income spectrum 42.1% of individual incomes were below the poverty line for a single adult and 76.5% were below the median AWOFTE. Census enumerations include the incomes of people in part-time employment and those not in paid work. Nevertheless, with there being only a few more households in the shire than the number of individual incomes above the defined poverty line it seems that there may be many households either living in poverty or dependent on more than one income to avoid this state.

With less than two thirds of total individual income coming from wages and salaries (though only half in post code area 2576) both investment income and government benefits are important locally. This may be a cause of the great disparities in the class distribution of individual incomes. Around fifty per cent of all individual income in 2001 went to fewer than the twenty per cent of income-earners who earned $800 or more weekly in 2001 (*Figure 40*).

There are income disparities also between males (median $513 weekly) and females ($291) that are larger than for NSW, reflecting the fact that females were more likely than males to be in part-time employment, or to be financially dependent on others or to have lower investment incomes.

Median household incomes at $766 weekly were also below that of NSW. The shire's median was comfortably above the Henderson Poverty line for an 'average' family (about $477 weekly in mid 2001) but nearly thirty per cent of households reported incomes below this poverty line. In part, this reflects the relatively large number of single person households, especially in parts of Old Bowral and Mittagong. This is reflected in *Figure 41*. Other parts of these towns have median incomes that are comparable with those of better-heeled parts of Sydney. Lower medians occurred widely in the other towns and more remote rural areas where CD data suggests that there may be a significant number of households living in poverty.

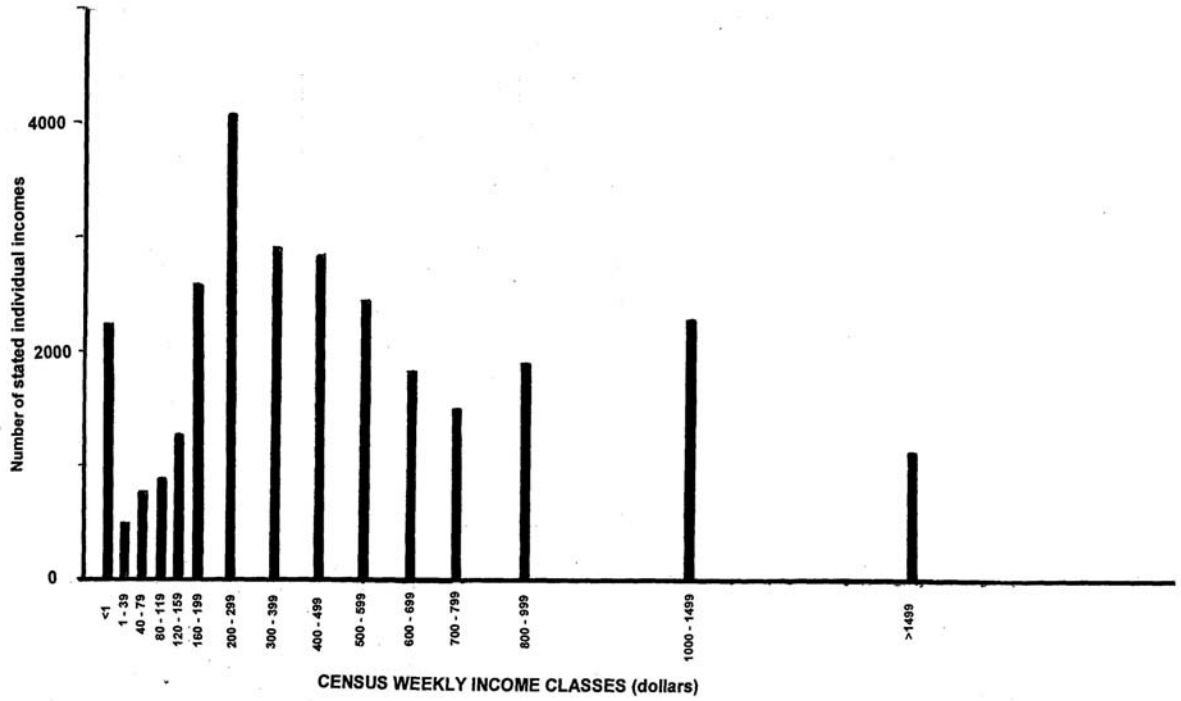


Figure 40: Class Distribution of weekly individual incomes, 2001. *Data from ABS.*

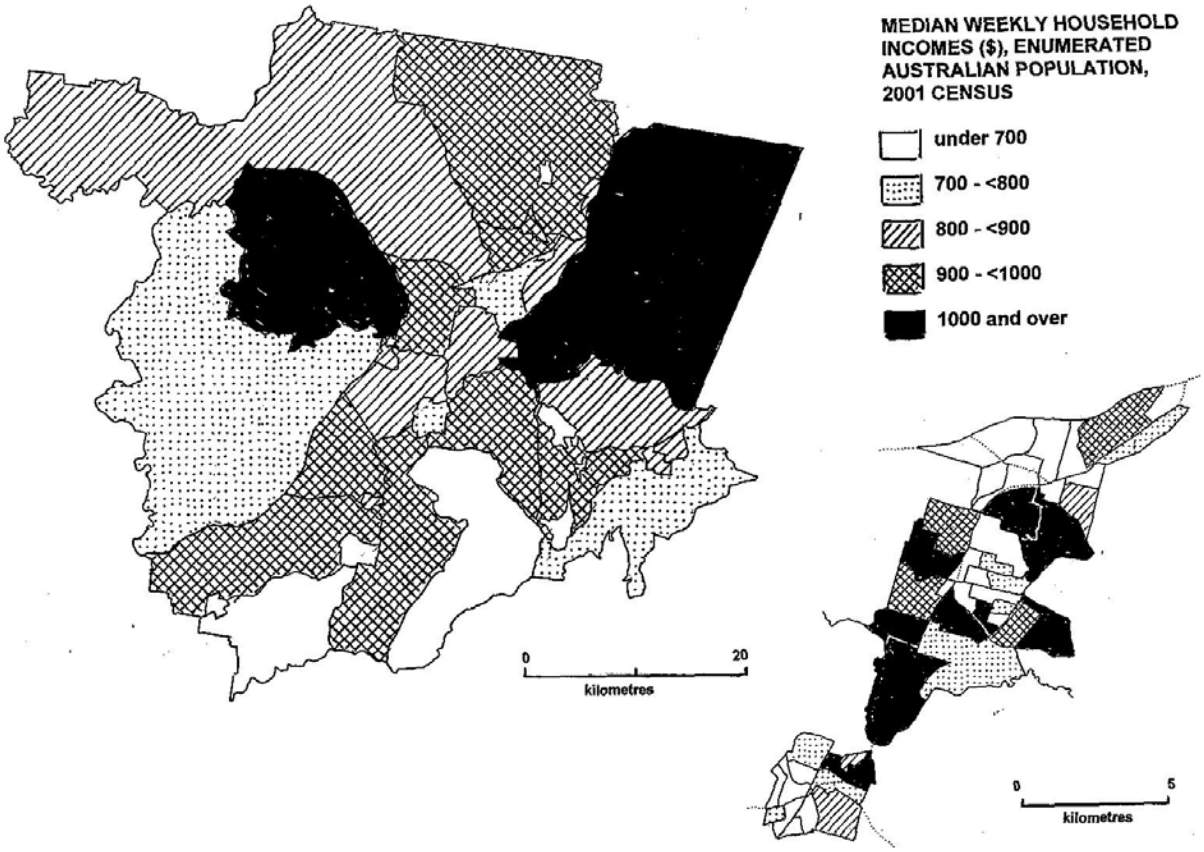


Figure 41: Median weekly household incomes, 2001*. Data from ABS.*

20 Society

Little has been written about the institutions and interactions that make up the social capital of the Wingecarribee, so it is not possible to determine the extent to which the people of the Wingecarribee might be seen as a single community or as sets of socially or spatially segregated communities. Such is the geographical and social diversity of the shire that statistical analysis of census CD data is needed to identify socially separate areas or social groups.

Although the shire has a reputation of being 'genteel' a review of census CD data suggests that this reputation might be more imagined than real. The reputation seems to have arisen because of associations between the Wingecarribee and the élites of Sydney that developed after the beginning of the railway era and that became very strong as the motor vehicle came into prominence.

It is an open question as to how large and significant these élites are today. Wild (1974) did seek to identify élites in Bowral in the mid-1960s, in a somewhat controversial but painstaking book on status, class and power there. He was partly successful in this (notwithstanding latter-day criticisms by Masterman-Smith and Cottle, 2001) but it is doubtful whether his analysis is relevant now to a much larger Bowral population forty years on or to the shire at large.

If income and occupational status are used to identify élites and people disadvantaged by poverty or unemployment, then the shire is similar to NSW in the extent to which disadvantaged and élites are represented. Even allowing for the absence on census night of residents and of others who move between homes both in the shire and in Sydney, relatively few people have high incomes or occupational status, although there are certain concentrations of these in parts of Bowral. The disadvantaged may be a little more numerous across the shire, though there are apparent pockets of poverty in some smaller towns and villages.

It is not possible to write definitively about the geography of social interaction in the shire but anecdotal evidence seems to confirm a pattern that is consistent with the road traffic data mapped in *Figure 3.* While they have strong links with the three main towns the people of the more out-of-the-way Bundanoon, Robertson and some smaller settlements form autonomous communities to some extent. The northern settlements do not exhibit the same degree of autonomy, which may reflect links as much to Sydney as to the rest of the shire.

In the three main towns, the people of Bowral and Mittagong are increasingly integrated but social barriers appear to remain between Moss Vale and the other two towns, even in the cases of institutions that serve the whole shire. As one example half of the membership of U3A – Southern Highlands comes from postcode 2576 which has only a quarter of the population of the shire and few come from the south. This pattern is repeated in other institutions.

The social barriers between the towns may be explained partly by travel distances between them but they may be explained also by the demographic differences and the traditional rivalries between the towns. Despite the mobility of most people in the shire parochial attachments to localities appear still to inhibit social interaction between the towns.

Other factors may also inhibit social interaction. One is that many shire residents interact socially as much with people in Sydney as with people in the shire. A second is that a quarter of the shire's workforce works outside the shire. A third is that many people travel large distances to work within the shire. It has long been recognised that long travel times for work (and other activities) limit the time available for social and community activities outside the family.

Census data shows the shire's population to be geographically diverse. However, there are cultural and life-cycle characteristics that are shared widely within the shire. In particular, the shire's people are strongly anglo-celtic in their background and some have lived in the shire for large parts of their lives. Many of them may not have been challenged by disturbing experiences such as unemployment, migration or culture clashes, which makes for a society that is essentially conservative.

This is expressed in the way the people vote. At the 2004 federal election conservative candidates won absolute majorities of votes cast for the House of Representatives in 19 of the 24 polling booths in the shire and two-party preferred majorities in all of the rest. It is expressed also in rates of most personal and property crimes that were well below those of NSW in 1996-8 according to the ABS.

Nevertheless, society is changing as immigration and improved transit outside the shire loosen local ties and enable closer ties with the outside world, especially Sydney. The people of the shire are becoming more cosmopolitan.

Economic Patterns

21 The economy

An economy gets goods and services to consumers, mostly in exchange for money that is generated from production or investment. In open economies, for which barriers to trade and other transactions have broken down, large proportions of the goods and services and income in circulation may originate from 'outside'. This has become the case especially for regional economies, which makes it very difficult to measure them.

The size and performance of an economy can be conceptualised in several ways: as *value added* by production (turnover or output, less the costs of intermediate inputs or consumption); as *factor income* (the payments accruing to owners of land, labour and capital); and as *final expenditure* (such as on investment and final consumption).

These should add up to the same thing in the longer term. Unfortunately, data on all of them for the Wingecarribee is very incomplete but it is possible to estimate the size of the economy using proxy data for factor income.

The ABS (2005) has published estimates of *household income* using data from the Australian Tax Office (ATO), Department of Family and Community Services and other sources to estimate personal income for Wingecarribee at $840.9 million in 2001. These estimates excluded payments made on behalf of income earners, such as fringe benefits and superannuation contributions.

Little is known about *gross operating surpluses* in the non-household sector. If, following Gillespie Economics (2003:5), it is assumed that these amount to forty per cent of regional income then they amounted to $560 million in 2001, giving an economy measured in terms of net regional income of about $1400 million in 2001.

With many of its larger economic enterprises being controlled outside the shire it is probable that much of their surpluses leaves the shire. However, these outflows are substantially offset by inflows for new capital expenditures, some of which – such as $45 million for the Mittagong Regional Sewerage Scheme (WSC, 2000b:3) and $75million for an upgrade of the Southern Blue Circle cement plant (Boral Ltd, 2004) – are large indeed.

More is known about personal income. The ABS estimates suggest that Wingecarribee has lower average disposable incomes per household ($843 as against $895 per week in 2001) than NSW. Less of this than for NSW comes from wages and salaries, while the percentage attributable to investment and superannuation is twice that of NSW (*Table 4*). The amounts attributable to government cash benefits are small but 20.5 per cent of the shire's population received some benefits in 2001 (similar to NSW).

TABLE 4: PERSONAL INCOME, WINGECARRIBEE and NEW SOUTH WALES, 2000-01 (PERCENTAGES, WITH TOTALS SHOWN)

Shire		NSW
Wage and salary	62.9	71.2
Unincorporated business	6.9	6.3
Investment	15.6	6.3
Superannuation and annuity	3.9	2.1
Government cash benefits	9.5	10.0
Other income	1.1	0.8
TOTAL ($ millions)	840.9	138,807.7

Source: ABS (2005)

There is a geography to this income but data on this is incomplete. Mean incomes calculated for census CDs are suspect and ATO statistics for taxable personal incomes are published for post-code areas only. However, the ATO data (ATO, 2004) do give a measure of the geography of income in 2000/1. Of particular note is that postcode 2576 (mainly Bowral) with 26.1% of the shire's population had 37.4% of the shire's taxable personal income in 2001. Barely half of that came from wages and salaries, unlike around seventy per cent in the shire's other post code areas.

Income data is published for where it was received, not where it was paid. It appears that perhaps forty five percent of total personal income was paid from outside the shire. This includes most investment income, virtually all superannuation, annuity and government cash payments and, reflecting the extent of commuting by residents to work outside the shire, probably thirty percent of wages and salary income.

Data on income tells nothing about patterns of spending or production in the shire. The only reliable local data on expenditure, ABS 1993/4 data on household consumption expenditure, contains no spatial detail. This data does not include capital-related expenditures such as those on housing, motor vehicles, investments and superannuation.

The expenditure data suggests (*Table 5*) that current consumption expenditure per household is lower than NSW on most household items other than fuel, power and transport.

The data should not be taken to suggest that living costs are lower. The only data published on prices in the shire is census data on household rents, which certainly are lower in the shire than in NSW

TABLE 5: AVERAGE WEEKLY HOUSEHOLD EXPENDITURES, WINGECARRIBEE and NEW SOUTH WALES, June 1997

	shire ($)	NSW ($)
Current housing	84.07	104.57
Fuel and power	16.96	15.85
Food and non-alcoholic drinks	116.49	128.73
Alcoholic beverages	20.45	20.04
Tobacco	11.93	12.68
Clothing and footwear	32.47	35.86
Household furnishings/equipment	40.95	43.18
Household services/operation	33.83	34.42
Medical care and health	32.24	33.68
Transport	102.03	98.75
Recreation	79.49	86.53
Personal care	13.00	13.73
Miscellaneous	47.10	49.55
TOTAL	623.82	673.32

Data derived from the 1993-4 Household Expenditure Survey and indexed according to the Consumer Price Index. Source: ABS, Wingecarribbee Regional Profile, 2002.

Only fragments only of information are available on local private capital expenditure. The 2001 population census reports higher percentages of both home-ownership (76.6.%) and mortgage-free dwellings (47.8%) than for NSW. However, because there is limited rental housing, and home-ownership is high, there was a higher proportion of households with mortgages, in the shire than in NSW overall. Mortgage repayments were at higher rates also and accounted for a higher percentage of disposable income (*Table 6*).

RTA motor registration data for 2003 indicates that private (and total) motor vehicle ownership, *per caput*, are at slightly higher rates and is rising more rapidly than in the state as an whole

TABLE 6: ESTIMATED HOUSEHOLD INCOME AND EXPENDITURE, WINGECARRIBEE AND NSW, 2000-1 ($millions)

	Shire	NSW
Household Income [1]	**840.9**	**138,807.7**
Personal Income tax[2]	185.7	29,968.5
Disposable income[3]	**655.2**	**108,839.2**
Mortgage repayments[4]	54.8	7131.2
Current consumption[5]	521.8	86,454.0
Other (as calculated)	78.6	15,254.0

[1] Excludes compulsory superannuation contributions
[2] Includes Medicare levy
[3] These were $843 and $895 weekly, respectively, per household
[4] Calculated using means estimated from Census data
[5] Estimated from 1993/4 Household Expenditure Survey for Wingecarribee, indexed to 2000-1; includes current housing expenditures of $63.6 million in Wingecarribee

Data from ABS and ATO

Obviously, the shire imports many of the goods and services it consumes from beyond the shire but it is not known how much of this is imported (paid for) directly from outside by consumers. It has been suggested (Dimasi, 2004) that 'escape expenditure' runs at 17.5% of current consumption expenditure. It is not clear whether this estimate relates to the whole shire or just its northern population but the estimate appears to be based on percentages for the whole shire of the residential workforce who commute out of the shire, less people who commute into the shire.

It is likely that escape expenditure is higher than this estimate because many 'higher-order' goods and services – such as specialised professional and entertainment services – are not available in the shire. Traditionally, people have travelled to Sydney for them. Today there is increasing on-line purchasing of goods and services as well. There is also increasing direct delivery from outside the shire of goods and growing delivery of services through day visits to the shire by professional and other people, for instance by medical and trades people.

No information is available on capital investment made by residents outside the shire. This is likely to be large, especially from Bowral on the indications of relatively high levels of investment income there. There is a general lack of investment opportunities in the shire other than in the real property markets.

22 Production

Production is best measured by *value added* but little regional data is available on this. Indeed, the ABS appears to have largely abandoned publication of regional economic data even on outputs or turnovers. However, there is some data relating to industry sectors that form the main export bases of the shire.

ABS estimates put the gross value of agricultural operations on establishments with an estimated value of agricultural operations (EVAO) of $5000 and over in 2001at $34.8 million. Other, older ABS data can be indexed crudely to 2001, to put manufacturing turnover at $296 million (but only $55 million paid in wages and salaries) and tourism expenditure at $93 million (with no indication of wages and salaries) in that year. No data is available for mining but this is unlikely to be large. Overall, productive industries that attract income from outside the shire probably account for less than twenty percent of the shire's personal income.

Information on these essentially 'export base' sectors is extremely sparse, except for agriculture from which virtually all of the produce of major industries goes to Sydney for lack of local markets. Cattle, milk, mushrooms, potatoes and pigs, in that order, accounted for eighty per cent of agricultural output in 2001. Most of the output of the few large manufacturers that dominate the secondary sector also goes to markets outside the shire, mainly to Sydney. In the case of cement it goes also to the south and elsewhere. Only 17 manufacturers (of 130 on the ABS Business Register in 1998) export overseas (Hodgkinson and Iredale, 2003). Many smaller manufacturers (such as concrete and metal fabricators) manufacture mainly for local markets rather than beyond.

Economic information about 'residentiary' sectors of the local economy, those that exist mainly to sell goods and services directly to local markets, is limited to estimates of retail expenditure, such as those of Dimasi (2004) of $323 million. Estimates of this kind need to be handled with caution. They are based on dated household consumption data, it is not clear what is included in 'retailing' and in the case of the Dimasi estimates it is unclear whether they relate to the whole shire. Moreover, these estimates give little indication of value added. Data from 1980s retail censuses suggest that wages and salaries are unlikely to account for more than ten percent of turnover, with total value added accounting for only a quarter of the total.

In the absence of economic data, employment is often used to describe the industrial makeup of economies. This is crude, at best. Some industries such as mining employ small numbers of permanent, fulltime, highly paid and highly productive workers; others such as retail trades and hospitality services employ large numbers of casual and lowly paid workers whose productivity is low. Hospitality, finance, retail, education and especially health and community services, all of which cater well for part-time employment, employ far more females than males. Industries such as mining generate high values-added; others such as agriculture widely report negative incomes. Still, employment data is a tangible indicator of economic activity, unlike floor space data, which often has to be used for planning purposes.

Employment data for Wingecarribee from the 2001 population census can give a misleading picture of production because it includes many visitors and excludes absent residents. It also includes about a quarter of local workers who commute to work outside the shire according to census journey-to-work data. The journey-to-work data (*Table 7*) gives a clearer picture of local production which, compared with NSW as an whole, has primary (especially) and secondary industries more highly represented in local employment, as are consumer and community oriented service industries. Transport, wholesale trade, government and business services are less well represented.

This suggests significant 'shortfalls' in jobs locally, particularly in industry sectors that are essential for the efficient functioning of an economy. The 17.6% gap between local employment and residential workforce shown in *Table* 7 tends to reinforce this view. Similar gaps occur in other sub-regional economies within metropolitan commuting zones (but to a lesser extent in non-metropolitan regional economies). They appear to be caused less by small local markets that stunt the development of higher-order services than by the attractions of metropolises for buyers of higher-order services and workers to higher-order jobs.

Most jobs locally are in small businesses. The ABS Business Register reported that only 88 establishments (of a total of 2410) employed twenty or more workers in September 1998. Amongst these, Council (with 310 equivalent full-time staff in 2001/2) was probably the largest employer in the shire (this is usual in non-metropolitan areas) and

Southern Blue Circle Cement (with 140 staff) was probably next.

Only a handful of other establishments – mainly other larger manufacturers, schools and hospitals – employ fifty people or more full-time or part-time. Perhaps twenty percent of local employment is in these larger establishments and perhaps as much again in establishments employing between twenty and fifty people.

Little is known about the geography of employment. A casual survey suggests that most local employment is located in Bowral and Moss Vale, though it is not always clustered in their central activity areas. Moss Vale and Mittagong both have clusters of light industry, while Berrima has two large establishments (the cement works and a jail) and a number of other significant employers.

The largest single concentration of employment locally is Bowral's business district. Data on floor space and zoning in the shire's main towns (WSC, 2004b), indicates that Bowral has nearly half of the commercial and retail floor space of the shire. While floor space is no reliable measure of economic activity, if commercial and retail employment is similarly distributed Bowral's business district would have only about twenty percent of all employment in the shire.

These geographic patterns of employment promote extensive commuting to work both within the shire and beyond. It is noteworthy that most of the commuting beyond the shire appears to originate from the north of the shire. It appears that the majority of the jobs within the shire are in the centre and south, though this needs to be confirmed.

Finally on production, two other features might be noted. Firstly, most of the larger establishments are controlled from beyond the shire. A 'branch plant' economy has limited control over its own destiny and is subject to the effects of corporate decisions made elsewhere (though it might be added that few trans-national companies are represented in the shire). Secondly, there appears to be little vertical integration of establishments locally as sources of materials and support services or as markets for products, something highlighted by Hodgkinson and Iredale (2003). This lack of linkages tends to limit the development locally of income and employment *multipliers*.

TABLE 7: WINGECARRIBEE: RESIDENTIAL WORKFORCE AND LOCAL EMPLOYMENT BY INDUSTRY SECTORS, 2001

Industry[1]	residential workforce[2]	local employment[3]	(deficit)/ surplus	as % of sector	as % of workforce
Rural industries	765	784	19	2.4	0.1
Mining	112	81	(31)	(27.7)	(0.2)
Manufacturing	1966	1708	(258)	(13.1)	(1.6)
Utilities	86	64	(22)	(25.6)	(0.1)
Construction	1531	949	(582)	(38.0)	(3.6)
Transport storage	701	411	(290)	(41.1)	(1.8)
Communications	173	141	(32)	(18.5)	(0.2)
Wholesale trade	625	503	(122)	(19.5)	(0.7)
Retail trade	2570	2426	(144)	(5.6)	(0.9)
Hospitality	1084	1146	62	5.7	0.4
Personal services	639	502	(137)	(21.4)	(0.8)
Culture & recreation	354	285	(69)	(19.5)	(0.4)
Finance and insurance	350	240	(110)	(31.4)	(0.7)
Property/business	1431	1117	(314)	(21.9)	(1.9)
Government & defence	392	299	(93)	(23.7)	(0.5)
Education	1368	1160	(208)	(15.2)	(1.3)
Health, Community	1681	1459	(222)	(13.2)	(1.4)
Other & not stated	374	133	(241)	(64.4)	(1.5)
TOTAL	**16202**	**13358**	**(2844)**	**(17.6)**	**(17.6)**

[1] Descriptions have been abbreviated
[2] Numbers are slightly lower than in Census reports because of the way in which they have been counted
[3] Includes workers locally both resident and from beyond Wingecarribee.

Source: Transport Data Centre, 2001 Journey To Work Summary Tables

23 Industries

Although it is difficult to distinguish between export-based and residentiary industries there can be no doubt that the Wingcarribee has been unable to develop a significant economic base. This is despite its natural resources and a location on the land transit corridor linking Sydney with Canberra and Melbourne, more or less equidistant between Sydney, Wollongong and Canberra.

In the primary sector, forestry, which developed as an ancillary to land-clearing, is now but a minor industry drawing timber mainly from softwood plantations planted in the west since 1919 (Forestry Commission, 1986). Even agricultural industries, which will be discussed in the next pages, are relatively unimportant.

Mining also is not a large industry, despite a long history. This could change, as reserves regionally of both coarse aggregate and sand may be needed to supply a large proportion of shortfalls in the Sydney region anticipated as early as 2010 for aggregates and later in shales (Pienmunne, 2000; MacRae, 2001; Cohen, 2003). Coal under much of the shire could be the last major accessible reserves of good quality coking coal in NSW after the Illawarra's reserves run out (WSC, 2000c:4).

The only active coal mine in the shire is Centennial Coal's Berrima Colliery at Medway. This has been in more or less continuous production since 1872 and since 1924 has supplied up to 220,000 tonnes annually (worth $14 million) of high-ash coal to its single customer, Boral's Southern Blue Circle cement works at New Berrima. Some of BHP Billiton's Dendrobium mine runs under the northeast corner of the shire but it feeds to a colliery in the Kemira Valley, seven kilometres west of Port Kembla, outside the shire.

There are 21 active quarries on Council's register of extractive industries producing sandstone, blue metal, gravel, sand and shale. Eight of these are classified as 'large', with Heggies' quarry, near Penrose, yielding 300,000 tonnes of sand annually. Other quarries provide sand, shale for brick and cement making locally and aggregate for concrete-making locally and in Wollongong.

In the secondary sector, manufacturing has become a major employer in the shire despite, rather than because, of the natural resource base of the shire. Few manufactories process, let alone further transform, raw materials from within the shire.

Over time, many manufactories set up to process primary produce from the shire have failed. While there were other reasons for this at the time, few would be operating today because of insufficient raw materials and scale of production. Examples include: the iron foundry at Mittagong (1848-1886); a kerosene distillery at Joadja (1879-1903; see Knapman, 2003); butter factories throughout the shire (following the first, in Mittagong, in 1881), a cheese factory at Robertson (1936-89); and killing yards and abattoirs in Moss Vale (until 1933 and 1963-94) and elsewhere.

Recent years, however, have seen establishment of a number of small, sophisticated primary producers which include seven wineries, producers of seed potatoes (Technico at Moss Vale) and semen (Murribrook Farm) and food processors (Gram at Braemar).

Most successful primary processors in the shire are ones that have capitalised on the location of the shire in relation to raw materials and markets beyond the shire. Amongst these are Omya's plant at New Berrima (1961), which processes limestone, and above all Boral's cement works also at New Berrima, which supplies about half of NSW cement needs.

The New Berrima cement works was opened in 1929 on a site where shale was quarried and that was on the tramway between Berrima Colliery and the Main South Railway line at Berrima Junction. The tramway, upgraded to standard gauge in 1927 (the section from the cement plant to the colliery was closed about 1970), gave access to markets in Sydney, Canberra and (from 1932) Wollongong. Most importantly it also gave access to a vast limestone quarry at South Marulan, which lies just southwest of the shire.

A fortunate location, progressive upgrades of technology and now very large scale have enabled low cost production. In round terms the works uses 1.7 million tonnes of limestone annually, delivered by rail, 0.2 tonnes of coal and 0.3 million tonnes of shale, both mined locally. It produces about 1.5 million tonnes of clinker, about a third of which is railed to be ground into cement at Maldon near Picton and the balance of which is ground into cement at New Berrima and trucked to markets in the south of the state and Canberra.

Producers of simply transformed products also have had mixed success. Successes include Austral's

Bowral brickworks (since 1915), a number of concrete and metal fabricators mainly in Moss Vale and Mittagong and Inghams stock feed plant at New Berrima (2000). All of these produce heavy or bulky goods for mainly local markets, using local and imported raw materials. The most obvious failure is Tooths' malting at Mittagong (1899-1980) for which the shire was never a very favourable location (Freestone, 1991).

A few, larger, producers of more elaborately transformed products for markets beyond the shire have been attracted to the shire over time but not many have stayed. None of the ambitious decentralisation initiatives of the 1960s and 1970s, which would have established a branch of Australian Iron and Steel in Moss Vale and enabled Commonwealth Engineering to build diesel locomotives in Braemar from 1973, have survived rationalisations and corporate restructurings.

Some engineering plants have been more successful. They include Vale Engineering (in Moss Vale since 1961), Tycan (making transformers and electrical wire in Braemar since 1979), Dux Hot Water Systems (in Moss Vale since 1989) and Bradken Engineering which has taken over what had become Clyde Engineering's locomotive plant at Braemar for rail wagon maintenance and refurbishment.

In the service sector most industries in the shire are residentiary. Some establishments in the retail and hospitality industries attract significant visitor spending but the most current estimate available of tourist expenditure in the shire indicated that total tourist spending was only $83 million in 1997. The numbers then of 250,000 overnight stays in tourist accommodation (half of which were on business) and a million day-visitors annually may sound large but they do not translate into many visitors on a daily basis. Anecdotal evidence suggests that visitor numbers have not increased over the last decade.

Other service industries that export their services from the shire include Harper Collins whose Australian distribution warehouse is in Moss Vale, a few schools that market their boarding establishments outside the shire and an unknown number of consultants. The latter, in fields ranging from agriculture to engineering, sell technical and research expertise beyond the shire, often travelling from the shire to their clients.

Locations relatively near to a mass market and a major airport, fairly centrally within NSW and the ACT and in amenable living environments, may be attractive but most service industries need to be in their markets to minimise transport costs.

Traditionally, service industries have developed when clusters of people have become large enough to enable establishments to supply needs locally. As transport has improved and become cheaper, people have been enabled to travel further for their needs, often to larger centres where needs can be supplied more cheaply. This has led to the decline of many smaller centres. Enlarged markets in larger centres have enabled new, 'higher-order' service industries to set up, often with links to further establishments. In turn, population growth and higher disposable incomes have brought further economic growth.

In the Wingecarribee the decline of smaller centres has been in evidence for more than a century but there has been limited growth only of higher-order servicing in the main towns. The main towns offer most 'essential' services such as banks and supermarkets, but there is a tendency for services to cluster in Bowral in a way that makes Bowral well-serviced but leaves other towns under-serviced. For example, the shire is under-supplied with generalist medical practitioners by national standards but Bowral, with sixty percent of the shire's generalist medical practitioners, is very well serviced. Smaller towns and villages are often distinctly under-serviced – although diversification of services offered by post offices, shops and clubs and Robertson's community transaction centre has compensated for this to some extent.

Nevertheless the main towns remain essentially 'suburban' rather than 'regional' in the services they offer. There are few outlets for 'discretionary expenditure' particularly on higher-order services. Despite recent strong employment in the entertainment, recreation, retail and health industries the shire doesn't have significant facilities for larger entertainment performances, base hospital and other advanced care provision, higher education or department store shopping.

This is partly because the shire has small numbers of higher-income residents and visitors. The 2001 census enumerated only about 1250 individuals in the shire with incomes more than $1400 weekly (though the number of residents with these incomes could be higher). Also, the populations of even the main towns are small and the perceived distances and traditional rivalries between the towns make it difficult for the shire to be seen as a single market. In consequence, there is no one central place in which higher-order commercial, entertainment, professional and retail services might congregate for the mutual benefits of contact intensity, business linkages and transit access. A notable exception has been the growth of part-time professional services such as in medicine and finance.

24 Agriculture

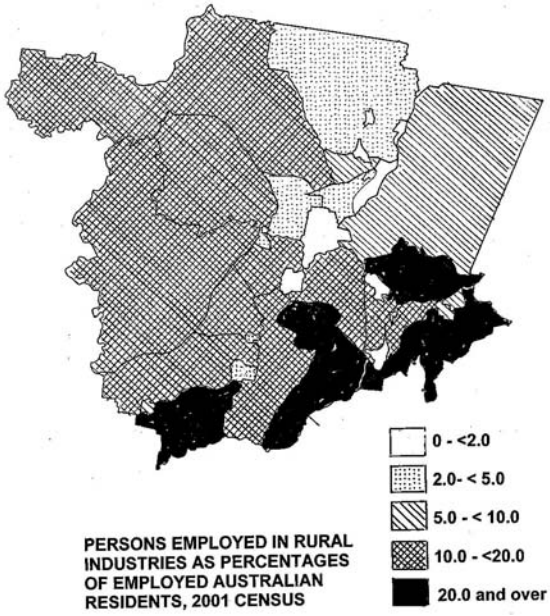


Figure 42: Employment in rural industries (agriculture, forestry, fisheries and related services), 2001. Data from ABS

Statistical records of agricultural industries go back to the nineteenth century. Most are publicly available, although results of recent agricultural censuses have to be purchased from the ABS.

Despite its historical importance agriculture makes only a small contribution to the regional economy today. In 2000/1 its gross value of agricultural operations (which excludes value added by processing) at $34.8 million was equivalent to only 2.5% of the regional economy. Its net contribution may have been less if ATO (2004) data is any indication. Most farms are corporate businesses but the 244 individuals in the shire who reported taxable income from primary production in 2001 reported a total income of minus $2.066 million!

It is hard to be precise about the extent of rural employment. In 2001, 784 people were enumerated in the shire as having their principal employment in rural industries (which include fisheries, forestry and rural services as well as agriculture), 5.9% of all employment, but these numbers exclude many hobby farmers. Many who were enumerated also may be hobby farmers, which would explain the high percentages of enumerated rural workers who are female (a third in the shire, compared with a fifth in NSW) and who are older (36.4% were 55 or older, against 30.0%).

A concentration of the rural workforce in the southeastern corner of the shire (*Figure 42*) suggests that much of the agricultural economy is concentrated here. Five rural CDs east of Moss Vale accounted for a third of all rural workers enumerated in 2001. This is an area that has long been associated with dairy farming because it has most of the shire's prime agricultural land and more reliable growing seasons and available moisture than elsewhere. More than thirty percent of people employed in the CD around Kangaloon were in rural industries. Rural employment is more thinly dispersed across the remaining 16 rural CDs, where it accounts for much smaller percentages of total employment.

The extent of agricultural land use in the shire is uncertain. ABS agricultural censuses are probably fairly comprehensive of commercial agriculture but may not include agricultural operations on all hobby farms. This may help to explain the discrepancy between the 404 agricultural establishments with an EVAO of $5000 or more enumerated by the ABS in 2001 and the 1555 holdings classified by Council as 'farmland' for rating purposes in that year (a number reduced to 1238 in 2005).

The extent of hobby farming may help also to explain why a large part of the shire is shown on *Figures 43* and *44* to be in 'other uses'. In the 2000/1 season the ABS recorded 54,971.4 ha – 20.1% of the shire's area – in establishments with an EVAO of $5000 or more. Although most of the remainder of the shire can be accounted for from other sources about a sixth of the shire is in land uses that cannot be accounted for.

Some of this land may be under crops such as grapes and olives that were yet to produce in 2001. Some may be marginal grazing land that is still available to be used as runoff for dry stock, or even for regular grazing in wetter seasons than in the 2000/1 year. Some may be land held in reserve for quarrying (possibly used for grazing in some years). However, a considerable area appears to be used for essentially rural residential and recreational purposes.

Traditional broad-acre livestock farming still accounts for more than half of the gross value of agricultural operations in the shire (*Figure 45*), mainly from the sale of milk and of cattle. Dairy farming is confined to the southeastern corner of the shire but beef farming is more widespread.

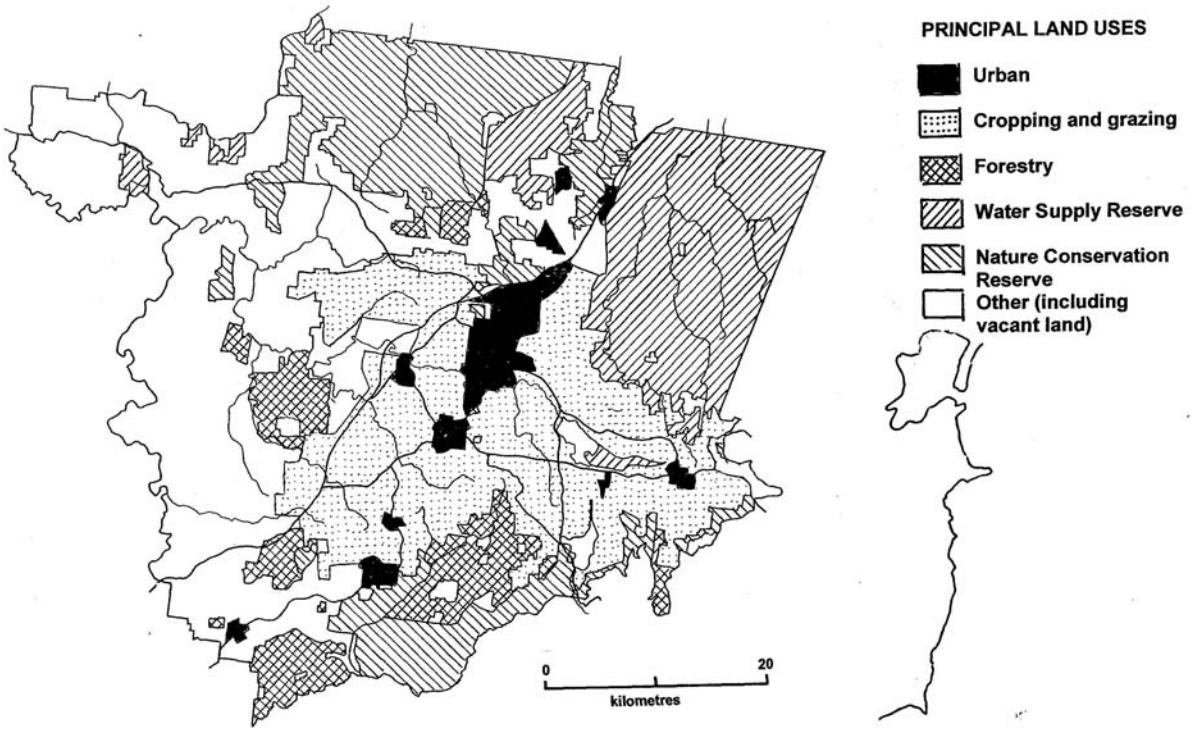


Figure 43: Generalised land uses. *Sources: ABS,* SLA 18350 Wingecarribeee 2001 Census maps, *AUSLIG* Wollongong Special (S156-13) 1:250,000 topographic map, *Ecological Australia (2003).*

Sheep, grown mainly for wool and once dominant in the drier margins of the shire, have been of minor importance since the 1980s.

In 2001 three quarters of all establishments carried cattle (9848 milk cattle and 33,154 meat cattle) and 27 carried sheep (13,665). Of these, 42 sold 29.6 million litres of milk, 297 sold 20,168 cattle and calves, 20 produced 45,010 kg of wool and 13 sold 5626 sheep and lambs and in 2000/1. By comparison, 16 establishments sold 116 horses, 2 sold deer and one each sold pigs and poultry.

Other than the pig and poultry producers few livestock producers appear to gross as much as $250,000 annually. Mean herd and flock sizes suggest that many cattle herds and probably all sheep flocks are too small to be regarded as full-time commercial operations.

Only dairy farming continues to be dominated by full-time commercial establishments. It is reported that there are now only 22 commercial dairy farms that sell milk to milk treatment factories in Sydney. If allowance is made for a few farm establishments that sell milk or milk products directly to the public the number of commercial dairy farms has probably fallen by a third since 2001. In many cases this has been by consolidation of herds. However, dairy herds remain small with typically 200 cattle (150 milkers) on 200 hectares. There is a handful only of larger dairy establishments.

Figure 44 : Land Uses in the Wingecarribee. D*ata from ABS 2001 population and agricultural censuses,* WSC, State of Environment reports, *NSW Forestry Commission (1986)*

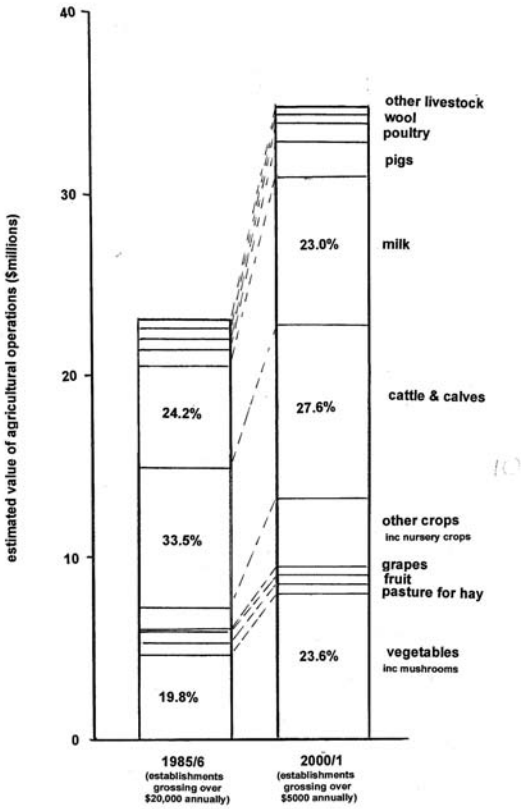


Figure 45: Gross Value of Agricultural Operations, by industry, 1985/6 and 2000/1. *Data from ABS*

Note: data is reported for agricultural holdings of 10 ha or more in 1975/6 or which grossed $1500 or more in 1976/7; and for agricultural establishments which grossed $1500 or more in 1977/8-1980/1, $2500 or more in 1981/2-1984/5, $20,000 or more in 1985/6-1990/1, $22,500 in 1991/2-1992/3 and $5000 or more in the years since.

Beef is characterised to a much greater extent by part-time farming. There are beef herds with several hundred breeding and other cattle, mainly in the west though increasingly in the east also. More typically a beef herd is one that carries 40 to 50 cattle on 40 hectares in a good year, with cattle being bought to be 'finished' (or fattened) for sale.

The commercial viability of both dairy and beef farming is at risk. Farmers are exposed not only to a continuing 'cost-price squeeze' but also to increasing competition from other areas in Australia and New Zealand that have better natural resources and larger holdings of good land. It is very difficult for most farmers to find ways of improving the efficiency of their businesses.

With very high land prices few farmers can hope to enlarge their land holdings to reap economies of larger scale. Specialisation into breeding of stud livestock can appear to hold attractive prospects bur it calls for considerable capital and labour.

Rationalisation of on-farm activities, such as by buying in stock feed rather than growing fodder crops as supplementary enterprises, can reduce costs and enable higher carrying capacities.

There has been little diversification into higher-yielding livestock enterprises other than stud breeding. There is only one commercial piggery in the shire, three poultry farms, a handful of farms carrying deer or alpacas and about thirty farms carrying horses. Any further development of these enterprises will be limited by land prices and by the lack of extensive areas of prime agricultural land. There are also needs for capital and for support services that are not available within the shire.

There has been limited diversification only into non-livestock agricultural enterprises. Much of the increase in annual gross value of agricultural in the Wingecarribee in the 1970s and 1980s (*Figure 46*) came from growth in mushroom production and the output of about twenty establishments (mostly retail) that sell nursery produce and cut flowers. Despite more recent emergence of grape growing and other 'boutique' forms of cropping, the gross value of cropping has grown little during the 1990s and since. The area under crops remains stubbornly small at 2397 hectares in 2001, of which nearly half was for hay.

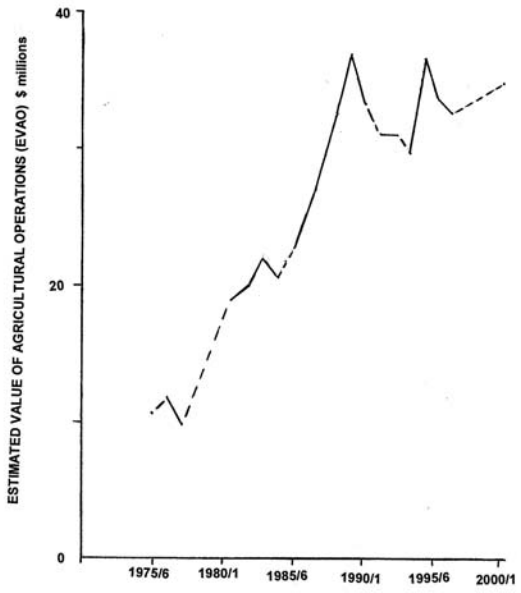


Figure 46: Gross Values of Agricultural Operations, 1975/6 to 2000/1. *Data from ABS*

Emerging crops, such as grapes accounted for small areas only. There may be more than sixty vineyards but there are only 200 hectares of grapes. Areas of traditional crops such as potatoes, vegetables for human consumption and hay for stock feed are falling. There were only 14 potato growers in 2001.

25 Agricultural Development

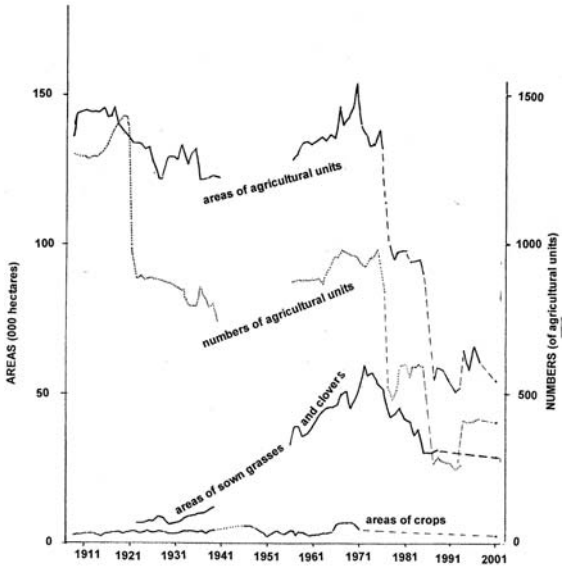


Figure 47: Area of rural holdings /establishments, crops, sown grasses, etc, 1907/8 – 2000/1.

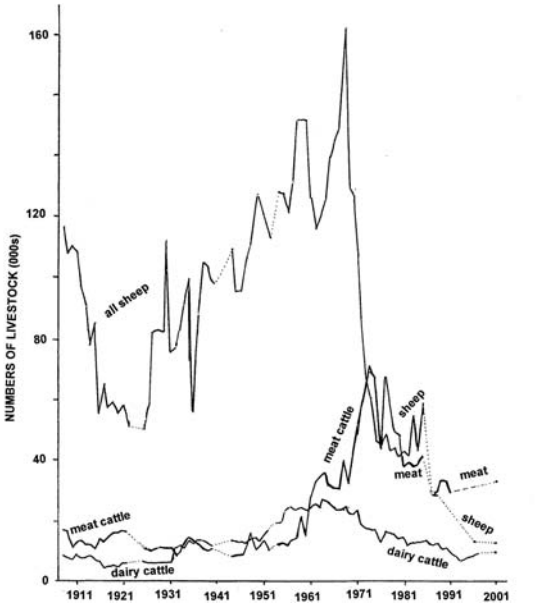


Figure 48: Number of sheep, meat/beef cattle and milk/dairy cattle, 1907/8 - 2000/1

Data from Statistical Registers of NSW *and ABS (various)*

Data is for the Police Districts that approximated to the Wingecarribee in1907/8 to 1921/2, 1924/5, 1925/6, 1926/7 to 1928/9 for livestock numbers only, and 1929/30 to 1939/40 (except for crops); otherwise, data is for the local government areas that approximated to the Wingecarribee. Data was enumerated for 'holdings' of 1 acre or more to 1972/3, 1 ha or in 1973/4 and 1974/5, 10 ha or more in 1975/6 and grossing $1500 or more in 1976/7; since then data have been enumerated for 'establishments' grossing $1500 or more in 1977/8 to 1980/1, $2500 or more 1981/2 to 1984/5, $20,000 or more 1985/6 to 1990/1, $22,500 in 1991/2 and 1992/3 and $5000 or more .in the years since. Numbers of dairy cattle are variously for 'milch cows' and 'milking cows' until 1962/3, since when they have been for all cattle in registered commercial dairies or 'cattle for milk'.

It is possible to construct a brief historical geography of agriculture in the shire using information from Jervis (1986), Jeans and Jack (1996) and agricultural statistics from

- *Statistical Registers for NSW* for the Berrima Police District (1859-1880), Berrima Police Patrol areas (1896 and 1908-1940) and the three local government areas that now make up Wingecarribee Shire (1945/6-1974/5); and
- ABS publications that contain more recent data for the three local government areas to 1979/80 and for Wingecarribee Shire from 1981.

At the time of Sir John Robertson's Land Act of 1861 less than 10 per cent of the Wingecarribee (some 23,121 ha) was in rural holdings of an acre or more. Only a small area, then as now, was cultivated and most was used for scrub cattle, though growing numbers of pigs suggests that there was some dairy farming.

Between 1861 and the early years of the First World War the area in rural holdings grew to more than sixty per cent of the Wingecarribee and the number of holdings grew by a factor of more than ten. The opening up of the Yarrawa Brush around Robertson led to 12,500 ha being taken up between 1861and 1865 but the greater part of the expansion came later with the spread of closer settlement into the drier western and northern margins.

Enclosure and clearing of vegetation followed. Initially Crown leases and licenses accounted for more than a third of occupied Crown land in the Wingecarribee. Much of this Crown land appears to have been in the west and north where, gradually and erratically from the 1880s as land was developed, this area was converted to freehold or was resumed by the Crown.

By the 1880s cattle numbers had more than trebled and sheep numbers had risen more than tenfold, although the numbers were then to be set back by

droughts. The advent of refrigeration enabled whole milk to be sent by train to Sydney and led to many dairy farmers supplying fresh milk to the Sydney milk zone rather than to local butter factories (Jeans and Jack, 1996:32). Dairy farming grew and by 1896 cattle numbers had stabilised but dairy cattle accounted for more than half of all cattle numbers. With less skim milk available pig numbers went into decline. Meanwhile, sheep numbers, especially in the west and north, moved on a trajectory that took them to a peak in the early 1900s.

After the First World War the area in rural holdings declined steadily (*Figure 47*) and there were dramatic falls in holding numbers, especially in the drier margins. The mean size of rural holdings, which was 99 ha in 1896, rose to 161 ha in 1940. Many holdings especially of Crown land appear to have been abandoned and others to have been consolidated. In part this reflected failed attempts to farm the margins successfully. In part also it was because of the resumption by the Crown of land for reserves, especially in the northeast to protect the catchments of the new Avon (built 1921-6) and Nepean (1925-35) dams.

By now the dominance in agriculture of the southern half of the Wingecarribee was well established. The inter-war years saw nearly a trebling of dairy cattle numbers in the 1930s (*Figure 48*) especially on larger holdings around Moss Vale, with falls around Mittagong and in more marginal areas. Meat cattle numbers struggled, with falls around Mittagong and in the west but some substitution of meat for dairy cattle elsewhere. Sheep numbers crashed, especially in the south, and then recovered somewhat elsewhere. Areas of sown grasses and clovers and commercial crops (eg potatoes) rose in the south and east.

In the three decades after World War II the area of rural holdings, especially in the west, rose to a new peak in 1969/70, but holding numbers declined further, though with some increase in the south. The mean area of rural holdings rose, to a peak of 214 ha in 1976/7. Dairy cattle numbers (about 60% of which were in the south) climbed to a 1964/5 peak then halved after the introduction of town milk quotas. Rationalisations in the dairy industry led to a nine-fold increase in beef numbers, to a peak in 1973/4. Sheep numbers continued an erratic rise, to a 1968/9 peak. The area of sown grasses and clovers continued to expand to a peak in 1971/2 and of crops to a peak in 1968/9.

In the last three decades there has been a loss of land in agriculture, especially on the drier margins. The extent of this loss may have been exaggerated by repeated changes in the bases of statistical collections and the progressive exclusion from the agricultural censuses of large rural holdings that already were not being used effectively for agricultural operations.

Nevertheless, steady declines in the numbers, areas and mean sizes of agricultural establishments from the 1970s are testimony to the effects of widespread rural subdivision of agricultural as well as non-agricultural land. Between 1981and 1986 more than 1000 new rural allotments were created through subdivision. Most of these and the larger ones were in the west and, if the agricultural census is any indication, probably did not involve land recorded as used for agricultural operations. Rural subdivision has continued since 1986, with the area of land in agricultural operations falling by fifteen per cent and the mean size of agricultural establishments falling from 155 to 136 ha by 2001.

Livestock numbers have fallen over the last three decades, quite dramatically in the cases of sheep and meat cattle whose numbers fell during the 1970s as a result of low prices and successive droughts, leaving few livestock in the west. Dairy cattle numbers fell also, though they have stabilised since the latest round of rationalisations in the dairy industry. New sowings of grasses and clovers have declined, perhaps for reasons of cost. Cropping also has declined, especially of feed crops on pastoral establishments, again because of costs. These declines have been accompanied by closure of the remaining dairy factories and abattoir and a reduction of agricultural support services. The only regionally significant agricultural service that remains is the Moss Vale saleyards, which relies heavily on adjoining regions for its cattle.

The last fifteen years have seen agriculture at a stand still. The limited diversification into specialised crops and livestock farming has yet to be reflected in either value of output or farm employment, both of which have remained fairly static since the decade of the 1980s (*Figure 46*).

By 2001 the total area of agricultural establishments had fallen to an area that was similar to that of all rural holdings in 1865, and their number was similar to the 1865 number of holdings. Sheep numbers were back to the levels of the 1860s but cattle numbers are still considerably higher. The area in agricultural establishments in 2001 was similar to the 1971/2 peak in the area under sown grasses and clovers. It seems that agriculture has effectively retreated to a core area of better land in the centre and east, where it seems probable that broadacres grazing will remain as the region's dominant, if small, core agricultural business.

26 Economic performance

Structurally, the Wingecarribee's economy is small, unsophisticated, fragmented and geographically dispersed. Much of it is owned outside the shire and it is very much under the control of outside forces and decisions, which leave it rather vulnerable. It is also heavily dependent on jobs and income from outside the shire over which it has little influence. The economy does not seem to have any obvious areas of comparative advantage, niches on which it might build supporting and ancillary industries or a sophisticated range of higher-order residentiary services.

It may seem curious that a shire that is bisected by the Sydney to Canberra and Melbourne land transit corridor, located between Sydney, Wollongong and Canberra, and apparently with abundant natural resources has not been able to develop a secure economic base. However, by international standards, traffic even along the Hume Highway is light; the shire is located too far from major urban areas to service them directly and the natural resource base does not give rise to much secondary industry in the region.

The shire's amenable living environments have not been enough to attract people in sufficient numbers to provide markets for many higher-order services. The stunted development of the shire's residentiary sectors has been exacerbated by the power of Sydney to draw 'escape expenditure' out of the shire, effectively reducing the size of local markets and potentially making it impossible for many services to survive in the shire.

On many indications – workforce participation (especially female), part-time employment and the level of work-related commuting in the workforce – the shire appears to have a shortage of rewarding, useful and secure jobs near to homes, which is not good for social as well as economic reasons.

Reasons for this might include the fact that the shire's workforce is not well qualified (although levels of qualification did rise between 1996 and 2001) and that opportunities for professionals and managers to move up promotion ladders are limited in a fairly unsophisticated economy.

However, unemployment is relatively low, numbers of people commuting into the shire for work appear to have increased between 1996 and 2001 (TDC 1998 and 2004; the data are not strictly comparable) and there was strong job growth in three sectors that are particularly amenable to female and part-time employment (health, retail and education). It might be, too, that lower workforce participation reflects choice, to work away from the shire or not to participate fully.

Moreover there is anecdotal evidence that there are professional people such as consultants and senior managers who commute to Sydney (and more widely), trading the burdens of travel against the benefits of living in the shire and staying on promotion ladders. There is evidence also of older males moving into part-time employment as part of their transitions to retirement.

Overall, employment growth in the shire in the 1990s was at rates comparable with those of NSW, apart from modest growth regionally in corporate support sectors such as finance, business services and government administration. There was growth in professional and white-collar occupations but many higher-status workers still had to commute out of the shire for their jobs.

Individual, family and household incomes are generally lower in the shire than in NSW. This reflects factors such as lower workforce participation, greater part-time participation and lower levels of occupational status than for NSW. These may reflect personal choices rather than necessity. The shire is also heavily dependent on non-work incomes, mostly from outside the shire and over which the shire has little influence.

The income gaps appear to be narrowing. Mean taxable incomes rose by 23.3% between 1996 and 2001, which was faster than for NSW. Median household incomes, and personal incomes, also rose faster (at 32.6% and 31.81% according to the censuses), which may reflect growth in non-taxable government cash benefits.

However, this rising prosperity is not shared evenly. The growth rate in postcode 2575 was lower than for NSW, while much of the high growth in postcode 2576 (37.5% between 1996 and 2001) came from taxable realised capital gains. Capital gains accounted for 12.4% of that postcode's taxable income in 2001 but unless they were spent locally this income would have had little regional economic impact.

In its higher-order consumer, community and corporate services the Wingecarribee remains under-serviced in comparison with non-metropolitan communities with similar populations

elsewhere, despite its rising prosperity. With cheap access to both motor transport and telecommunications it is easy for producers and consumers alike to bypass local and regional markets and suppliers. People in the shire often look to Sydney, rather than the shire's towns for higher-order services. More locally, people often bypass local suppliers in favour of suppliers in the shire's main towns.

Reduced amounts spent locally reduce the potential viability of local and regional suppliers of services. This can lead to closures. It may also deter new suppliers. The results can be empty shops and lack of higher-order facilities such as department stores, central government offices, higher education, entertainment centres, financial services and recreation.

The extent of escape expenditure is large. Dimasi (2004) estimated this to be 17.5% of the shire's household expenditure which, if older household expenditure data is indexed to 2001, puts escape household expenditures at about $91million. That number might be higher, given both an increasing use of on-line modes for purchasing goods and services and a traditional tendency locally to look to Sydney for higher-order professional and entertainment services. Business and government escape expenditures outside the shire may be even higher as larger establishments often do not use local suppliers.

There has been large recent employment growth in industries such as entertainment, property services, retail and health but this has been broadly in line with state trends and doesn't indicate much improvement in levels of service provision. Anecdotally, though, there does seem to be a trend toward professionals and trades-people making day visits to the shire to supply some high-order goods and services (medical, for example) within the region.

Although consumers have easy access to goods and services from the metropolis there are transport costs associated with this and these are set to rise. Moreover, seven percent of private households in the shire did not have access to a motor vehicle (including motor cycles) on census night in 2001 and a further forty percent had access to only one. Only about fifteen percent of the population had walking access (within 400 metres) to night-time and weekend public transport services and perhaps only half to any sort of public transport at all.

The limited provision of higher-order services is partly a result of a geographically inefficient pattern of land uses and economic activities in the Wingecarribee. In Australia input-output tables show the transport sector to account for more than twenty percent (and rising) of national income and outlays. Directly or indirectly these costs of transit are born by consumers. Long travel distances mean high transport costs for road users. Long lines of infrastructure mean high capital and maintenance costs for communities. Both mean high prices of goods and services

The spread-out nature of settlement in the shire, in towns and villages as well as in rural areas, means relatively large travel distances for residents. It means also relatively high infrastructure costs for the community because of the long lengths *per caput* in the shire of roads, of reticulation for electricity, gas, telephony, water and sewerage and of services such as garbage collections.

These costs of distance in the shire are exacerbated by the manner in which some activities have been located, requiring people to travel long distances across the shire for both work and personal reasons. An example is in the disproportionate location of generalist medical services in Bowral, which requires many people to travel away from their localities for what are essentially 'local' services.

Other examples are in the location of 'regional' services away from the shire's demographic centre (which is just north of the Kangaloon Road/Old South Road intersection in Bowral), which increases the total distances travelled within the shire. For instance, location of Council's chambers and the district courthouse in Moss Vale on average adds five kilometres to every return trip within the shire to these locations.

The volume of trips across the shire exacerbates heavy traffic on roads within the shire, notably through the main towns where in each case road traffic movements have been measured at higher levels than along the Hume Highway just to the north of Welby (RTA, 2004; see *Figure 3*). Heavily trafficked roads mean costs both to the community and to individuals, which would be less if regional services were located more centrally and if localities had more local services.

The purpose of an economy is to enable the consumption of goods and services. In that respect the Wingecarribee economy performs adequately. There are inequities in service provision and there are cost-inefficiencies, both of which are geographical in their nature, but for most people the economy appears to be providing acceptable jobs and incomes.

Future Patterns

27 Challenges

The Wingecarribee is very important for the Sydney region. It sits astride the main land links between Sydney and the southern capitals. It is a potential source of building materials, coal and ground water. It has the largest area of river catchments that supply Sydney's dams with water of any LGA. It offers opportunities for a variety of mainly outdoor recreations.

The shire also contains living environments that are highly valued by its long-term residents, by younger adults who have moved there with their families and by older adults who have settled in it for their retirement. Small towns in rural settings, attractive landscapes, and places of cultural or natural heritage significance all make for a special sense of place.

In a world that is constantly changing these qualities are under threat from both individual behaviour and changing biophysical and socio-economic forces. A core challenge for the people of the Wingecarribee is to manage change in such as way as to conserve as much as possible of what is important to them and to minimise the adverse effects of change.

Intra-regional challenges

The shire is faced with local and regional challenges that have been documented extensively by Council in issues papers (such as WSC 2000a and b) prepared in the course of developing the first iteration of its strategic plan, *Wingecaribee, Our Future*, and in annual state-of-environment reports (such as WSC, 2004a). It is useful here to look beyond the ten-year perspective of those issues papers. This must necessarily be speculative, even contentious.

Most of the issues documented by Council were ones aggravated by unprecedented population growth in the shire in the 1980s and 1990s, compounded by the effects of affluence and technology. By then under-investment in facilities and infrastructure had left backlogs in the public provision of community and environmental services and the shire was without many of the higher-order services commonly found in populations of 40,000. Little provision was being made for future growth.

Since the first iteration of a strategic plan for the shire (WSC, 2002a) backlogs and lagging service development are being addressed. For example, Council has embarked on an Infrastructure Renewal Program and, with state government assistance, has also expended over $60 million on augmenting sewerage for Bowral and the north of the shire. New shopping centre developments are under way or have been proposed.

How much further public and private investment is needed now on major facilities and infrastructure such as sewage treatment plants (STPs), regional entertainment centres, traffic relief routes, public transport interchanges, regional shopping centres and major care facilities? The difficulty in answering this question is that there are still backlogs, while future needs are hard to predict.

When large costs and long lead times are involved, neither governments nor private investors care to put large investments into facilities or infrastructure that may lie under-utilised. Equally they are reluctant to make under-provision where economies of large scale might be obtained by, or where the costs of retrofitting facilities or infrastructure will be higher than those of, *ab initio* investments. So, planners and developers like to have some certainty about the future.

For guidance, planners and developers widely rely on official population projections. However, population projections are based on past population behaviour and are very unreliable when prepared for small-areas such as the Wingecarribee.

When the latest sewerage augmentations were approved, rapid population growth was taking place both in areas served by inadequate STPs and in the north of the shire where there was no sewerage. There were also the livestock equivalents of 500,000 humans. These led to concerns about the quality of urban effluent entering rivers that drain ultimately into the dams of Sydney Water. These concerns were exacerbated by scares about *cyanobacteria* and pathogenic micro-organisms in this effluent.

At the time official population projections for the shire suggested that its population was set to continue a rapid growth (see the first three rows of data in *Table 8*). New or augmented sewerage was planned for Mittagong and towns and villages in the north, and for Bowral, Robertson, Moss Vale and Bundanoon.

However, population growth has now slowed somewhat. The more recent population projections in the Table including ones prepared for Council

TABLE 8: WINGECARRIBEE: POPULATION PROJECTIONS

	2001	2006	2011	2016	2021	2026	2031
Department of Urban Affairs and Planning [1]	46600[5]	51100	56200	69900	65000	na	na
Wingecarribee Shire Council[2] (unconstrained)	43016[5]	50463	55734	na	na	na	na
(constrained)	43016[5]	45141	51089	60677			
Census Applications[3] (constrained)	40432[5]	43704	47285	50569	53544	na	na
(unconstrained)	40432	44025	47222	50159	52838	na	na
Transport and Planning Data Centre[4]	42740[5]	46050	48940	51730	54550	57400	60180

Sources and Notes: 1 NSW, Department of Planning, Population Projections 1991-2021 *(1994)*
2 WSC, Housing Strategy *(1998)*
3 Census Applications (2004b)
4 TPDC (2004)
5 *l ABS Actual ERP was 42,740 in 2001. Provisional ERP was 44,670 in 2004*

that bravely forecast future populations in localities (Census Applications 2004b) reflect this.

If population turns out to grow at lower rates, major capital investments in the shire might be deferred. For example, on the latest forecasts the sewerage capacity in the shire could now be sufficient until 2016 once the Bowral augmentation is completed. Further sewerage augmentations might be deferred and private sector investments in centrally located, regional-order servicing might also be delayed.

However, all of the scenarios suggested in the Table remain possible. What will eventuate now depends on the future of Sydney because net immigration from the Greater Metropolitan region and more especially from the Cumberland Basin is now clearly the main driver of population growth in the shire.

Inter-regional challenges

Over its two centuries the population of Sydney has grown, steadily but erratically. As new modes of transport, firstly trains and more recently motor vehicles, have increased mobility the metropolis has also spread. For most of its time Sydney remained confined to the Cumberland Basin but from the 1950s railway electrifications and the construction of freeways enabled Sydney to spread further, into the Blue Mountains and Central Coast.

By the 1980s Sydney's growing population had begun to spill over into adjacent parts of the Illawarra, Lower Hunter and Central Western regions of NSW. A larger metropolis, incorporating Newcastle and Wollongong as well as Sydney had begun to form and populations in peri-metropolitan regions such as the Wingecarribee had begun to grow as commuters and retirees migrated there.

By the 1990s, well before the completion of the F5/M5 motorway, migration from Sydney had become the main driver of population increases in the shire. However, migration is highly responsive to fluctuations in the growth of Sydney's population. It reflects a complex interplay of demographic and economic forces that make Sydney a more, or less, attractive to live in.

Over the last decade there have been considerable fluctuations in Sydney's residential population growth. Rates of natural increase have continued a downward trend while net immigration from both within Australia and beyond has ebbed and flowed. Reflecting this, more recent population projections for Sydney and its local government areas have recently been generally revised downwards.

For the Wingecaribee, uncertainties about the growth and spread of population in the Cumberland Basin (which still accounted for 78.4% of the 4.9 million residents of the metropolis in 2001) raise questions about the extent and timing of future overspill into the shire.

Since the 1970s much of the population growth in the Cumberland Basin has been in what have become known as the Northwest and Southwest Sectors. Here, staged releases of green-field land have enabled urban Sydney to spread, to Campbelltown and beyond into the Wollondilly Shire in the case of the Southwest Sector.

As these sectors have sufficient land to cater for any foreseeable needs for green-field sites it is not conceivable that Sydney will physically spread into the Wingecarribee. However, overspill of people from the metropolitan region is likely and the shire needs a supply of urban land to cater for this. A problem for both public and private sectors in the

shire is to know how many new allotments, and when they will be needed.

One way of addressing this problem, and of making provisions for the very large capital investments needed for roads, sewerage, facilities and the like, is to plan for releases of new urban land on to the market. This is done around Sydney through the Metropolitan Development Program. The state government has decided that development in the larger new urban releases should be managed by a Growth Centres Commission. In the shire, Council has committed itself to a new small town after 2011 (WSC, 2002b). A challenge for the shire is to ensure that land releases are managed in such a way that Council retains control over development in the shire while minimising its capital commitments.

An alternative is to allow the market to manage land releases. This risks the kind of unregulated development that happened on the Central Coast where residential population quadrupled over twenty-five years, to 160,000 in 1980, without significant strategic direction and before provision of infrastructure. That region is still struggling to cope with backlogs and the consequences of ad hoc development decisions, while also providing for continuing growth.

Unregulated growth of that kind is less likely to happen in the Wingecarribee than on the Central Coast because environmental management is now more rigorous and because the Wingecarribee is more important for Sydney. Nevertheless, there are cautions for the shire and for the state government in the Coast's experience.

In the longer term there are uncertainties also about development in adjacent inland regions. At present, Goulburn, Canberra and regions further inland are largely irrelevant to the Wingecarribee. This could change with transport improvements in the Sydney to Canberra and Melbourne corridors, particularly if development in the Cumberland Basin were to makes access to Sydney from the shire (such as via the M5) more difficult.

Already, Canberra is a viable alternative to Sydney for high-order services such as in medicine, finance and education. It is interesting to note also that the 2005 master plan for Canberra International Airport sees a potential role for that airport as a second airport for Sydney, particularly if linked to improvements in land transport such as very high-speed trains.

Improvements of this kind to transport in the inter-capital corridors between Sydney, Canberra and Melbourne have long been proposed as a means of breaking down the geographical fragmentation of Australia's economy and enabling it to compete more effectively internationally. However, little has happened, other than incremental spending of some $5 billion (2004 dollars) on Hume Highway improvements since 1974 (Laird, 2004).

Consequently, inter-capital flows of freight and people between the state capitals (other than movement of people by air) remain surprisingly small by international standards. In 2003 fewer than a million tonnes of freight (excluding steel) moved between Sydney and Melbourne by rail, less than the freight moved inter-regionally (such as 1.7 million tonnes of limestone to New Berrima and comparable amounts of grain to Port Kembla). Inter-capital road traffic was similarly small, with road carrying nine million tonnes of freight between Sydney and Melbourne and two million tonnes between Sydney and Canberra. Daily, inter-capital road movements averaged less than 8,000 axle-pairs (Sydney-Melbourne) and 11,000 (Sydney-Canberra) in 2003. Most of the traffic on the Hume and Federal Highways is local and intra-regional.

Although various studies (eg DTERS, 2002, and PCIE, 2002) have considered the effects on inter-capital movements of very high-speed and electrified rail, it is possible only to speculate about implications for the Wingecarribee. One possibility is that producers for national markets might be drawn to the shire because of a shortage of suitable 'employment lands' in the Cumberland Basin and Illawarra. Another is that new residents could be attracted to the shire because of a shortage of high-quality living environments close (in time terms) to Sydney. A less attractive possibility is that transport noise and traffic might diminish the amenity of Wingecarribee living.

Global challenges

Speculating, there are three challenges likely to have particular implications for the geography of the shire. No easy solutions are suggested here!

Firstly globalisation, encompassing the processes that remove barriers and other constraints on the movement globally of people, goods, services, ideas, information and money around the world will have enormous implications for a small dependent and somewhat insulated regional population.

The most likely implication is that economic activities will become increasingly centralised geographically as they seek to realise the potential economies of scale from being in centres. The extent and pace of this will be affected by the

extent to which transport and communication remain cheap and by the extent to which protections are afforded to the special interests and characters of individual places and groups of people.

It may be expected that much production of goods and services will continue to drift to central places, within the shire, within the state, within Australia and within the Asia-Pacific region, according to the order of markets served. These central places will not necessarily be existing centres, if congestion of existing infrastructure makes this uneconomic, or if people and their residentiary activities do not follow the drift of basic economic activities.

It is possible that processes of decentralisation, such as the counter-urbanisation that has been widely observed in advanced economies, might continue. This could lead to development of new centres and of growing differentiation of regional communities one from another.

In the foreseeable future, however, the shire is likely to remain essentially as a residential region adjunct to the Greater Metropolitan Region of NSW. Its population might grow to a size sufficient to enable new economic bases to emerge, but new economic bases are unlikely without radical changes to transport and communication patterns in southeastern Australia.

Radical changes to transport in fact could present a second global challenge. Over the last half-century the geographies of most advanced economies have altered rapidly and radically because of cheap energy, which has revolutionised both transport and the nature of production and consumption. Cheap oil has been fundamental in this, notwithstanding the oil price shocks of the 1970s, because it has set other energy prices. Transport now depends almost exclusively on oil in most economies, to an extent that has made traditional explanations of the location patterns of economic activities somewhat redundant!

The era of cheap oil could end quite rapidly. The finite nature of oil resources is increasingly being acknowledged but cheap alternative sources of energy are not available. For transport this is a special problem because most popular forms of transport require energy that can be transported easily. Neither oil rendered by gasification or liquefaction from coal (which might be a possible future industry for the Wingecarribee) nor electric-powered vehicles are likely to be economic for transport in a foreseeable future. Reduced travel and moves to public transport appear inevitable.

Higher real transport costs could promote some localisation of both production and consumption. They are likely to reverse a travel behaviour that has enabled both a continuing urbanisation of the countryside and the physical spread of towns over the last half century.

The Wingecarribee will be particularly vulnerable to higher real transport costs because of its spread-out settlement and land use patterns and the considerable road movements between it and Sydney. Higher transport costs are likely to encourage higher densities in residential development in the main towns, which may enable community transport to operate more effectively within the towns. They might render rural living less attractive. They might also enable more effective public transport between the shire and Sydney.

To some extent there will be substitution of communication for physical transport, so the extent of possible cost rises in production and distribution is not clear. It seems certain, though, that disposable incomes will be reduced, which would reduce economic activity in the shire.

A third global challenge for the Wingecaribee lies in the implications of climate change. There is little serious disagreement now that temperatures will rise globally as a consequence of human-induced greenhouse gas emissions, regardless of what may be done to reduce emissions. In a best-case scenario in which emissions were cut radically, mean temperatures will rise by 1°C globally over the 21st century. In a worst-case scenario they could rise by 6°C, which would put the human species at risk.

For the Wingecarribee climatic modelling (Hennessy, *et al*, 2004) is now sufficiently precise to predict a warming of at least 1.6°C by 2030 (mean annual temperatures in the shire are currently between 13° to 14°C). Warming will be greater at night and in winter. There will be a twenty per cent reduction in rainfalls, especially in winter and spring. Variability and extreme weather events are both likely to increase.

This is very bad news for plant growth because, while winters may become milder, there will be less available moisture in soils. This might enable more cropping in the east but livestock carrying capacities will fall generally and many natural communities and ecosystems may not survive. Bush fires will become more common and, while winters might be more comfortable for humans, garden plantings may not survive increasingly unreliable conditions.

28 Managing change

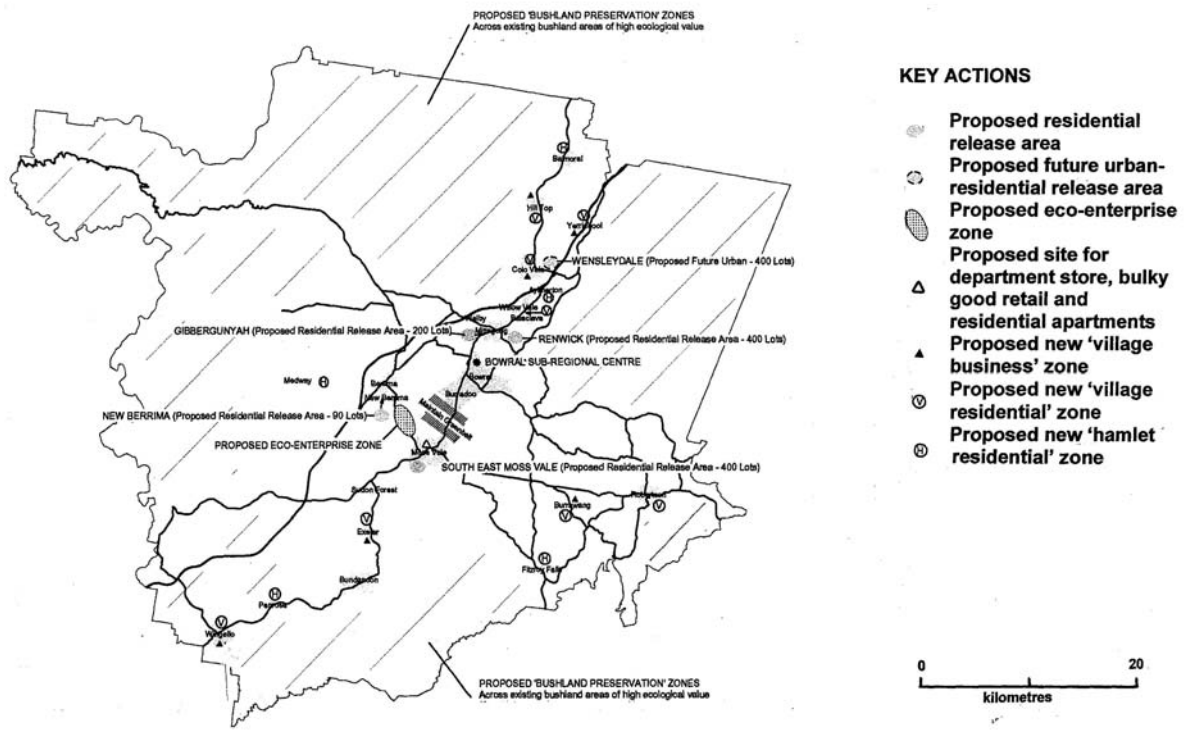


***Figure 49: Key actions proposed in* Wingecarribee Our Future.** *Reproduced from: WSC, 2002a: Key actions.*

The challenges facing the Wingecarribee require changes in individual and corporate behaviour. Whilst changes can be initiated by individuals and corporations, universal changes in a complex society generally have to be led by governments.

There are many ways in which governments may lead change. Traditionally, governments have favoured regulation rather than more subtle means managing change. Over recent decades, however, it has become accepted that regulation on its own, without clear objectives and programmes of action, may be neither an efficient nor an effective way of managing change.

Strategic planning has developed, as a better way of articulating desired outcomes and spelling out how these might be achieved. In this perspective regulation is but one way of achieving objectives, along with incentives and disincentives and the negotiation of agreements.

Strategic planning has not been readily accepted in Australia, as a way of managing change in communities and their environments. To be successful strategic planning requires commitments that neither public nor private sector corporations are willing to make when they involve large sums of money over long periods of time.

This reluctance stems in part from the fact that, while three quarters of all government revenues in Australia are collected by the federal government, over forty per cent is spent by state and local governments. The lower levels of government are dependent on higher levels of government for much of their income.

The federal government has no constitutional role in managing communities and their environments but as the paymaster it has substantial influence over public spending, especially through grants that are tied to particular purposes.

In this separation of responsibilities from power it has long been difficult for local Councils, the minor partner in government, to do much more than address the needs of communities and their environments in an *ad hoc* manner. However, the state government in NSW has done much in recent decades both to strengthen local government in NSW and to empower it to carry out a widening range of responsibilities (often without additional resources!).

Environmental management is one area in which Councils have been given special responsibilities. At first, after the amalgamation of three LGAs into one in 1981, environmental management by the new Wingecarribee Council was substantially limited to administering local environmental plans (LEPs), which are essentially instruments for regulating new development.

LEPs make little provision for the future other than a framework for regulation. By the late 1990s it became clear that the shire needed a strategic framework within which to provide both for infrastructure and facilities, subdivision and housing and economic development, and for the more rigorous regulation of development being required by the state government.

In response to the need, Council embarked on a process of strategic planning, *Wingecarribee Our Future*, in 2000. This involved extensive consultation on community and environmental issues and eventuated in a strategic plan of nearly 700 pages of text plus many maps.

The plan (WSC, 2002a) detailed proposals for many issues discussed during community consultations; set constraints on future built development by identifying 'ecological settings'; outlined possibilities for future development in twenty three identified 'precincts'; spelt out actions needed to achieve these possibilities (and to deal with backlogs); and proposed ways for paying for these.

This plan has been important for the shire because it provided a rationale for, amongst other things, Council's Infrastructure Renewal Program and a program of sewerage augmentation. Yet it doesn't state concisely its underlying principles, such as for spatial patterns of settlement and land use, on which everything else rests.

On the basis of a map in the plan (see *Figure 49*), the following appear to be the core spatial principles of the strategy:

- a focus on Bowral as the shire's centre for regional-order commercial and retail activities
- industrial lands to the west of Moss Vale and north of Mittagong
- other development in the three main towns to be essentially' suburban'
- some residential development in estates on the fringes of the three main towns
- most new development to be contained within existing urban boundaries
- encouragement of medium density residential development toward the centres of towns
- maintenance of an open space buffer between Moss Vale and Bowral/Mittagong, and
- restriction of new development in towns and villages to sewered areas

The plan provided for 1490 residential allotments on green-field sites across the shire and spoke of 'potentials' for a further 3300 new dwellings in existing urban areas, which would be realised by in-fill development in sewered parts of Bowral, Moss Vale and Bundanoon and 300 in sewered villages.

On the populations projected then, nearly 5000 anticipated new residential allotments would have accommodated growth up till about 2011, after which the plan committed Council to a 'new small town' for further growth. The plan did not indicate a location for or size of the new small town.

Council revised its targets in 2005 in an urban release program that provides now for 1980 residential allotments on green-field sites, the 3000 lots in existing urban areas and 2400 residential allotments in a new town. In its rezoning strategy Council deferred the zoning of the new town until 2014.

This leaves unanswered questions about how a new town might relate the shire's future settlement strategy and about the form of the new town and about how it might be managed. Now, with forecasts of slower population growth, decisions about the new small town, and about further new sewerage may yet be deferred.

These questions cannot be resolved until the shire has some certainty about its future population growth. This depends in large degree on whether the state government's latest metropolitan strategy and promised 'separate but complementary' strategy for the Sydney-to-Canberra corridor will be any more successful in containing the spread of Sydney and curbing over-spill than earlier plans.

Since the state government abandoned the green belts of the 1951 *County of Cumberland Plan* there have been six further metropolitan plans. All of these have introduced new ideas for managing Sydney's population growth and none has done much to contain urban Sydney or give guidance for non-metropolitan planning regions. The strategies have been beset by the problems of foreseeing change over long periods of time but their failures lie mainly in the failures of successive state governments to adhere to the plans and to commit to the necessary investments in infrastructure.

Now, a new strategy, *City of Cities* (Department of Planning, 2005) offers the shire little more certainty about the future growth of Sydney. It covers only the Cumberland Basin and Central Coast. It seeks to provide for a population that is projected to grow from 4.1 million in 2001 to anything between 5.0 and 5.6 million in 2031 (expecting growth to fall after 2006/2011 from a peak of nearly 50,000 annually).

The new strategy sets a target of 655,000 new dwellings in the Sydney region by 2031, two thirds to be in existing urban areas with a goodly proportion in major centres and corridors where it is hoped that over half of all new jobs will locate. Half of the new dwellings on green-field sites would be in the Southwest sector, mainly in designated Growth Centres.

On the face of it, the new strategy provides for enough new dwellings to accommodate projected populations, so long as household sizes do not fall. However, the strategy offers little that will actually generate employment or that will achieve the physical and social infrastructure that is needed particularly in centres and corridors where congestion and crumbling infrastructure exacerbate the problems of providing for new infrastructure.

If households do become smaller or if governments fail to provide adequate infrastructure Sydney's population growth could become self-limiting. To the extent that this may happen some of Sydney's projected population increases will spillover, including into the Wingecarribee. Council, state government agencies and the private sector need guidance on this so as to invest in housing, jobs and service provision when and where they are needed.

A Sydney-Canberra Corridor Strategy was prepared in 1995 to give this kind of guidance but that strategy is a curious document. It treats a diverse area between Yass and Wollondilly shires as a single entity and largely ignores the magnetic attractions of the metropolises beyond each end (Canberra and Sydney). It also proposes a settlement hierarchy in which a small, struggling town in the centre of the area (Goulburn) would be the 'regional centre', without suggesting any way in which that centre might offset the magnetic pulls of the metropolises away from this town.

The current Sydney-Canberra strategy does identify a range of sensible policies and strategies, which were to be applied in all LEPs affecting land in the corridor. *Wingecarribee Our Future* defers extensively to the 1995 corridor strategy, and it is expected that promised revisions of the shire's plans will similarly defer to any updated Sydney-Canberra Corridor Strategy.

Implementation of these plans depends on all of the powers of governments to address issues. However, although governments do use the full range of their powers to influence the behaviour of individuals and corporations, mostly they rely on infrastructure spending and on regulating new development as their primary means of addressing issues and fostering the interests of communities and their environments.

As society becomes more complex it is inevitable that regulation will become increasingly complex. Regulation is effected through many statutory and non-statutory instruments aimed at both new and existing development. Examples include the state government's State Environmental Planning Policies such No 66 *Integrating Land Use and Transport* and Council's many management plans, housing strategies and the like.

The main means of environmental regulation in NSW is the battery of statutory instruments that affect particular areas, such as Environmental Planning Instruments (LEPs especially, and regional environmental plans such as *Illawarra REP No 1* and the *Drinking Water Catchments REP No 1*) and Council's own Development Control Plans. Essentially these are bodies of rules that developers are expected to follow when designing, and that governments are expected to apply in determining, proposed new buildings, works, uses and subdivisions.

Wingecarribee's current LEP was gazetted in 1989, a decade before the first iteration of the shire's strategic plan and before an era of more rigorous environmental management. A new LEP is needed as the principal regulatory means of implementing the strategic plan but because the state government (which has to approve new LEPs) is changing its requirements for LEPs this will not now happen until 2006, or later.

As for managing challenges that might extend beyond a human generation, or that might accompany radical departures from trends that have been established over more than a generation, governments are little better equipped than individuals and corporations to understand these challenges. Encouraging governments to lead in identifying, understandng and addressing these challenges might be the biggest of all the challenges facing the shire.

Summary and Conclusions

29 Summary

This book and especially its maps and diagrams (and in a more general way data in Table 2) show a region of great diversity. The following suggests some generalisations about this diversity

- The region is relatively small and compact, extensively fringed by Crown reserves
- Its ties by most of its drainage and most of its human interactions are to the Sydney region
- Mostly an elevated, undulating plateau, fringed by cliffs, canyons and gorges
- Plays a major role in water transfers to urban Sydney and supplies some of that water
- The plateau surface is the eroded remains of sediments that formed part of the Sydney basin
- A regional 'hot spot' has produced igneous intrusions and vulcanism, mainly in the east
- Significant mineral and ground water resources reflect the underlying geology
- Soil patterns also reflect this geology but have been widely affected by other processes
- Prime agricultural land is limited in extent and in pockets rather than continuous areas
- Weather comes from mainly from the west but rain is mainly from the east
- Temperatures are controlled by elevation, though humidity and radiation are important
- Rainfalls are a function of elevation and of distance from the coast
- Potential plant growth is severely limited by moisture deficits and variable rainfalls
- Nearly two thirds of the region is under native vegetation, mainly towards the margins
- Much natural vegetation has been cleared or remains now in degraded condition
- About half of the cleared area is used for built-and-related covers or crops-and-pastures

- Census enumerated populations exclude many residents and include overnight visitors
- Visiting populations (overnight and day-trippers) generally remain small
- absentees, visitors and institutional populations may distort local population profiles
- Population and dwelling densities are low in clustered settlements and rural areas
- Percentages of unoccupied dwellings in some areas may reflect second home ownership
- Total population has grown slowly over time, except in the 1980s and 1990s
- Recent volatility in growth reflects fluctuations in migration and declining natural increases
- Most recent net migration has been in the north and of younger adults and their families
- Population in the three main towns has grown faster over time than in smaller settlements
- Mostly the towns have grown by spreading, helped by the spread of infrastructure
- Currently physical development in the towns growth is focussing on inner-areas
- The population is strongly 'Australian' and strongly 'anglo-celtic' in its heritage
- Households and families are small and single person households are common in the towns
- Workforce participation is high but there is under-employment of females and older people
- About a quarter of the workforce commutes away from the shire for its main work
- In income terms, relative poverty may be more widespread than real affluence
- Commonly held perceptions of the people of the shire may be misleading
- Geographical divisions limit social interaction within the shire

- The economy is small, unsophisticated, fragmented and geographically dispersed
- It is essentially 'residentiary', with no clear economic base or comparative advantage
- It relies heavily on the external income of commuters, investors and beneficiaries
- It is dominated by three competing small towns and has no clear regional centre
- It lacks many of the higher-order services commonly found in comparable populations
- 'Escape expenditure' and market fragmentation discourage higher-order service development
- Spread-out land use and economic patterns lead to high transit costs in the economy
- The economy is not well supported by sectors important for its efficient functioning

- With population growth slowing down it is difficult to forecast future populations
- We can only guess about the local impacts of future development in Sydney and elsewhere
- impacts of globalisation, transport and energy prices and climate change are also uncertain
- The shire has an evolving strategic plan that robustly addresses short-term issues
- A new local environmental plan to implement the strategic plan may come in 2006
- Dealing with longer-term challenges may be the greatest challenge facing the shire

30 Conclusions

In recent decades it has become unfashionable to undertake geographical studies of small regions. Geography, like other academic disciplines has been subject to paradigm shifts and it is true that much regional geography of the past was not intellectually rigorous. Today, improving data and better techniques for their presentation are making possible more rigorous studies of places and their people. The practical application to more effective environmental management and their inherent interest for residents are two good reasons for regional studies being carried out.

This book has viewed the Southern Highlands of New South Wales from a strongly empirical perspective. It has described geographic patterns and has sought to put these patterns into wider contexts. It has sought to explain these patterns in terms of how they have evolved and why they are. It has sought also to apply its explanations to some of the management issues that confront the region. The book reflects a state of knowledge that is anything but comprehensive.

The book has considered a shire in which there is great geographical diversity, amongst both people and their environments. This diversity can make it difficult to see geographical patterns clearly. There are great transitions from east to west in geology, climates and biology. There are significant contrasts between north and south, in the social and economic activities of the people.

In this diversity it can be difficult to see the Wingecarribee as a region. At its edges, parts of the shire seem to be more akin in biophysical or socioeconomic terms to neighbouring areas. The north is increasingly integrated with Sydney, the east and south have much in common with adjacent parts of the Illawarra and the west could be regarded as part of the Southern Tablelands.

Yet there is commonality in this diversity. The shire might be seen as divided by the Wingecarribee River into an urban north where eighty percent of the people live in towns and a more rural south where only sixty percent live in towns. However, in another view, the shire may be seen as comprising an urban core in which sixty percent of its population lives within ten kilometres of the shire's demographic centre, around which is a more extensive semi-rural periphery.

A view of the shire as core-and-periphery makes it easier to comprehend the shire as a single entity and it offers a perspective against which generalisations about patterns in the shire and about the shire in a wider world may be better understood.

The view of the shire as core-and-periphery is relevant also for tackling its uncertain future. The shire is small in both area and population. It sits on the periphery of a metropolis whose dominance makes it difficult for the shire to establish or maintain its own identity. If the shire is to establish a niche in relation to that metropolis it must be united in promoting its own urban core.

Although this core is spread out in a way that is not spatially efficient, it contains a population that is comparable in size with those of other regional centres in NSW. It has fifteen per cent more people than Goulburn and this is growing. The core needs to be recognised and organised as a single regional centre. This doesn't require that individual towns give up their individuality but it does require that the core be identified as something more than an unrelated collection of competing, small towns.

The periphery also is spread out, in a manner that may give rise to isolation at the edge of the shire. Remoteness cuts two ways. It may limit access to centres but it also offers an antidote to the hassles of being near centres. To the extent that remote communities are disadvantaged it may be judged necessary to find ways of offsetting this. When populations are sparse, as in the periphery of the Wingecarribee, this may require closer integration of core and periphery, while supporting the individuality of localities.

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A descriptive analysis such as presented in this book should have several outcomes. It should inform the reader. It should invite the reader to speculate about implications and applications of the information presented in it. It should enable readers better to understand and support decisions that are made on their behalf. It should encourage people to participate in the making of these decisions.

If this book stimulates readers to ask questions about their home, perhaps even to try to answer more fully the many questions that it begs, then the effort that has gone into this book will have been worthwhile.

Asking questions is the first step towards understanding. Understanding is the best way for any region to achieve a robust future.

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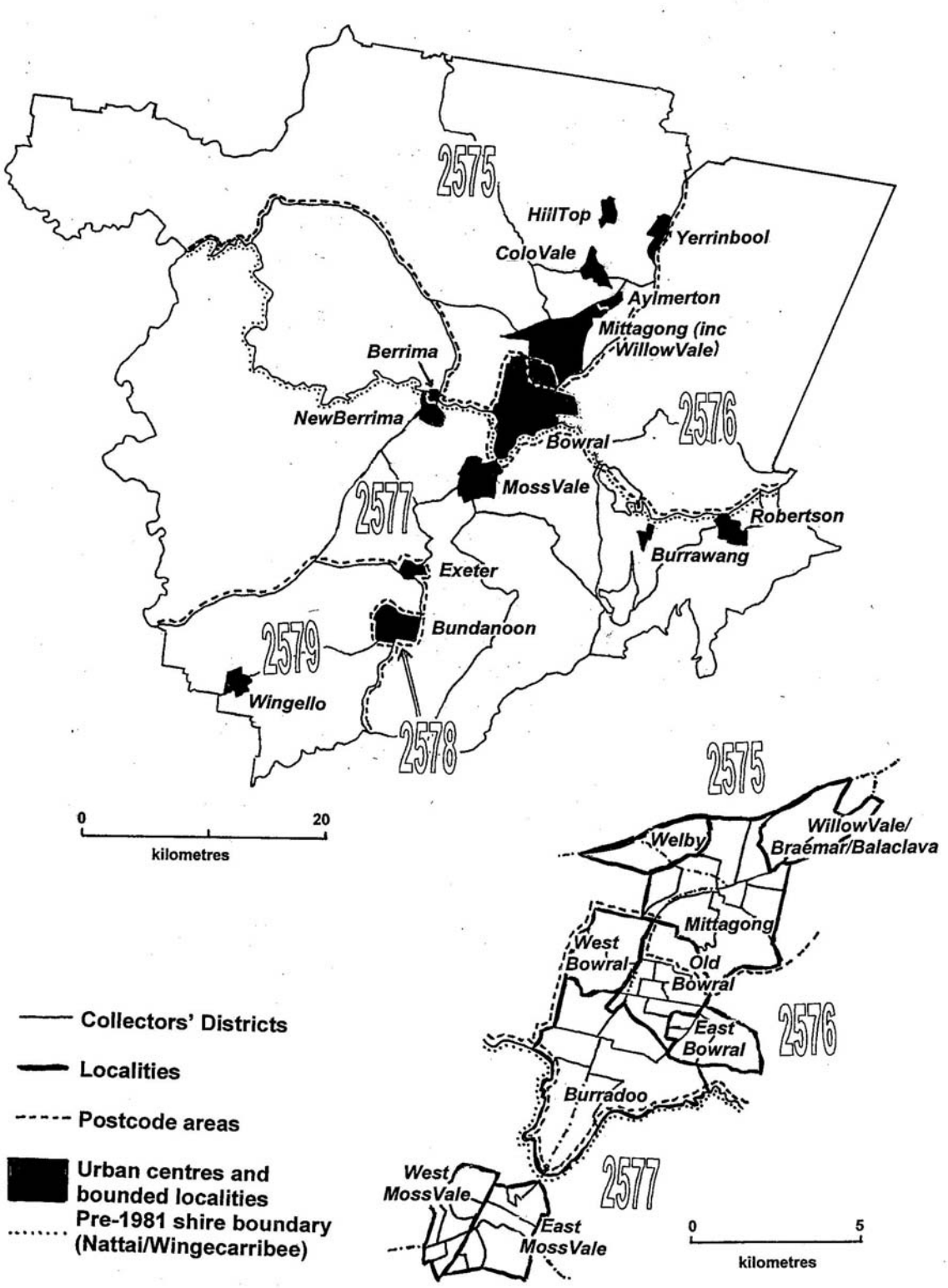

Figure 50: Statistical Geography. *Source: ABS,* SLA 18350 (Wingecarribee Shire) 2001 census maps*, and WSC.The map of the shire shows Urban Centres, Bounded Localities, rural Collectors' Districts, Post Code areas and the boundary between the former Nattai and Wingecarribee shires (the boundaries of the former municipality of Bowral are not shown). The inset shows Bowral, Mittagong (including Willow Vale) and Moss Vale in more detail, including Collectors' Districts, WSC-defined Localities and Post Code areas.*

Wingecarribee, Our Home: A Geographical Interpretation of the Southern Highlands of New South Wales is based on materials prepared for a course that was first offered by U3A – Southern Highlands, Inc in 2005. It presents an overview of the Southern Highlands of NSW that draws on a wide range of statistical data as well as the limited available literature on the area. The book not only looks at the diversity within 'the Wingecarribee' but also considers the region in the wider geographical context of Sydney and NSW.

Ian Bowie, the author, is a former academic who has retired to Bowral after a career in which he taught geography, environmental management and town and country planning at universities in three countries and later practised as a consultant planner.