History of land use in the Murrah/Dry River catchment, NSW South Coast

By Anthony Scott

CSIRO Land and Water, Canberra
History of land use in the Murrah/Dry River catchment, NSW South Coast

By
Anthony Scott
CSIRO Land and Water

Technical Report 54/99
December 1999

Acknowledgements

The following people and organisations provided valuable assistance with the collection of information and production of this report;

• Bega Valley Historical Society for providing historical information,
• Betty Taylor for the old photos of Quaama and valuable information about the river.
• Robyn Levy for providing transcripts of interviews with local residents of Murrah and for a set of old photos,
• Norma Gowing for providing photos of the 1971 flood at Murrah,
• Department of Land & Water Conservation for lending aerial photos,
• NSW State Forests for providing data on recent logging activities,
• Peter Wallbrink for reviewing the draft report, Jo Allison for assisting with map production, and Ruth Crabb for library searches.

Front cover photo: Lower reaches of the Murrah River and surrounding farmland in about 1910. (photo supplied by Robyn Levy)

Copyright

© 2002 CSIRO Land and Water.
To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO Land and Water.

Important Disclaimer

To the extent permitted by law, CSIRO Land and Water (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.
# Table of Contents

**SUMMARY** ................................................................................................................................................................................... 3

1. **INTRODUCTION** ........................................................................................................................................................................... 6

2. **REGIONAL SETTING AND DESCRIPTION OF MURRAH CATCHMENT** ................................................................. 8
   2.1 **DESCRIPTION OF BEGA DISTRICT** ............................................................................................................................. 8
   2.2 **MURRAH CATCHMENT** ............................................................................................................................................. 8

3. **PHYSICAL ATTRIBUTES** ................................................................................................................................................................. 9
   3.1 **GEOLGY** ................................................................................................................................................................. 9
   3.2 **CLIMATE** ............................................................................................................................................................. 9
   3.3 **STREAMFLOW** .................................................................................................................................................. 10

4. **HISTORY** .......................................................................................................................................................................................... 11
   4.1 **ABORIGINAL OCCUPATION** ..................................................................................................................................... 11
   4.2 **LOWLAND VEGETATION PRIOR TO EUROPEAN SETTLEMENT** .................................................................................. 11
   4.3 **FIRST EXPLORERS** ................................................................................................................................................ 11
   4.4 **EARLY SETTLEMENT – THE SQUATTERS** .................................................................................................................... 12
   4.5 **GROWTH OF BEGA TOWNSHIP – 1850s** ...................................................................................................................... 13
   4.6 **THE IMPACT OF THE 1861 ROBERTSON LAND ACTS ON FARMING INTENSITY** .......................................................... 14
   4.7 **CHANGING AGRICULTURAL PRACTICES IN THE LATE 19TH CENTURY** ........................................................................ 15
   4.8 **DEVELOPMENT OF THE DAIRY INDUSTRY** .............................................................................................................. 15
   4.9 **BEJA VALLEY CLEARED BY THE EARLY 20TH CENTURY** .......................................................................................... 17
   4.10 **AGRICULTURAL DEVELOPMENT IN THE 20th CENTURY** ...................................................................................... 17
   4.11 **URBAN DEVELOPMENT IN THE BEGA DISTRICT** ................................................................................................. 18
   4.12 **HISTORY OF FARMING IN THE DRY/MURRAH RIVER CATCHMENT** ........................................................................ 19

5. **FORESTRY** .................................................................................................................................................................................... 20
   5.1 **FOREST TYPES** .................................................................................................................................................. 20
   5.2 **EARLY TIMBER UTILIZATION** ................................................................................................................................. 20
   5.3 **TIMBER INDUSTRY EXPANDS IN THE LATE 19TH CENTURY** ................................................................................... 20
   5.4 **SAWLOGS AND SLEEPERS IN THE EARLY TO MID 20TH CENTURY** ........................................................................ 21
   5.5 **WOODCHIP OPERATIONS COMMENCE IN 1969** ....................................................................................................... 22
   5.6 **WHAT IS ‘INTEGRATED LOGGING’?** ...................................................................................................................... 22
   5.7 **LOGGING OPERATIONS** ....................................................................................................................................... 23
   5.8 **RECENT LOGGING WITHIN THE STATE FORESTS** ................................................................................................. 24

6. **FLOODS** ...................................................................................................................................................................................... 25
   6.1 **THE FLOOD RECORD FOR THE BEGA VALLEY** ........................................................................................................ 25
   6.2 **THE GREAT FLOOD OF 1851** .................................................................................................................................. 28
   6.3 **FLOODS ON THE MURRAH RIVER** .......................................................................................................................... 28
   6.4 **1971 FLOOD IN THE BEGA DISTRICT** .................................................................................................................... 29

7. **DROUGHTS AND FIRES** ................................................................................................................................................................. 32

8. **IMPACTS OF LAND CLEARING** ................................................................................................................................................. 34
   8.1 **LAND CLEARING LEADS TO GULLY EROSION** ........................................................................................................... 34
   8.2 **HARE AND RABBIT PLAGUES CONTRIBUTE TO SOIL EROSION** .............................................................................. 34
   8.3 **GEO MORPHIC CHANGES TO RIVERS AND STREAMS IN THE BEGA VALLEY** .......................................................... 35
   8.4 **GEO MORPHIC CHANGES IN THE COBARGO VALLEY** ............................................................................................ 37
   8.5 **GEO MORPHIC CHANGES IN THE MURRAH/DRY RIVER CATCHMENT** ............................................................ 38
   8.6 **SOIL EROSION IN STATE FORESTS** .......................................................................................................................... 39
   8.7 **ERO SION CONTINUES TODAY** .................................................................................................................................. 39

9. **CONCLUSIONS** .............................................................................................................................................................................. 41

**REFERENCES** ..................................................................................................................................................................................... 42
Summary

Project objectives
CSIRO and the CRC for Catchment Hydrology have commenced a study of contemporary and historical erosion processes in the Murrah/Dry River catchment (an area of 195 km²) just north of Bega on the NSW South Coast. The Murrah/Dry River catchment was chosen because it contains roughly equal proportions of cleared land for dairy and beef production, and forested land used for integrated logging operations.

The primary aims of this study are;

- to develop a better understanding of where in the catchment the eroded material is derived from (in particular the cleared grazing lands or the forested regions), and
- to determine if the erosion rates have changed over time.

An important part of this study was the collection of historical information about European settlement, and in particular any information that would help develop a better understanding of how this may have affected the rates of erosion. Although there is little specific information about the Murrah catchment itself, quite detailed accounts of European settlement in the Bega valley and surrounding districts are available, and these have been used to provide a general picture of the changes to the landscape over the last 170 years.

Agricultural development and impacts
The Bega district was first settled in the 1830s, however, large scale clearing of valleys and lower hillslopes generally commenced after the introduction of the Robertson Land Acts of 1861. Clearing of fertile land continued with the expansion of the dairy industry from the 1870s onwards. By the first two decades of the 20th century, nearly all the accessible, arable land of the Bega district had been cleared and utilized. Old photographs of the lower Murrah River, taken in the early 20th century, confirm that this valley had also been cleared by this time. A comparison of aerial photos of the entire Murrah/Dry River catchment in 1944 and 1994 show little change in the extent of clearing over the last 50-60 years.

Anecdotal and scientific evidence suggest that at the time of European settlement, the upper and middle reaches of streams in the Bega district were discontinuous, with extensive swamps, chains of ponds and flow-outs. Further downstream along the lowland plain was a continuous, low capacity channel. The channels were characterised by deep pools with extensive rushes along the base of the high, relatively cohesive, vegetated banks. Extensive stands of large river oaks (Casuarina cunninghamiana) lined the banks along these lowland reaches.

Changes to the morphology of these rivers and streams probably commenced as settlers started clearing large areas of vegetation, particularly along the valleys. Other activities such as the drainage of upland swamps, ploughing of alluvial flats, and the construction of tracks and roads, would also have contributed to the initiation of headcut incision along stream lines. Incision would have been quickly followed by channel expansion, supplying massive volumes of sediment to the lower catchment. Up to 2 metres of sand accumulated on lower floodplains, which were previously dominated by silt. Within a few decades of European disturbance, river courses became continuous, transforming river character and behaviour throughout the district.
Aerial photographs from the 1940s confirm that considerable erosion had already occurred in the cleared regions of the Murrah/Dry River catchment, and large deposits of sand can be seen along the middle reaches of the river near the village of Quaama and also along the lower reaches near the river mouth. Photos taken near the Murrah Bridge in the early 20th century also show large sand deposits in the river channel.

By the 1920s most rivers in the Bega district seem to have adjusted their width-to-depth ratio to the new hydrologic regime and sediment supply conditions associated with catchment disturbance. There have also been further localised changes associated with major floods during the last 70 to 80 years, in particular the 1971 flood.

Forestry activities and impacts
In addition to clearing of lowland forests for agricultural purposes, the forestry industry was established by the 1860s, supplying timber to the town of Sydney. Initially these operations were mainly confined to the lowland zone and the readily accessible coastal forests. The dry sclerophyll forests of the surrounding ranges were dismissed as valueless. However towards the end of the 19th century timber was also being extracted from the hills, and from 1900 sleeper cutters opened up the forested hills surrounding Bega, including the Murrah and Mumbulla State Forests in the Murrah/Dry River catchment. Selective logging for sawlogs and sleepers continued until the late 1960s, although the industry was limited by the poor quality of the timber stands caused by past wildfires and selective harvesting, coupled with a general lack of access.

The Eden woodchip industry began in 1968 when NSW agreed to provide Harris-Daishowa P/L with 500,000 tonnes of wood each year from the forests of the south-eastern corner of the State. A mill was built at Eden and integrated logging (for woodchips and sawlogs) commenced around Eden in 1969. In 1976 extensive road building ushered in a period of unprecedented utilization of the South Coast forests, taking a much wider range of tree quality than was acceptable as sawlogs. It also allowed timber extraction in the steeper parts of the catchment, which previously had only been selectively logged, if at all. Integrated logging in the forests of the Murrah/Dry River catchment began in 1979. After the first logging cycle (from 1979 to 1983), the Mumbulla and Murrah State Forests had a chessboard appearance of cut and uncut logging coupes.

While soil erosion occurs on hill slopes both during and following timber harvesting, the eroded material is generally transported over short distances and deposited in situ on the forest floor, with little sediment leaving the harvested slope. Tongues of deposited coarse sediment have been observed downslope of snig track drainage points on undisturbed areas, however, the filtering action of areas of undisturbed ground-cover vegetation prevents most of the material from entering the natural drainage. Where sediments in overland flow do enter the natural drainage, these mobilised sediments are mostly fine grained material (silts and clays). Minor access roads, snig tracks and harvesting areas are not long term active sources of sediments. The forest regrowth quickly restores vegetation and litter cover, which stabilise the site following disturbance.

Other factors contributing to erosion
Local farmers have noted that the most severe soil erosion occurs during large flood events, particularly if the flood is preceded by a drought (and hence ground cover is poor). During the 1971 flood, for instance, a large quantity of material was eroded from farmland in the middle and upper reaches of valleys throughout the Bega district, and a thick layer of sand was deposited on the alluvial flats along the lower reaches of rivers. Over the last 140 years the accumulation of a series of relatively thick (up to 50cm) fine to medium grained sand deposits
on the lower floodplains can be observed in the soil profile and these have been associated with the large flood events.

Erosion of hillslopes due to land clearing was accentuated by a rapid increase in the hare population from 1886 onwards, until they reached plague proportions a few years later. After the hare population declined, there was a rapid increase in the rabbit population, and these also reached plague proportions. By 1910 the rabbit population “had increased to hundreds of millions, (and) they actually turned the whole country into a desert”. The very large numbers of hares and then rabbits greatly increased grazing pressure, leaving many hillsides bare of grass. When heavy rain fell, these hillsides were prone to massive soil erosion. Rabbit numbers peaked around 1912 and then declined over the next four years. However they remained common throughout the 1920s and by the early 1930s numbers began to rise again. Another rise in numbers occurred in the late 1940s, but the introduction of myxomatosis in 1950 effectively controlled the rabbit population for the next decade. Destruction of cover, ripping of warrens and shooting are now the most commonly used control methods, assisted since 1996 by the introduction of the biological control agent, Calicivirus.

Erosion continues today

Erosion continues today, but probably at a lower rate than 80-100 years ago. In the 1950s the dairy industry within the Bega district introduced intensive farming practices to maximise milk output. Pastures began to be intensively managed, including the cultivation and maintenance of improved pasture species with superphosphate and spray irrigation. Such practices enabled greater numbers of cattle to be carried on the available land, but probably also reduced the potential for erosion on hillslopes with the increased pasture cover. The eradication of rabbits in the area through the introduction of myxomatosis in the 1950s also reduced the potential for erosion.

However, active gully and sheet erosion continue to be a problem in the Bega District. Recent data for the adjacent Bega Valley catchment estimated that there were 4,306 ha of land affected by sheet and rill erosion. There was also 13 km of gully erosion, including 128 ‘headcuts’, and 89 km of streambank erosion. In addition, there were 106 farm dams with eroding spillways. Anecdotal evidence from local farmers indicates that similar erosion problems exist in the Murrah/Dry River catchment.

Also, over the last 150 years, large quantities of sediment have accumulated along the middle and lower reaches of the Murrah/Dry River, and this material will probably take many more decades to move completely through the system.
1. Introduction

European-style land management practices have changed the face of landscapes in much of south-eastern Australia. This had many impacts on the way catchments behave, and as affected physical processes such as the hydrologic regime, stream hydraulics, sediment generation and sediment delivery. This in turn has resulted in a range of secondary impacts on water quality, biophysical processes and ecosystem functioning.

The impacts of European settlement are particularly evident in the granitic catchments of the South Coast of NSW (Brierley and Murn 1997, Brooks and Brierley 1997). Prior to European settlement, many of the watercourses in the upper reaches of these catchments were probably discontinuous, with extensive swamps and chains of ponds (Brierley 1998). Within a few decades of settlement, gully erosion had released massive quantities of material, and created steep-sided continuous channels up to 10 metres deep and 100 metres wide (Brierley 1998). Eroded material was flushed downstream, and the river channels became wider and shallower as large quantities of sand were deposited in the channel and on the floodplain.

Although a basic outline of the geomorphic changes since European settlement has been developed, there are still many questions that need to be answered. These include;

1) When did the bulk of eroded material arrive on the lowland plains: was it related to catchment clearing, or particular events such as floods, fires or the introduction of rabbits?

2) What are the pre-European, post-European and current rates of sediment delivery to the floodplain?

3) What is the relative contribution of eroded material from the agricultural land and managed forests within the catchment, since European settlement? These two land uses are often targeted as contemporary sources of eroded material, however in spite of much emotive debate, little hard evidence exists that quantitatively examines their relative contribution to sediment production within a catchment.

The answers to these questions will enhance our understanding of the major changes to the landscape that have occurred since European settlement. This in turn should allow us to improve current land management practices and also assist in the development of guidelines for river rehabilitation projects. With this in mind, a research project was commenced by CSIRO and the CRC for Catchment Hydrology, and the Murrah/Dry River catchment just north of Bega on the NSW South Coast was selected for the study. This catchment was chosen because it contains roughly equal proportions of cleared land for dairy and beef production, and forested land used for integrated logging operations.

The first two questions are being addressed by taking a series of cores from the floodplain in the lower reaches of the catchment. This is where much of the material eroded from the catchment has been deposited. Three dating techniques are being used to determine the ages of various sediment layers within the deposit. The first technique is the detection of the radionuclide Cs-137. Presence of this nuclide in a sediment layer effectively dates it to post-1960. A second method is the measurement of pollen grains. In this case the presence of exotic pollen grains can be used to date the boundary between pre-European and post-European times. Following clearing and conversion of forested slopes to native and improved pasture species, there is also a change in the ratio of abundance of grass species to that from trees. A third technique involves application of a novel technique known as ‘optically stimulated luminescence’ (OSL). This last technique enables the age at which quartz grains were last exposed to sunlight to be determined.
The third question will be addressed by analysing the chemical composition of the sediment to determine what proportion originates from the metasediment soils in the forested portion of the catchment, and from the granitic soils of the cleared agricultural portion.

To properly interpret the results of the sediment analyses and dating techniques, it is fundamentally important to obtain as much detailed historical information as possible about European settlement within the catchment, and this is the primary aim of this report.

Although there is little specific historic information about the Murrah catchment itself, quite detailed accounts of European settlement in the Bega valley and surrounding districts have been drawn upon to provide a general picture of the changes to the landscape over the last 170 years.
2. Regional setting and description of Murrah catchment

2.1 Description of Bega district

The Bega district is situated on the far South Coast of NSW and consists of a narrow coastal plain at the base of a steep mountainous escarpment. The coastal plain includes the valleys of the Bega, Brogo and Bemboka rivers, which drain a catchment of 1040 km² (Figure 1). The main town in the district is Bega, with smaller villages at Candelo and Bemboka. On the coast, near the mouth of the Bega River is the township of Tathra. About 30 km north of Bega is the small village of Quaama which is located on the banks of the Dry/Murrah River. The township of Cobargo, another rural centre, is further north in the valley of the Murrabrine and Narira Creeks.

In the Bega district, agriculture is largely confined to the river valleys and the surrounding hills which have granitic soils. In addition there are smaller areas of cultivated agriculture associated with alluvial soils along the river valleys. The main pastoral and agricultural activities are dairy, beef cattle, sheep grazing and a small amount of cropping. In the steeper forested areas of the escarpment and foothills, the principal land use is forestry; and substantial areas of this forested land are also managed for conservation purposes.

2.2 Murrah catchment

The Dry/Murrah River catchment drains an area of around 195 km² on the South Coast of NSW, immediately to the north of the Bega valley (Figure 2 and Figure 3). The upper catchment comprises two sub-catchments, Dry River itself and Katchencarry Creek, both of which drain from steep headwaters in the escarpment. These streams meet at Quaama, forming the Murrah River. Roughly 5 km downstream from Quaama, the Murrah River is joined by a tributary from the north, Pipeclay Creek. This tributary subcatchment does not drain from steep headwaters, rather it drains from rounded foothills.

Downstream from the Pipeclay Creek confluence, the Murrah River flows for about 12 km through a bedrock-confined valley, comprising state forest. Finally, the river flows into the lowland plains where valley width increases markedly and the river is tidally influenced.
Figure 1. Bega district, showing the Murrah/Dry River Catchment
Figure 2. Murrah/Dry River catchment

- Catchment area = 195 sq km
- % forested = 67%
- % cleared = 33%

Key locations:
- Cobargo
- Bermagui
- Cuttagee
- Wallaga Lake
- Murrah Lagoon
- Wapengo Lagoon
- Murrah River
- Dry River
- Pipeclay Creek
- Katchencarry Creek
- Narira Creek
- Quaama
- Brogo River
- Mumbulla Creek
Figure 3 Topography of the Murrah/Dry River catchment
3. **Physical attributes**

3.1 Geology

There are four main rock types in the Bega district which are represented in the Murrah/Dry River catchment;

1) **Ordovician metasediments:** These are the oldest rocks, in the district, and are a sequence of Ordovician metasediments, including sandstones, mudstones, shales, quartzite and slates. Metasediments are mixtures of sedimentary rocks and metamorphic rocks. In the Murrah, these rocks occupy most of the steep forested land in the lower half of the catchment (see Figure 4). Soils formed from Ordovician metasediments tend to vary depending on the degree of metamorphism of the parent rock materials. On areas where hornfels have been formed, the soils tend to be skeletal, whilst soils formed over unmetamorphised parent material tend to have a more earthy profile (State Forests 1994).

2) **Upper Devonian sediments:** These are terrestrial sediments, comprising conglomerates, sandstones and mudstones. In the Murrah catchment they can be found in a narrow band along the western part of Murrah State Forest (see Figure 4). The soils are generally quite thin and stony.

3) **Early to Middle Devonian - Igneous intrusive:** The Bega batholith is the dominant geological feature of the district (State Forests 1994). It comprises three major igneous rock types; granite-adamellite, adamellite, and quartz diorite-granodiorite. These rock types occur in hilly countryside with some steep slopes and small graded valleys, and are found in the cleared, central portion of the Murrah catchment, around the village of Quaama. They also occur in the steeper forested terrain in the south-west of the catchment, around Mumbulla Mountain (Figure 4). The soils consist of brown and red friable earths. The A horizons are loamy with clay contents which increase gradually down the profile (Crichton *et al* 1989). B horizons are well structured and brown or red in colour.

4) **Upper Devonian A-type granitoids:** These are part of a younger upper Devonian granitoid intrusion characterised by alkaline anhydrous (A type) granites. Soils formed from A-type granite are likely to have poorer structure than those formed on the Bega batholith (State Forests 1994). These rocks occupy the upper reaches of the Murrah catchment in Murrabrine State Forest (Figure 4).

3.2 Climate

The climate of the far south coast is warm temperate maritime (Tulau 1997). Air temperatures over most of the district are mild, owing to the coastal influence. February is the warmest month, with mean temperatures at Bega ranging from a daily minimum of 14.5°C to a maximum of 27.0°C. July is the coolest month with temperatures ranging from 1.4°C to 16.7°C.

The general distribution of rainfall in the south coast of New South Wales is controlled by orographic effects, with the highest elevations receiving most rainfall (Crichton *et al* 1989). In addition, rainfall declines westwards, away from the coast. Consequently, rainfall throughout the region is quite variable. The mean annual rainfall for Bega is 879 mm (see Table 1). The distribution of rainfall throughout the year is fairly uniform with a greater summer incidence but short term dry periods of two to four months frequently occurring (State Forests 1994). Mean annual rainfall for the Murrah catchment is presented in Figure 5 (data for this figure was obtained from Adomeit *et al* 1987).
Table 1 Rainfall statistics for Bega (Meringo St)

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.0</td>
<td>27.0</td>
<td>25.7</td>
<td>23.0</td>
<td>19.7</td>
<td>16.8</td>
<td>16.7</td>
<td>18.2</td>
<td>20.5</td>
<td>22.5</td>
<td>24.0</td>
<td>25.9</td>
<td>878.6</td>
</tr>
</tbody>
</table>

| Mean Daily Min temp (deg C) | 14.2 | 14.5 | 12.6 | 8.9 | 5.5 | 2.9 | 1.4 | 2.6 | 5.1 | 8.2 | 10.7 | 12.9 |

| Mean monthly rainfall (mm) | 82.0 | 89.7 | 97.1 | 73.8 | 76.7 | 82.8 | 52.9 | 51.8 | 53.1 | 70.7 | 68.0 | 79.9 | 878.6 |

| Highest monthly rainfall (mm) | 431.8 | 730.9 | 669.9 | 409.5 | 635.9 | 689.0 | 354.9 | 326.6 | 240.0 | 369.4 | 301.4 | 324.6 |

| Highest recorded daily rainfall (mm) | 192.8 | 454.2 | 384.8 | 176.5 | 252.5 | 196.3 | 179.4 | 162.3 | 129.5 | 151.9 | 189.2 | 235.4 |

---

3.3 Streamflow

Streamflows are typically higher during the December to March period and lower between the July to September period, with the seasonal pattern of streamflow closely related to that of rainfall. However, significant flows occur throughout the whole year. Streamflows are also highly variable on a monthly as well as annual basis and are dominated by moderate to high intensity rainfall events (State Forests 1994). Short periods of high intensity rainfall can occur at any time during the year, and it is not uncommon for half the annual rainfall to occur in two or three months.

The district is also susceptible to drought, and streams commonly cease to flow or have minimal flows in late summer and autumn.

Mean monthly flow for the Murrah/Dry River at Quaama for the years 1966 to 1983, was 1161 ML/month, and the median monthly flow was about 200 ML/month (data obtained from the Department of Land & Water Conservation).
Figure 4 - Geology of the Murrah/Dry River Catchment

**LEGEND**

- **Quaternary**
  - Alluvial and colluvial sediments

- **Late Devonian Sediments**
  - Merrimba Group; thin-bedded sandstone, siltstone and mudstone
  - Merrimba group; fluvial sandstone with mudrock and conglomerates

- **Late Devonian Volcanic Rocks**
  - Mumbulla Granite; medium leucogranite

- **Silurian and Devonian Intrusive Rocks**
  - Quaama Granodiorite; biotite-hornblende granodiorite
  - Kameruka suite; biotite granodiorite/hornblende adamellite
  - McLeod Hill Gabbro; gabbro, diorite

- **Cambrian and Earliest Silurian**
  - Adamantly Group; undifferentiated sediments, turbidites
Figure 5. Murrah/Dry River catchment - Annual Mean Rainfall

- 800-900mm
- 900-1000mm
- 1000-1100mm
- 1100-1200mm
- 1200-1300mm
4. **History**

4.1 **Aboriginal occupation**

The length of time that the Far South Coast of NSW has been inhabited is unclear although the oldest date from an aboriginal site located on the South Coast is about 21,000 BP (Lampert 1971, cited by Tulau 1997). It is more likely however, that the Bega coast and its hinterland were first inhabited at an earlier date. The Aboriginal Yuin people ranged widely through the Bega district (Byrne 1983) and probably lived a lifestyle heavily dependent on coastal resources; shellfish featured prominently in their diet, although the hinterland would also have been used as a source of fruit, roots and meat (Byrne 1983). There is evidence that forest fires lit by aboriginals had some effect on vegetation patterns (Sullivan 1982), although the level of impact is unknown.

It is also difficult to determine with any certainty how many Aborigines were in the district at the time of first settlement. In census returns between 1841 and 1847, John Lambie, Commissioner for Crown Lands in the district of Monaro, noted the presence of about 160 Aboriginals in the Bega area, and similar numbers in the Wandella/Murrabrine area to the north (Lambie 1839-48, cited by Byrne 1983). However by 1871 the Bega Gazette noted that there were “thirty-three Aboriginals only around the Bega District” (Lunney and Leary 1988).

4.2 **Lowland vegetation prior to European settlement**

Other than portion plans and explorer notes, little photographic or written evidence remains with which to characterise the native vegetation cover of the river valleys and coastal floodplains. So effective was the process of clearance that very little native cover remains intact. What evidence that does exist, indicates that before clearing the lowland hillslopes were dominated by a tall open forest of spotted gum (*Eucalyptus maculata*), forest red gum (*E. tereticornis*), and woollybutt (*E. longifolia*), with a fairly dense shrubby sclerophyllous understorey (Lunney and Leary 1988).

Riparian vegetation on alluvial reaches would have consisted of mature river oak (*Casuarina cunninghamiamana*) lining the banks, with manna gum (*Eucalyptus viminalis*) sub-dominant. A dense understorey of various wattles, tea-trees and bottlebrush was likely (Brooks and Brierley 1997). Away from the channel, river oak gave way to various eucalypt species on the floodplain, such as forest red gum (*Eucalyptus tereticornis*), and river peppermint (*E. elata*), plus rough-barked apple (*Angophora floribunda*) as the dominant overstorey vegetation (Brooks and Brierley 1997).

4.3 **First explorers**

The first white men in this part of the South Coast were the survivors of the shipwrecked Sydney Cove in 1797. The made their way up the coast from Point Hicks in Victoria to Port Jackson (Sydney), but were ill equipped and only four of the seventeen men survived. Shortly after, in December 1797 George Bass sailed down the coast in a whaleboat, on his way to Western Port Bay, and entered the mouth of a river although there is some debate about whether it was the Bega River (Bayley 1942) or Barmouth Creek (Evans 1994).
4.4 Early settlement – the squatters

During the next 30 years the Bega district remained unvisited by Europeans, until in 1829, after forming a station at ‘Oronmeir’, near Braidwood, WD Tarlinton made his way along the southern tablelands, finally discovering a route from Braidwood to Cobargo (Bayley 1942, 1946). Tarlinton discovered undulating fertile valleys, lightly timbered, with ample rainfall and watered by streams fed from the mountains.

Other squatters of the Braidwood district were quick to follow Tarlinton’s visit to the area and late in 1829 John Campbell, Henry Badgery, Bill Gerard and Thomas Cowper had also pushed through to Cobargo and the Bega Valley (Bayley 1942, 1946).

The Bega Gazette of 18/8/1888 reported;

“We have the names of Gillespie, Tarlinton, Jauncey, Dr Wilson, Major Elrington, Captain Bunn, Kerlewis, Ryrie, Lintot, Polack, Nolan, Burton, William and Henry Badgery, and others more or less connected with taking up the land from 1833 onwards.”

On October 18 1893 the same newspaper specified the areas taken up;

“Narira was picked out by Mr Kerlewis, but was jumped by Dr Wilson, Mr Jauncey came to Tilba, Major Elrington took up Wandell and Cadgengarry; Mr W Badgery took Bowago near the Cobargo Catholic chapel, Mr Henry Badgery came to Dry River; Captain Bunn sent Mr Nolan to Cobargo; Mr Ryrie from Arnprior secured Belowra and sold out to Mr C Byrne; Mr Lintot had Yowrie; the Polack brothers took Waccawich; Mr Allsop came to Brogo; Mr Burton followed Nolan at Cobargo and from him Mr Tarlinton purchased.”

During the 1830s further squattages were taken up, with the richest and most accessible lands along the river flats and valleys being settled first. All land taken up in the district was beyond the limits of location for settlers, which had been defined by Governor Darling in 1824 as the ‘19 counties’ and had no official protection from the government (hence the term squattages).

Huts of wooden slab were erected and occupied shepherds. Sheep were taken to pasture in the mornings and returned at night, to yards or folds made of logs or stones.

John Jauncey in 1886 described the countryside near Bega;

“I first saw and passed through this beautiful Bega country about 53 years ago (1833). I was then a youth of 17, and one of a party in search of suitable sheep country. There were at the time in the way of homesteads only two cattle stations in this neighbourhood – Cowper’s, in sight of where we are now (near Yarranung), and Badgery’s, near where Mr Manning’s vineyard is situated, and there were only two men at each station.” (Comments by John Jauncey on his 70th birthday in 1886, and recorded by A.B. Jauncey, 1918).

On July 4th 1834 Governor Bourke, in a dispatch to the Home Office, described the Twofold Bay district in more glowing terms;

“Already the flocks and herds of the colonists spread themselves over a large portion of this southern country…. The excellence of the pastures in the part of the colony I am describing has induced graziers to resort to it; and much of the fine wool, which is exported to England, is taken from sheep depastured on vacant Crown Land beyond the limits assigned for the location of settlers.” (Watson 1923 and cited by Bayley 1942)
The first squatters faced many difficulties due to their isolation and were forced to be self-sufficient. Communication throughout the district at that time was by horseback over the roughest of bridle paths which led from Braidwood through Belowra, Wandella, Brogo and “Bika” to the only port in the district at Twofold Bay (Bayley 1942).

By the early 1840s the Inlay brothers had become one of the largest landholders in the district having acquired 7 farms totalling almost 70,000 acres (30,000 ha) (Bayley 1942, Campbell 1968). In 1844 George Augustus Robinson made a tour through south-eastern Australia, and he included a description of the Bega valley in his report;

“On the 29th crossed a succession of wooded ranges of granite and sandstone and entered Biggah singularly situated in an amphitheatre of the Dividing Range about thirty miles from the coast and nearly encircled by the spars of the mountains. Corn, vegetables and fruit grow to perfection, and sheep and cattle on the rich downs (the largest portion of the surface) thrive amazingly.

The country bore evident indication of its having been submerged. Granite and sandstone is the chief formation. The average width of the river for eight miles from the coast is one hundred and fifty yards; the Casuerina Paludora (swampy oak) is almost exclusively in belts along the banks of the stream, some of them measuring from twelve to fifteen feet in circumference.” (Mackaness 1941)

Initially grazing of cattle and sheep for meat and wool production was the main land use, and by 1846 much of the land in the valleys and surrounding hillslopes were staked out as large stock runs on which the sheep and cattle wandered freely (Bayley 1942). However, land clearance was restricted to the alluvial flats which were used for cropping and subsistence farming. Cultivation was not extensive since home-made wooden ploughs were the only implements available for working the soil, however many farmers grew small amounts of oats, barley, sorghum, corn and wheat (Russell 1978). Grain was initially ground at each farm, but in the 1840s and 50s a few small mills were set up in the district.

Settlement at Bredbatoura in the 1850s – as described by Alexander Tarlinton.
WD Tarlinton shifted his family from their farm near Braidwood to his farm at Bredbatoura (near where Cobargo stands today) in 1851. His son, Alexander was 7 years old at the time;

“The first land taken up was under the license system but father added to his holding by buying the rights of several other settlers, until in a few years, we held all the land from the Brogo River to the Tuross, a distance of over 30 miles. There were no fences then, stockmen’s huts being built here and there. They were not worried by neighbours as the nearest might be ten miles away…” (Bayley 1946)

4.5 Growth of Bega township – 1850s

In 1851 the township of Bega was officially proclaimed by the government on a site next to the Bega River. At this time the town and nearby farms had a population of only 100 people and consisted of a shearing shed, a blacksmith’s, a few farm huts, and a boiling down establishment at Tarraganda. At the end of the year, Bega’s first inn was established by John James White (Bayley 1942). The flood of 1851 destroyed many of the original buildings and 17 lives were lost. New buildings were constructed on higher ground to avoid another such disaster.
4.6 The impact of the 1861 Robertson Land Acts on farming intensity

A major change in the nature of European settlement came in the 1860s after the Robertson Land Acts of 1861 were passed. This placed squatters at the mercy of the free selectors and the large pastoral runs were broken up. The first land sales under the act were soon held at Eden and free selectors began to arrive in the district.

“In 1861, when Sir John Robertson’s Act was passed, new settlers attracted by the luxuriant growth of wattle, began to take up selections on our run so father secured the portions now known as Bredbatoura and Murrabrine, and our family has held these ever since.” - recollections of Alexander Tarlinton, (Bayley 1946).

Prior to 1861 little ringbarking had been done, but from then on it became very necessary, as the smaller areas could not carry enough stock to ensure the free selector a living. Grass grew a lot thicker on the ringbarked land and crops would not grow among the green timber, so the open forest gave way to small, cleared and ploughed paddocks and thicker grassed areas. (Tarlinton 1986). Under the Robertson Land Act, all selected lands also had to be surveyed and fenced. So from this point on, farming and settlement became much more intensive. Selectors could purchase 40 acres (16 ha) of land or multiples thereof up to 320 acres (130 ha) (Russell 1978).

In a publication released 5 years after the passing of the Land Acts, it was noted that;

“Since the passing of the new land bill 50,000 acres (20,234 ha) have been taken up in the locality by free selectors” (Bailliere 1866, cited by Lunney and Leary 1988).

In 1877 total holdings in the Bega district, exceeding 1 acre (0.405 ha), amounted to 212,000 acres (85,826 ha) held by 704 landholders (Anon 1878, cited by Lunney and Leary 1988). The population of Bega and the surrounding district increased from 626 in 1861 to 1,643 in 1881 (Bayley 1942)

Selectors built up holdings along the Bega and Brogo Rivers and produced a variety of crops including maize which was used as fodder for pigs. Farm produce was shipped from ports at Tathra and Bermagui to Sydney and Melbourne. Land was also taken up along the coast at the mouth of the Murrah River, at Wapengo, Tanja and other localities with available flat land.

A description from 1866 reflects the widespread impact that the settlers were starting to have on native vegetation;

“The native grasses have nearly disappeared; their place being taken by clover (Trifolium sp.), prairie (Bromus uniloides) and rye-grass (Lolium)” (Braine 1866, cited by Lunney and Leary 1988).

By the 1870s the dramatic increase in land usage had resulted in clearance of forest cover from large portions of the lowland zone as indicated by the following description of the area;

“The whole country in every direction is studded with homesteads enclosed by substantial fencing. Splendid grass lands, timbered like an English park comprise the low country, while on the hills the grass springs as if by magic, as the ring-barking of timber lets the sun to it” (Anon 1878, cited by Lunney and Leary 1988).

The Moruya Examiner of January 22 1881 also described the countryside around Cobargo and Brogo;
Quaama village in 1938 (Photo supplied by Betty Taylor)

“Clearing land and collecting wattle bark, probably in the 1920s, on my Grandfather Hyland’s property, most likely at ‘The Ville’, just south of Quaama” (photo and description from Betty Taylor)
Cricket match at Quaama early this century, possibly the 1920s. Note the ringbarked trees in the background. (Photo; Betty Taylor)

The Gowing’s farm next to the Murrah Bridge, April 1999. (Compare this view with the front cover photo from the early 1900s)
Collecting wattle bark, probably in the 1920s on ‘The Ville’, just south of Quaama. (Photo supplied by Betty Taylor)

Sam and Betty Taylor’s children and their friends playing in the Dry River in about 1964. Note the bedrock as well as the sand deposit in the foreground. (Photo; Betty Taylor)
“The country between Cobargo and Brogo is all selected and fenced, being occupied by dairymen, who, in some cases, are the owners of the land; in others, merely tenants. This country some few years back formed a portion of the extensive Bredbatoura run, owned by WD Tarlinton Esq., who I believe, has been a resident of the district for more than thirty years. The run has been so extensively cut up into selections that little more than the name of a run remains to it. In the meantime Mr Tarlinton has not been idle, having on behalf of himself and family, secured many thousands of acres of the primest land, as the appearance of the cattle depasturing in his meadows, rolling in fat from the natural grasses will verify.”

Much of this clearing was for the burgeoning dairy industry, which began its rise in the 1870s as the principal form of land use.

4.7 Changing agricultural practices in the late 19th century

Wool figured largely among the exports of the district up to 1870, but gradually sheep gave way to Illawarra Shorthorn cattle, which many of the settlers brought with them (Bayley 1942). The drought of 1864 and the ravages of pleuro-pneumonia caused great havoc among the herds, thousands of cattle falling victim to them. In 1868 a severe drought again had to be faced, and the year ended with serious bushfires, which swept the whole district, doing untold damage to crops and property (Bayley 1942).

Dairying had begun but initially little attention was paid to quality or quantity in butter production and by the time it was loaded onto a ship at Tathra, much of it was rank. By 1877 cheese was also being produced at some farms in the district.

“In the early seventies the late WD Tarlinton started dairying and this was probably the genesis of the dairying industry in this district.” (Cobargo Chronicle 19/5/1933 and cited by Bayley 1946)

The wheat crops began to suffer as rust made its appearance, many paddocks being destroyed by it, and in the late 1880s wheat-growing ceased in the district altogether. Maize crops however fared much better, and a ‘maizena’ mill was constructed at ‘Merrimbula’ in 1868 which had the capacity to process 7 to 8 tons weekly.

In 1875 the following description of Bega district was published;

“The district is an agricultural and pastoral one, the land on the river being remarkably rich; the principal products are grain, cheese, butter and wool, and the land is held by small farmers and free selectors; ….. The township is small, but flourishing – its churches, public school, court-house, etc, being creditable buildings.” (Greville’s Post Office Directory, NSW, 1875, p46, and cited by Bayley 1942)

4.8 Development of the dairy industry

Dairy products gradually made their way to the fore as indicated by the following comments in the local newspaper in the 1880s;

“A gentleman now on a visit from Sydney informs us that in Sydney nothing will go down but Bega hams and cheese.” Bega Gazette 28/6/1882.

“Cheese making and pork-growing seem to pay the Bega farmer better than anything else. Rural industry has advanced rapidly since the Land Act of 1861 enabled free selectors to secure
those pretty homesteads which adorn the whole district.” (Bega Gazette 4/3/1884, cited by Bayley 1942)

The advancement to the 1880s, however, was small compared with that which took place during the succeeding 20 years, in which dairying became the most important industry of the district. Attention was given to herd improvement, and Ayrshire and Jersey cattle were introduced (Bayley 1942). Improved farm methods increased production, the disc plough largely replacing coulter and mouldboard. However, there were also many setbacks including a very severe drought in 1884-85 and fluctuating market prices. In 1887 it was reported;

“During the last few years the business of the dairy farmer has been anything but a rosy one. The drought took away first his savings and next his cattle, and when the turn of the tide came, with the spring of 1886, covering the land with herbage and affording an opportunity for making produce again, the market began to decline until the staple product of this district, cheese, became almost a dead letter.” (Bega Standard 19/3/1887)

Despite the setbacks, dairying throughout the region was expanding;

“The principal industry is dairy farming and nearly every farm or estate has a cheese factory and dairy of its own, worked either by the proprietors themselves or sub-let on a system of shares which prevails in the district. .... The dairymen direct their principal energies to cheese-making, as, owing to the distance from Sydney, butter can only be sent to market in a salted state.” (Bega Standard, quoting from Sydney Morning Herald 18/1/1888)

Three inventions revolutionised butter production. They were the cream separator, which was introduced to the Bega district in 1885, the refrigerator, and the Babcock tester, by which farmers could be paid on an equitable basis for milk and cream.

In 1894 the NSW Creamery Butter Company’s factory at Yarranung was opened and a few years later expanded. In 1899 it was reported;

“It is just 4 ½ years since the Company opened the Bega factory and, under the management of Mr Reynall, this Company, which has revolutionised the dairying industry in the district, has gained the confidence of and such extensive support from the dairy farmers of the district, and there are locally at present three factories (one at Bega, one at Mogilla, and one at Cobargo) and 14 auxiliary creameries in full working order. These factories in a good season would turn out about 20 tons of butter and eight tons of cheese per week.” (Bega Standard 28/2/1899, cited by Bayley 1942)

Butter and cheese production increased and the farmers became aware of the advantages to be gained from co-operatives. The first co-operative factory was opened at Wolumla in the 1890s and soon after many others opened around the district and they took over from the proprietary company.

By 1892 the average annual shipments to Sydney from the district consisted of;

“Cheese (130,000) 1,500 tons
Butter (10,000 kegs) 500 tons
Bacon 500 tons
Large quantities: maize, wattled bark, tallow, lard, hides, leather, maizena, horses, fat cattle, pigs, calves, sheep” (Bega Standard 5/8/1892)

Pig raising continued as an important sideline, the pigs being fed on the skim milk and the plentiful supply of maize which was grown for ensilage and fodder. Poultry and bee-keeping
also began to receive increased attention. Soap-making, brewing and cordial making were occurring, and fruit growing reached a high standard.

In 1903 it was reported;

“During the past few years the man on the land has, by discarding the old slip-shod methods and going in for a more up-to-date system, got far more from his acres than he did in former times. He is awakening to the fact that a little science introduced into his work means a bigger credit balance at the bank…. Each year there are more crops grown, more ensilage stacks seen, and more rugging done.” (Bega Standard 26/5/1903)

4.9 Bega Valley cleared by the early 20th century

Within the first 2 decades of the 20th century, all the accessible, arable land of the Bega district had been cleared and utilized;

“Arriving at Bega, one takes stock of the picturesque town and compares, or rather contrasts it with the place of well nigh 40 years ago…. But the hills are denuded of their original forest trees and well grassed” (Sydney Morning Herald 2/12/1916, cited by Lunney and Leary 1988).

Photographs taken around Bega at the turn of the century show it to be much like the present day landscape, with the valleys and river flats entirely cleared of their original forest vegetation. A local resident born in the Bega Valley in 1909, recalled in 1983;

“Out our way there wasn’t much left for my father to clear. When my grandfather moved out there, there was very little cleared. That was over 100 years ago he moved in there.” (S Blacker, 1983, cited by Lunney and Leary 1988)

Aerial photos were used to map the extent of clearing within the Murrah/Dry River catchment in 1944, 1967 and 1994 (Figures 6, 7 and 8). These show no change over the 50 year period.

4.10 Agricultural development in the 20th century

The dairy industry continued to develop during the early twentieth century. Improved farming practices included the increased use of silage, with wooden and later concrete silos replacing the old pit silos (Bayley 1942). Careful testing of herds by some of the more progressive farmers in the district proved that the Jersey cow was a better butter and cheese producer than the shorthorn, and slowly farmers changed their herds (Bayley 1942; Codrington 1979). Milking machines were first installed in the district in 1909, and in 1915 the pasteurisation process was introduced at the Bega Butter Factory. After the introduction of refrigerated transport ships the export market for butter also expanded. By 1942 the Bega Butter factory was producing 1,200 tons of butter annually (Bayley 1942).

In the 1950s the dairy industry within the Bega Valley introduced intensive farming practices to maximise milk output. Grazing pastures began to be intensively managed, including the cultivation and maintenance of improved pasture species with superphosphate and spray irrigation (Murray 1987, J Collins pers comm 1994 and cited by Brooks 1994). Such practices enabled greater numbers of cattle to be carried on the available land. As an element of the Bega valley’s economy, dairying continued to grow in importance, although signs of future problems were starting to emerge. In 1957 it was stated;
"The prosperity of the entire coastal strip depends in the main, on the prosperity of the dairy farmer. ….(However), the dairying industry faces many problems today. Prices for butter have fallen to a very low figure in the United Kingdom, where the surplus Australian production is sold. The realization on this market is completely unprofitable. Attempts to find profitable outlets elsewhere have, in the main failed. Australian per capita consumption is falling, but overall consumption is increasing because of growing population…. Today almost all the dairy herds are Jerseys. (Smith and Bayley 1957, cited by Codrington 1979)

Due to changes in markets and regulations, the industry was eventually forced into considerable change at the farm level, with a 57% reduction in dairy farm numbers between 1971 and 1989 (Codrington 1979, Crichton et al 1989). Butter making ceased in 1978 with the closure of the last factory at Cobargo. Over 60% of production in the Bega district is now used for liquid milk with most being consigned to the Sydney and Canberra markets. The major shift to supply liquid milk occurred in 1978 when the Bega Co-operative Society entered the Canberra and Sydney markets as a result of a state government policy change (Crichton et al 1989). Cheese making remains a significant industry, however, with approximately 35% of milk production currently being used for this purpose (Crichton et al 1989).

Today, the main farming activities in the Murrah/Dry River catchment (and the Bega district in general) are dairy and beef cattle. Beef cattle properties primarily occupy the hillier more isolated areas but production is also located in the more fertile valleys, where it is usually associated with dairy farming. Many of the present beef properties were previously smaller dairy farms involved in cream production. With rationalisation of the dairy industry and closure of many smaller factories during the early 1970s, many of these farmers switched to beef production (Crichton et al 1989). The average beef property runs between 80-150 cows on an area of 200 to 300 hectares. A small number of specialist beef producers run in excess of 300 cows and an increasing number of smaller hobby farmers run between 20 and 60 breeders.

4.11 Urban development in the Bega district

In the early 1850s, when Bega township was officially proclaimed, it consisted of only a few buildings. Beyond the ‘town’ a few outstations and stockyards were linked by tenuous bridle tracks which stretched across the region (Codrington 1979). However Bega soon established itself as the main town within the valley. Smaller towns, such as Bemboka, Candelo and Cobargo were also slowly established to overcome the transport difficulties, and most of these had dairy factories established during the late 19th and early 20th centuries. However, from the 1920s onwards, when motor cars and sealed roads became more common, people preferred to bypass the small towns and purchase their supplies in larger centres where they had greater choice and there was competition between goods and services. Thus the smaller towns became less viable and slowly declined. Table 2 presents the population figures for selected towns in the district.

<table>
<thead>
<tr>
<th>Town</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quaama</td>
<td>149 225 149 204 183 158 92 50</td>
</tr>
<tr>
<td>Wolumla</td>
<td>352 511 441 450 273 176 131 166 85 65</td>
</tr>
<tr>
<td>Bemboka</td>
<td>277 323 593 458 361 495 356 213 180</td>
</tr>
<tr>
<td>Candelo</td>
<td>118 146 473 542 643 424 350 309 388 272 240</td>
</tr>
<tr>
<td>Cobargo</td>
<td>346 519 610 520 390 527 413 290 280</td>
</tr>
<tr>
<td>Bermagui</td>
<td>174 398 374 316 332 544 554 512 685</td>
</tr>
<tr>
<td>Tathra</td>
<td>56 81 83 184 402 371 433 433</td>
</tr>
<tr>
<td>Bega</td>
<td>625 872 1643 2023 1960 1969 2024 2344 2967 3644 3858 4250</td>
</tr>
</tbody>
</table>

Data for 1871-1979 from Codrington (1979). Data for 1861 from Bayley (1942)
Figure 6. Catchment clearing, 1944

Catchment area = 195 sq km
- forested = 67% of catchment
- cleared = 33% of catchment
Figure 7. Catchment clearing, 1967

Catchment area = 195 sq km

- forested = 67% of catchment
- cleared = 33% of catchment
Figure 8. Catchment clearing, 1994

Catchment area = 195 sq km
- forested = 67% of catchment
- cleared = 33% of catchment

km
4.12 History of farming in the Dry/Murrah River catchment

The settlement of land along the river flats and valleys in the upper half of the Murrah/Dry River would have first occurred in the early 1830s as squatters moved south from Cobargo into the Brogo and Bega valleys. By the 1840s the first farms had also been established along the alluvial flats near the coast, with the Imlay brothers recorded in 1848 as the holders of ‘Murrah’, a 1,000 acre property (Campbell 1968). Not long after, the property changed hands when the Imlays suffered financial difficulties (Bayley 1942), and in 1858 the property was purchased by Mr JE Gowing from the Polack family (Hearn 1996).

After the Robertson Land Acts of 1861, many of the large farms held by squatters would have been split up as selectors bought the land in parcels of 40 acres (16 ha) or multiples thereof up to 320 acres (130 ha). Much of the land clearing around Quaama would have commenced as the large squattages were carved up into smaller farms.

In the 1880s, a group of Chinese, who had left the goldfields near Bermagui, were employed to clear the land along the alluvial flats of the Murrah near the coast (John Gowing, pers. comm. 1999). They also drained many of the swamps or wet areas along the valley so that the land could be grazed. Some Chinese graves are sited on the Gowings farm today.

“There’s a lagoon out across the river from Rutters, (farm) called Shaeffers Lagoon. When we were out farming, Harry the boss decided he was going to plough a section of the flat and he had a good tractor and plough and he’d only gone about 100 yards and the plough started to bury and he wondered why, so we dug down, and the reason we couldn’t plough was the hop roots were still there from when the Chinese had hop gardens on the Murrah, and they were about 2 inches thick and stronger than rope and they got tangled in the plough and stopped the tractor because there were hundreds of these roots through the ground for about 4 acres. There’s a Chinese cemetery out near where John Gowing lives now, about three graves and they used to have vegetable gardens up there and it was called the Chinese gardens.” (Interview with Murray and Margo Douch by Robyn Williams in 1993)

In 1894 the Tarraganda bridge across the Bega River was completed, and this greatly improved access to the coastal farms between Bermagui and Bega. In 1900 further improvements were made when a vehicle punt was constructed across the mouth of the Bega River at Tathra (Evans 1994) and a bridge was built across the Cuttagee Creek. In 1902 the bridge across the Murrah River was also completed (Hearn 1996; Robyn Levy, pers. comm. 1999; John Gowing, pers. comm. 1999).

Photographs from the early 20th century show that the lower Murrah valley had already been cleared by this time (see photo on front cover of this report). Many ringbarked trees however were still standing, indicating that much of the clearing must have occurred only a decade or two earlier, ie 1890s and 1900s. Close examination of the early photographs also reveals sandbanks next to the Murrah Bridge, probably indicating that substantial catchment erosion had already occurred.

The Gowing’s property, which is situated next to the Murrah Bridge on the coastal road, was run as a dairy farm for most of this century, until the 1980s when changes in the dairy industry meant that they had to change from supplying cream to fresh milk. This would have meant buying extra processing equipment and it was decided to convert to beef cattle (John Gowing pers. comm. 1999). Many other farmers in the district made the same decision.
5. Forestry

5.1 Forest Types

The forests that exist today, as either State Forests or conservation reserves, can be divided into two broad categories; dry sclerophyll forest and moist sclerophyll forest. Dry sclerophyll forest dominates the coastal hills and valleys on sites with lower fertility and/or poorer structural soils, often associated with Ordovician metasediments (State Forests 1994). The overstorey is dominated by silvertop ash and stringybark and the understorey is usually quite open, with a ground cover of leaf litter and scattered shrubs. On more sheltered sites, there may be a denser shrub layer dominated by one of the wattle species. Moist sclerophyll forest occurs on more fertile soils at higher elevations (and higher rainfall) and dominates the forests along the escarpment and adjacent tablelands. In the coastal hills and valleys it is restricted to the more protected sites on better soils. The overstorey contains messmate, brown barrel and a variety of gums (State Forests 1994).

In general, the escarpment and adjacent tablelands, and also the coastal hills which have the poorer metasediment derived soils, are still heavily timbered, although an increasing proportion of it is regrowth forest. The lowland zone however is now virtually entirely cleared. The lowland zone was previously dominated by a tall open forest of spotted gum (Eucalyptus maculata), forest red gum (E. tereticornis) and woollybutt (E. longifolia) (Lunney and Leary 1988). There is now less than 10% tree cover over the entire lowland zone, most of which is scattered cover (Brooks 1994).

5.2 Early Timber utilization

In addition to clearing of lowland forests for agricultural purposes, the forestry industry was well established by the 1860s, supplying timber to the town of Sydney (Lunney and Leary 1988; Lunney and Moon 1988). At this time, however, forestry operations were mainly confined to the lowland zone and the readily accessible coastal forests.

Following the initial clearing of the lowland forest cover there was generally extensive colonisation by various wattle species (Lunney and Leary 1988). Their presence spurned another whole industry, the cutting of wattles for tanning purposes. Many families relied on income from the cultivation and cutting of wattlebark (mainly black wattle, Acacia decurrens) for tanning while they were preparing their land for agriculture, and it had become a well established industry by 1865 (Bega Gazette 21/10/1865). One traveller commented on the effect of the wattlebark industry on the landscape around Brogo;

“The wattle abounds here, but is quickly disappearing before the bark stripping operations”

(Bega Gazette 11/8/1870).

After 1916, wattlebark ceased to be an important source of revenue for the district (Sydney Morning Herald 2/12/1916), although it continued to be cut until the 1970s (Lunney and Leary 1988).

5.3 Timber industry expands in the late 19th century

Manually operated pit saws were operating in the Eden and Bega districts in the 1850s, and in 1869 the first steam sawmill was built at Bega. By 1900 there were at least 10 steam powered sawmills operating in the district, all of them located near creeks or rivers to obtain water for the boilers (Russell 1978, Harris Daishowa 1986, Tathra Historical Society, undated). Sawn timber...
production was high in the second half of the 19th century and there was a good market for timber in the colony. The sawmills advertised;


Forest red gum is exclusively a valley species, while the box and stringybarks may have been either valley or hill species.

5.4 Sawlogs and sleepers in the early to mid 20th century

When logging commenced in the Bega district, the valley country was the main source of timber and the dry sclerophyll forests of the surrounding ranges were dismissed as valueless (McCabe 1846; Parkinson 1851, both cited by Lunney and Leary 1988). However towards the end of the 19th century timber was being extracted from the hills and from 1900 sleeper cutters opened up many areas of the hills surrounding Bega (Lunney and Leary 1988). In one month in 1911, the Forest Guard (or inspector) passed 7000 sleepers at the ports of Bermagui and Narooma and noted that the timber industry in the district was assuming vast proportions (Bega Standard 11/8/1911). At its peak, this industry employed about 300 cutters (Harris Daishowa 1986). Large quantities of woollybutt (Eucalyptus longifolia) and grey box (E bosistoana) were cut; but by 1934 supplies of these species were nearly exhausted (Kessell 1934, cited by State Forests 1994). Through the 1940s and early 1950s, silvertop ash (E sieberi) sleepers were cut for export contracts but, by the late 1950s, the sleeper industry was declining (State Forests 1994).

In 1916 the Forestry Commission was formed to regulate the commercial use of forests throughout the state, which at that time were being logged indiscriminately. Consequently, most of the remaining forest in the district was dedicated as State Forest. Mumbulla State Forest was the first to be assessed for its timber potential. In 1922, the Forestry Commission Assessor decided that roads into hilly country would be too expensive in relation to current timber prices (Williams 1922, cited by Lunney and Leary 1988), and so the less accessible sections of this forest remained relatively untouched.

Records dating back to 1920 show that State Forests close to Bega not only supplied sleepers but also small quantities of sawlogs. These records show that sawlogs were harvested after the mid 1920s from the tablelands forests of Bondi, Coolangubra and Nalbaugh, with yields increasing, mainly from Nalbaugh State Forest, from the mid-1930s. Both sawlogs and sleepers were produced from Cathcart and Tantawangalo State Forests around the 1930s and later in the 1950s. Other timber products, such as girders, fencing timbers, poles and mining timber, were supplied on an irregular basis from East Boyd, Murrah, Mumbulla, Tanja and Nullica State Forests (State Forests 1994).

Immediately after World War 2 there was an increase in demand for building materials, but by the 1950s the timber industry in the Bega and Eden districts was in a gradual decline. Immediately prior to integrated harvesting in 1969, stringybark and silvertop ash were being cut for sawlogs, however the industry was limited by the poor quality of the timber stands caused by past wildfires and selective harvesting, coupled with a general lack of access (State Forests 1994).
5.5 Woodchip operations commence in 1969

The Eden woodchip industry began in 1968 when NSW agreed to provide Harris-Daishowa P/L with 500,000 tonnes of wood each year from the forests of the south-eastern corner of the State. A mill was built at Eden and logging commenced in 1969 (Recher et al 1981). The commencement of woodchipping operations near Eden on the South Coast of New South Wales in 1969 marked the end of over 50 years of selective logging in the State Forests of the district by the Forestry Commission (Lunney and Moon 1987).

Typical production figures for pulpwood supplied to Harris-Daishowa are presented in Table 3.

Table 3. Harris-Daishowa annual pulpwood supply at Eden in 1985.

<table>
<thead>
<tr>
<th>Source</th>
<th>amount (t)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>State forests in agreement area</td>
<td>530,000</td>
<td>57.5</td>
</tr>
<tr>
<td>Private property</td>
<td>130,000</td>
<td>14.1</td>
</tr>
<tr>
<td>Sawmll waste from East Gippsland</td>
<td>125,000</td>
<td>13.6</td>
</tr>
<tr>
<td>Sawmll waste from NSW</td>
<td>55,000</td>
<td>6.0</td>
</tr>
<tr>
<td>Crown land outside agreement area and lease land</td>
<td>81,000</td>
<td>8.8</td>
</tr>
<tr>
<td>Total</td>
<td>921,000</td>
<td>100</td>
</tr>
</tbody>
</table>

(from Lunney and Moon 1987)

The introduction of a market for pulpwood permitted the utilization of both sawlogs and pulplogs in what would often have been an uneconomic operation for sawlogs alone.

In 1976 extensive road-building by the Forestry Commission for the woodchip industry, ushered in a period of unprecedented utilization of the forests. This allowed timber extraction in the steeper parts of the catchment, which prior to this time had only been selectively logged, if at all. For the first few years pulpwood logging was restricted to the forests in the Eden district but in 1977 it commenced in the forests around Bega (Harris-Daishowa 1986).

5.6 What is ‘integrated logging’?

A woodchip operation differs from the more conventional kinds of logging normally associated with timber harvesting. The objective is to produce pulp for the manufacture of paper. The trees which are harvested are not sawn into lengths, but are processed into ‘chips’. For this reason the trees do not need to be tall or straight or even particularly sound.

Pulpwood logging is effectively clearfelling; most of the trees are cut. However, the intensity of logging does differ considerably from place to place. In the forests near Bega where Woollybutt is abundant and near Eden where there are extensive stands of young trees which grew after wildfires in 1952, large numbers of trees may be left standing after logging (Recher et al 1981). There is also a policy to retain young trees which are otherwise suitable for harvesting as woodchips, if these are judged capable of growing into sawlogs.

During logging, trees which are useful as sawn timber (sawlogs) are kept apart and not used for pulp. For this reason, foresters refer to it as ‘integrated logging’ meaning the simultaneous harvesting of sawlogs and pulpwood. The advent of this type of logging dramatically changed the way in which forests of south-eastern NSW were managed (Recher et al 1981). Timber harvesting became more intensive and affected a larger area of forest.

The extent of logging associated with the woodchip industry means a major change in the age structure of the forest; old trees are replaced by young ones. The method used is to log alternate coupes or patches of forest. Each coupe is slightly different in size and shape, but most are
about 10 to 20 hectares. When all coupes have eventually been cut, a large expanse of mature forest is replaced by a mosaic of regeneration from newly cut to 40 years old.

Buffer strips along watercourses are left to protect stream channels and reduce turbidity. Other areas left unlogged include scenic reserves along skylines, major roads or rivers, and forest which is too steep or rocky for logging (Recher et al 1981).

Apart from integrated logging, other forest activities over the last 30 years have included, thinning of regrowth in wildfire areas (from the 1952 fire) to produce better timber, planned burning to reduce fuel loads, and construction of tracks to gain access to logging areas.

5.7 Logging operations

Extraction of logs begins with the cut log being dragged from the stump to the nearest log dump by a tracked vehicle known as a snigger. Log dumps are located along the top of ridges, the cut log is thus snigged up the side of the hill to the top of the ridge along a snig track (Byrne 1983). At the log dump it is loaded onto a log truck and driven along a feeder road connecting the log dumps to the nearest access road via a series of secondary and primary access roads (see Figure 9).

Forest roads are generally unsealed (including all those within the Murrah catchment). Access roads are permanent features which follow ridge-lines but are likely to curve around summits in order to keep within a grade limit of 6-10%. Feeder roads are constructed prior to the logging of a particular compartment, are bulldozed for wheeled log trucks travelling at low speed. Log dumps are situated on ridge-tops on areas of level or near level ground. They are levelled prior to use and ripped after use (Byrne 1983).

In 1975 State Forests and the Soil Conservation Service developed guidelines for mitigating soil erosion associated with forest management activities, including harvesting operations, road construction, and road maintenance (State Forests 1994). These procedures were known as the Standard Erosion Mitigation Conditions for Logging (SEMCL).

![Figure 9. Timber extraction.](image)

(Timber is dragged from the stump to log dumps along snig tracks and then trucked out of the forest via a system of feeder and access roads.)
5.8 Recent logging within the State Forests

Sections of both Mumbulla and Murrah State Forests are located within the hilly mid-catchment of the Dry/Murrah River. Prior to the 1970s, sections of these forests had been selectively logged for over a century (Lunney et al 1987). In the 1960s and early 1970s, a program of timber stand improvement, known as TSI, was undertaken, and 1180 hectares were clearfelled to encourage a regrowth forest of millable logs (Lunney et al 1987). In December 1977 forest roads were constructed and soon after, high intensity logging for woodchips and sawlogs began.

The design of the woodchip-sawlog operation was to log alternate coupes (or cutting areas), each of about 10-20 ha (Forestry Commission 1982, cited by Lunney et al 1987). After the first logging cycle (from 1979 to 1983), the forest had a chessboard appearance. Operations continued through the late 1980s and 1990s, with the uncut coupes being progressively logged. Over the last 30 years most of the State Forest within the Dry/Murrah River catchment has undergone integrated harvesting (Figure 10).

In 1983 7,508 hectares of forest around Mumbulla Mountain was gazetted as Biamanga Aboriginal Place and logging was excluded from a core area of 1100 hectares (Lunney and Moon 1987). Mumbulla Mountain is now part of Biamanga National Park. The small area of State Forest in the headwaters of the Dry River catchment has also been recently gazetted as part of Wadbilliga National Park.
Figure 10
Murrah River Catchment
Logging History

LEGEND
- Logged 1950's
- Logged 1960's
- Logged 1970's
- Logged 1980's
- Logged 1990's

Data from State Forests, South-East region, 1999
6. Floods

Floods can cause major damage to crops, farms, and urban centres. They can also have significant impacts on the natural landscape, in particular soil erosion. In a single large flood (such as a ‘one in 10 year’ or ‘one in 100 year’ flood) the quantity of soil eroded from a catchment can be far greater than the annual average erosion rates. It is therefore imperative to determine when the major flood events occurred when attempting to understand the history of erosion in a catchment. Since there is only a small amount of specific information on the floods of the Murrah/Dry River, most of the details have been inferred from information collected from the adjacent Bega River Valley.

6.1 The flood record for the Bega valley

The official flood records for the Bega River, held by the Department of Land & Water Conservation, extend back to 1851, but only comprises a ‘flood stage’ record for the gauge at North Bega Bridge. These records show that the biggest floods were in 1851 and 1971 both at about 9.8m height. Another large flood occurred in 1919. A summary of other floods for the Bega Valley is presented in Table 4.

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1851</td>
<td>(May) Bega population 100. Gale and torrential rain for a week. All Warragaburra stations swept away, including haystacks and stores. Approximately 17 lives lost.</td>
</tr>
<tr>
<td>1860</td>
<td>(February) Severe flood. Heavy losses of stock, crops and haystacks. No loss of life</td>
</tr>
<tr>
<td>1870</td>
<td>(May) Bad weather prevailed from March to May, then a large flood was reported (Bayley 1942). “In 1870 there was bad weather from March 9th to May 13th, and at the latter date, the families of Messrs Ralph, Leemon, Hopkins, Maples, at North Bega, had to leave their houses, the water rising in one house to the wall plates; and at the mill cottage then occupied by Mrs Hinton, the flood reached the eave of the verandah.” (article from local newspaper, 1898)</td>
</tr>
<tr>
<td>1873</td>
<td>(March) Large flood, as high as 1870, gauge height reached about 28.5 feet at Bega (NSW WRC 1972). Potato crop damaged. Logs, trees, fences, pumpkins, melons, apples carried away. Damage estimated at £15,000 to £20,000. (Bayley 1942)</td>
</tr>
<tr>
<td>1878</td>
<td>(February) “High” flood. 1,500 acres maize totally destroyed. Losses estimated at £30,000. Potato crops destroyed. Men put off work as result. Another flood followed in September, 1879. (Bayley 1942) “In February 1878 floods caused damage estimated at £30,000, while later that year another flood let a considerable amount of water and sand on the flats, so it was many months before they could be made productive again, although drainage work was carried out with scoops and horses.” Smith (1978)</td>
</tr>
<tr>
<td>1891</td>
<td>(June) The previous year had been a wet year, then flood from June 20 to 29, 1891. “Over 18 inches of rain fell and the water at the foot of Gipps Street rose to near the iron fence at the A.J.S. Bank.” (article from local newspaper, 1988). “Mails delayed for 9 days. Crops damaged, roads and bridges seriously affected. New Brown Mountain Road impassable. Fences washed away. Jellat submerged” (Bayley 1942). (Official records; 473mm of rain in 7 days.)</td>
</tr>
</tbody>
</table>
### Table 4 continued

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1893</td>
<td>(March) Light rain only in Bega. Clouds arrested by Brown Mountain. Water spread from Gipps Street to Yarranung Gate. Large logs, fencing, pumpkins and debris washed down. Bridge piles were snapped off by floating logs. Water rose to within 8 feet of the deck of the old Bega bridge (Bayley 1942). (Official records; 210mm of rain in 2 days.)</td>
</tr>
<tr>
<td>1897</td>
<td>(February) Small flood.</td>
</tr>
<tr>
<td>1898</td>
<td>(February) One of the highest floods ever recorded. 27 inches rain in 6 days. Kiss’s lagoon to Yarranung Factory a sheet of water. Telegraph line under water along flats beside Brogo River. Jellat and Penuca a vast sea. Water over telegraph posts along Jellat flats. Heavy road and bridge damage. Bega isolated for several days. Fences and corn washed away. Punt sunk at mouth of river. Land-slides and trees on Brown Mountain Road (Bayley 1942, Smith 1978, NSW WRC 1972) (Official records; 687mm in 5 days.)</td>
</tr>
<tr>
<td>1900</td>
<td>(May) Small flood. Corn, roads and Double Creek Bridge damaged (Bayley 1942, NSW WRC 1972). (Official records; 392mm in 3 days)</td>
</tr>
<tr>
<td>1908</td>
<td>(August) Small flood. Coach washed down at Auckland St Crossing. One horse drowned.</td>
</tr>
<tr>
<td>1913</td>
<td>(July) 1,108 points fell in 36 hours. Highest flood since 1898. (Official records show 281mm fell on 29-30 June 1913)</td>
</tr>
<tr>
<td>1914</td>
<td>(March) River rose 23 feet. 25 inches rain fell in 5 days. Timber, refuse and stock washed down. Maize and potato crops and roads damaged. North Bega bridge seriously damaged. (Official records show 649mm of rain fell in 6 days)</td>
</tr>
<tr>
<td>1922</td>
<td>(July) Not as high as 1919. 12 inches of rain recorded in one week. All communication cut off (Bayley 1942) (Official records; 349mm rain in 5 days)</td>
</tr>
<tr>
<td>1925</td>
<td>(May and June) two floods in quick succession. 11 inches rain recorded in 3 days and 22 inches in a month. Two men drowned at Yarranung. Communication cut (Bayley 1942, NSW WRC 1972).</td>
</tr>
<tr>
<td>1928</td>
<td>(June) 10 inches rain fell in 48 hours. Small flood. Man drowned at Jellat attempting to drive across flats (Bayley 1942). (Official records; 274mm rain in 2 days)</td>
</tr>
<tr>
<td>1934</td>
<td>The year 1934 brought a total of 72 inches 19 points, one of Bega’s wettest years. Much gravel and sand was washed down (the river) and blocked drains (Smith 1978). (January) 12 inches ran fell in 2 days. River rose 26 feet on 7th January. Moran’s crossing bridge swept away. Land slips on Brown Mountain. All minor bridges in district washed away. Brogo bridge, except for one span, swept away. Bean and maize crops, vegetables, fruit trees and fences destroyed (Bayley 1942, NSW WRC 1972). (Official records; 346mm in 3 days)</td>
</tr>
<tr>
<td></td>
<td>(February) More damage. River at 22 feet on 22nd Feb. (April) Temporary bridge at Brogo washed away. Water supply installation damaged. (Official records; 252mm in 5 days)</td>
</tr>
<tr>
<td></td>
<td>(June) Small flood</td>
</tr>
<tr>
<td></td>
<td>(July) Temporary bridges again washed away; traffic delayed and suspended. (August) Bridge approaches washed away again (Bayley 1942).</td>
</tr>
<tr>
<td>Year</td>
<td>Event Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1935</td>
<td>A small flood occurred in November when 251 points fell. The mouth of the Bega River had closed, only to be opened by the local farmers and puntsmen (Smith 1978).</td>
</tr>
<tr>
<td>1941</td>
<td>(October) Bega River in moderate flood, some crops lost and slight road damage (NSW WRC 1972).</td>
</tr>
<tr>
<td>1942</td>
<td>(November) Extensive flooding in Bega Valley with much damage to roads (NSW WRC 1942).</td>
</tr>
<tr>
<td>1943</td>
<td>(August) Bega River in flood; large areas inundated (NSW WRC 1972).</td>
</tr>
<tr>
<td>1944</td>
<td>(May) Bega River in flood for several days, roads and bridges damaged.</td>
</tr>
<tr>
<td>1948</td>
<td>(May) 6 ½ inches of rain caused extensive flooding in the Bega district. The Princes Highway was flooded in a number of places and 2 ½ feet of water covered the Snowy Mtns Highway (NSW WRC 1972).</td>
</tr>
<tr>
<td>1950</td>
<td>(Feb) 352mm rain in 7 days.</td>
</tr>
<tr>
<td>1952</td>
<td>(June) “Bega River breaks its banks, isolates town. Torrential rain, driven with great force by gale winds, started to envelop the district on Friday and continued all day Sunday, causing the rivers and creeks to rise, culminating in a flooding of the low lying areas.&quot; (Bega District News 17/6/52) (Official records; 324mm in 4 days)</td>
</tr>
<tr>
<td>1956</td>
<td>(February) Flooding caused damage to numerous minor culverts and bridges (NSW WRC 1972). (Also; in May 1956 325mm rain fell in 2 days)</td>
</tr>
<tr>
<td>1959</td>
<td>(November) Floods damaged crops and minor bridges; Bega was isolated (NSW WRC 1972).</td>
</tr>
<tr>
<td>1960</td>
<td>(July) Minor nuisance flooding occurred (NSW WRC 1972)</td>
</tr>
<tr>
<td>1961</td>
<td>(March) 384mm rain fell in 24 hrs on 4th March.</td>
</tr>
<tr>
<td>1966</td>
<td>(November) Main Street in Bega covered by flood waters. Snowy Mtn Hwy cut by 1 ft water over road. Some minor roads damaged (NSW WRC 1972).</td>
</tr>
<tr>
<td>1971</td>
<td>In January and February 1971, intense and prolonged rainfalls occurred over much of NSW. The effect of these rains was particularly severe along the rivers of the South Coast region and especially the Bega and Towamba Valleys where the floods exceeded the previous highest levels at a number of locations. Substantial damage occurred in the town of Bega and a comparison with historical flood data has indicated that the flood reached the highest level recorded in a period of more than 100 years (NSW WRC 1972).</td>
</tr>
<tr>
<td>1975</td>
<td>302mm rain in 5 days from 9th-13th March. “The flood earlier this week was the biggest since the major one of 1971, coming within 6 feet of the previous highest level.” (Bega District News 14/3/75.)</td>
</tr>
<tr>
<td>1976</td>
<td>(14-18 Oct) 305 mm rain in 5 days at Bega. Cobargo recorded 437mm in 3 days. Princes Highway cut at several locations. (The caption to a photo on page 3 of the Bega District News commented: “Erosion was evident in Candelo creek at the weekend, following heavy rain in the upper reaches of the creek.”)</td>
</tr>
<tr>
<td>1992</td>
<td>(11th Feb) 224mm in 24hrs. Damage to buildings, roads and vehicles. (6th Dec.) 235mm in 24hrs. All the usual roads were under water, such as Jellat Jellat, Tarraganda, Wallagoot Lake Road and Buckajo. The Princes Highway was closed at Cobargo, south of Pambula and north of Eden. Most of the water flooding the Bega valley came from the Brogo River which was the highest since 1974 (Bega District News 8/12/92).</td>
</tr>
<tr>
<td>1997</td>
<td>(3rd March) 235mm in 24 hrs</td>
</tr>
</tbody>
</table>


6.2 The Great Flood of 1851

This was the first and most disastrous flood in Bega’s history. Gales and torrential rain followed in quick succession, lasting a week (Bayley 1942).

“Stacks of corn and hay, dwelling houses, barns, stables, horses, pigs; all were gone, and along with them every living soul, save a black man and his gin.” Sydney Morning Herald, 29/5/1851.

In all, 17 lives were lost in the district, but this did not deter the hardy pioneer settlers. The township of Bega was re-built on higher ground on the south side of the river.

The 1851 flood

In 1851 the township of Bega consisted of a few bark huts built close to the northern banks of the river, where water was readily available. The river flats were used to cultivate crops such as wheat and barley. However in May of that year, gale-force winds blew up, bringing heavy rain. As the waters rose rapidly, the few settlers climbed to the roofs of their houses and onto haystacks, but within a few hours the haystacks were washed away and houses collapsed, throwing all into the water. In this flood 17 lives were lost.

The flood left many deep holes in the cultivation ground, so many farmers dug deep drains to run the water back into the river. Again in 1852 two more floods occurred, the land once more covered with deep water. The residents had by now learned to go to higher ground, so no lives were lost. Deep water stayed on the flats, covering the crops, and great efforts were made to open drains to the river. In many places, however, the wash of the river deepened these drains, forming permanent lagoons and dams. Popes Hole, now known as Coopers Creek, and the Donkeys Hole, behind the butter factory, are examples of this. Both are very deep and full of platypus.

(edited from Smith (1978)

6.3 Floods on the Murrah River

The hydrographic data collected by the Department of Land and Water Conservation includes a record of water level for the Murrah/Dry River at Quaama between 1966 and 1983 and recommencing from 1997 onwards (Figure 11). During this period the 1971 flood reached the highest level, followed by smaller floods in 1975 and 1983. Hydrographic data for nearby streams indicate that small floods also occurred in February and December 1992.
Anecdotal evidence (summarised below) also describes floods at Murrah in 1934 and 1954.

**Floods on the Murrah**

“1934 was the biggest flood to ever hit the Murrah and we were on the place where Rutters are now (36º 32’ 10” S; 149º 59’ 50”) and about 4 o’clock one morning was the peak of the flood and the water was 21 feet from our front verandah right up to the bails, the water almost ran between the bails and the house and in the oak trees after the flood went down you could see 20 or 30 feet up the trees all the flood rubbish. It just rained and rained for days, it was a February flood.

“In 1954 we planted a crop of beans which would have cost about £3,000 and when it was just about ready to pick it started to rain and rain and rain and we watched our bean crop go down the creek. The water had gouged out so much earth that you could walk under the fences which were just left suspended”. Interview with local farmers, Murray and Margo Douch, by Robyn Williams in 1993.

No information on floods prior to the 1930s could be obtained, and hence can only be estimated from descriptions of floods in the adjacent Bega valley.

### 6.4 1971 flood in the Bega district

In January and February 1971, intense and prolonged rainfalls occurred over much of NSW. The effect of these rains was particularly severe along the rivers of the South Coast region and especially the Bega and Towamba Valleys where the floods exceeded the previous highest levels at a number of locations. Substantial damage occurred in the town of Bega and a comparison
with historical flood data has indicated that the flood reached the highest level recorded in a period of more than 100 years.

The highest rainfall total for this period (3rd to 8th Feb) occurred over the steep terrain between the Dry and Brogo Rivers where the two stations at Verona and at Upper Brogo Road recorded more than 32 inches (813mm).

The village of Bemboka received 16.58 inches (421mm) in the 24hrs ending on 9am 6th Feb, and Upper Brogo received 16.55 inches (420mm). These totals are not much less than the record reading for the Bega valley of 18.58 inches (472mm) recorded at Candelo during the 24hrs ending 9am 27th Feb 1919.

Most streams in the South Coast region reached peak heights during the period from about midday on the 5th February to as late as midday on the 7th February, and most flood hydrographs were characterised by multiple peaks.

In the Bega Valley the most significant damage was to three major bridges – Hancocks Bridge at Tathra and the Bimbaya and Candelo bridges. Hancocks bridge was of concrete construction and spanned 700 feet across the mouth of the Bega river. Only six of the original fifteen spans remained after the flood had passed. The timber bridge on the prince’s Highway across the Bega River at North Bega was subjected to enormous pressures from the debris laden waters of the Bega and resulted in an 18 inch lateral displacement in its alignment.

In Bega 40 families were evacuated and the Bega racecourse was damaged. Rural properties in the area were severely affected, inundating thousands of acres of pasture, and the floodwaters on the Lower Brogo, the Bemboka and Bega Rivers washed away virtually all farm pump installations and pipelines. The 1971 flood at Bega was reported to be the highest flood in more than 100 years, being about 4 feet higher than the flood which occurred in 1919.

**Worst soil erosion**

“A record flood in February 1971 took 50 bridges including the Hancock at Tathra. Murrabrine Bridge lost an approach. I lost three out of four farm bridges and suffered the worst soil erosion ever in a flood of 30 inches (rainfall). At least 8 feet higher than any I remember before. My pump and pump house were washed away.” (Tarlinton 1986 – a farmer in the Murrabrine valley near Cobargo)

**Flood sidelights**

“The flood on the Brogo River was about 2 ft higher than the previous record known flood in January 1934….On the Brogo River the force of the water sent a heavy slasher about 300 yards downstream, floated a diesel oil tank about five miles and caused severe erosion in parts. ….Some parts of the river flats are covered with sand. Maize crops have been flattened”. (The Bega News 16/2/71)

**Erosion caused by 1971 flood**

“One of the worst features (of the 1971 flood) was the destruction of cultivation land by the piling up of many feet of sand and debris. ….. Many bridges could not be repaired for months, owing to the serious washouts around them and the huge amount of work that had to be done on the roads by the Shires and Bega Municipal Council. Temporary crossings were first put in to get the milk tankers running again. However it will be a long time before Bega will recover from all the damage done to farmlands, roads and bridges.” (Smith 1978)
Flooding at the Murrah Bridge, February 1971. (Photo supplied by Norma Gowing)

The February 1971 flood along the lower reach of the Murrah River (photo supplied by Norma Gowing)
The lower Murrah River in flood in February 1971 (near the Murrah bridge) (Photo supplied by Norma Gowing)

Murrah River in flood, near the Murrah Bridge, in February 1971 (Photo supplied by Norma Gowing)
Tremendous damage was caused by one of the worst floods in the history of the Far South Coast. From Narooma in the north to Eden on the Victorian border the entire district and across to the mountain ranges to include Bemboka, Candelo and other centres was deluged by phenomenal rain. The rainstorm began late on Thursday night and at Bega on Monday morning when the rain had ceased there were unofficial recordings of 1850 points. In the catchment areas of the river systems there was much heavier falls, probably as much as 30 inches.

Yesterday it was impossible to assess accurately the damage caused by the floods. Some unofficial estimates placed the damage at 43 million or more. The damage is represented by the loss of many bridges including the large concrete bridge across the Bega River at Tathra.

Power lines and telephone lines were swept away on low land. There were extensive washaways on roads, bitumen surfaces were stripped in many places. It has been impossible to assess the damage on farms which is known to be heavy. There have been heavy losses of fencing, of crops and pastures on low ground. Some flat country has been covered with silt and sand. (article from the Bega News, Feb 1971)

1971 flood on the Murrah – sand deposited on paddocks
“In the 1971 flood the river rose very quickly, in less than half an hour. After this flood there was a lot of sand across the paddocks. The flood went to the top railing of the bridge. There have been a few floods since then that have gone to the boards or middle railing.” (J Gowing, pers comm. 1999)
7. **Droughts and Fires**

The Bega district has experienced many droughts over the last 150 years, and often during these periods wildfires have burnt large areas of forest and pasture land. After a drought or fire, the soil is often left bare, and if heavy rainfall immediately follows, large amounts of erosion can occur. Tulau (1997) reported such an incident in 1952.

In the following section are descriptions of some of the more memorable droughts and fires that have struck the Bega district, and in particular the Murrah catchment.

*The great drought of 1885*

After bushfires had burnt out the district, the rain failed. Whilst the Bega River did not entirely cease flowing, it became necessary to sink an iron tank in the river-bed, from which water was sold at 1/- per gallon. Water was also imported from Sydney. The district suffered losses estimated at £200,000 and the problem of a water supply was much discussed.

In early 1886 it was reported; “All signs of grass have disappeared and the corn shows no vigorous growth. As to vegetables, they are turning to dust, and the potatoes, except in moist spots, have made no yield.” (Extracts from Bayley 1942)

*Forest fires in 1939–40*

“Bush- and grass-fires still ravage the countryside periodically, but their destructive possibilities have been reduced by systematic forest clearing and burning and the provision of fire-breaks. Although the disastrous fire of 1940 destroyed a section of Tathra township, the bush-fire brigades formed the year previously proved their value in minimising such outbreaks.” (Bayley 1942)

*1944 drought*

A drought in 1944 resulted in severe dust storms, and further droughts occurred in 1915, 1941, 1952, and 1983, the latter being the driest year on record. (Tulau 1997)

*Bush fire of January 1952*

“Bushfires raged from Tilba Tilba to south of Eden, and from the ranges through to the edge of Bermagui” (Hearn 1996).

*1952 – worst fires in Bega*

“When January 1952 came, the grass had ripened, being dry and long. Everyone grew anxious about bushfires with the excessive heat being experienced. On the 25th a hot westerly wind blew up, and fires which had been burning in the mountains spread through the district. These were the worst fires ever known in Bega.” (Smith 1978)

*1952 forest fire followed by heavy rainfall*

“The January 1952 fire that burnt from the mountains to Tathra was followed by heavy rainfall and flooding, and led to widespread, massive soil losses” (Tulau 1997).

*1952 wildfire in Murrah*

“In Jan 1952 a large wildfire wiped out the whole area (lower Murrah valley and surrounding hills)” (John Gowing pers. comm. 1999.)

*Extended drought in early 1980s*

Occasional extended periods of drought occur in the study area, the last being the period between late 1978 and March 1983 (State Forests 1994).
**Drought and wildfire in early 1980s**

The fire of November 1980 occurred 7 months after the beginning of the worst drought on record for south-eastern Australia (Bureau of Meteorology 1983, cited by Lunney *et al* 1987). It burnt intensely on the first day, scorching or burning the forest canopy; on subsequent days it was less intense and less of the canopy was scorched. A large section of forest in the mid-reaches of the Dry/Murrah River catchment, and all the forest in the upper reaches were burnt during this wildfire (GIS data from State Forests 1999).

The drought broke in May 1983, the Bega district having been drought declared by the Pastures Protection Board for 33 of the 38 intervening months (Lunney *et al* 1987). The only relief in the drought came in 1982 (Feb – June inclusive).

**Recent Droughts**

The major constraint facing dairy farmers in the area is the somewhat erratic rainfall. The area has frequent periods of insufficient rainfall for pasture growth with major droughts having been experienced in 1965-68, 1979-83 and 1985-87. Of dairy farms on the South Coast, 64% have sprinkler irrigation systems to alleviate the impact of seasonal rainfall deficiencies (Crichton *et al* 1989).

**Wildfires**

“Wildfires are likely to have been a feature of the study area (Eden Management Area) for many thousands of years. In 1939, parts of the study area were burnt by high intensity wildfire, and in 1952, many of the forests in the study area were burnt again, with patches of killed trees covering thousands of hectares. Severe fires also occurred in 1954, 1964, 1968, 1972, 1980 and 1983.” (State Forests 1994).
8. Impacts of Land Clearing

8.1 Land clearing leads to gully erosion

Little ringbarking occurred until free selection permitted the subdivision of the larger runs following the introduction of the Robertson Land Act of 1861. Lunney and Leary (1988) consider that these initiatives led to the clearance of the entire lowlands in the following decades – the smaller farms of up to 320 acres could not carry enough stock to ensure the free selectors a living until land was cleared and ploughed (Tarlinton 1986) and it appears that much of the valley was cultivated at some time for fodder crops. Historical photographic evidence indicates that the levels of clearance similar to the present had probably occurred by the 1890s, with minor thinning up to the 1920s.

The clearing of trees and shrubs, the grazing of sheep and cattle and the ploughing of land for crops would all have resulted in increased soil erosion, particularly along stream lines.

“Ploughing was first done with an iron mouldboard plough. This had long handles and with its long curved mouldboard, it did a job pleasing to the eye. These ploughs were made in Bega by the blacksmith named Brown. At times bullocks were used, but mainly horses. The early mistake was to plough up and down the hill, causing severe erosion.” (Russell, 1978)

Significant gully erosion was also initiated by the trampling of stock (Tarlinton 1986) or by the deliberate draining of valley-flat alluvial soils. Brooks (1994) considered that major changes to river systems were evident within 50 years of intensive land use. By 1917, a Public Works Department report (cited in Bayley 1942) advised against weir construction on the Bega and Brogo Rivers due to “drifting sands”. Bayley observed that;

“From the time of earliest settlements, soil erosion has developed with the clearing of the land; whilst this has not yet assumed serious proportions in the valley, it is known that the river-bed has risen many feet since arrival of the white man”. (Bayley 1942)

Inspection of the 1944 aerial photos indicates that many gullies in the cleared portion of the Murrah/Dry River catchment were already eroded. Sand deposits can also be seen along the main channel of the Murrah and Dry Rivers.

In the 1950s the dairy industry within the Bega Valley introduced intensive farming practices to maximise milk output. Grazing pastures began to be intensively managed, including the cultivation and maintenance of improved pasture species with superphosphate and spray irrigation (Marshall 1984, Murray 1987, J Collins pers comm 1994 and cited by Brooks 1994). Such practices enabled greater numbers of cattle to be carried on the available land, but probably also reduced the potential for erosion on hillslopes with the increased pasture cover. The eradication of rabbits in the area through the introduction of myxomatosis in the 1950s would also have reduced the potential for hillslope erosion.

8.2 Hare and rabbit plagues contribute to soil erosion

Erosion of hillslopes due to land clearing and subsequent grazing of sheep and cattle was accentuated by a rapid increase in the hare population from 1886 onwards until they reached plague proportions between 1890 and 1910 (Tarlinton 1986, Lunney and Leary 1988). The subsequent rapid decline in numbers coincided with the arrival of the fox and with a rapid rise in rabbit densities.
In 1900 the first rabbit was reported to have been shot at Tantawangalo, 20km south-west of Bega. By 1904 the rabbits had increased and were said to be very numerous in the upper half of the Bega valley, near Bemboka (Bega Standard 28/10/1904). According to a local farmer;

“by 1910 the rabbit had increased to hundreds of millions, they actually turned the whole country into a desert” (Bega Standard 6/2/1951).

A rabbit canning factory, the first of its kind in NSW, was opened in 1911 (Bega Standard 7/7/1911) and was reported to be receiving rabbits at the rate of 1000 pairs a day (Bega Standard 27/10/1911). Not only did rabbits consume large quantities of grass, leaving entire hillslopes bare during dry spells, but they also disturbed the soil by digging large warrens. All manner of exterminating the new pest was tried, including poisoning, trapping, ferreting and fumigating (Tarlinton 1986). All of these methods were merely temporary checks, and in a few months the rabbit plague would have returned.

“Strychnine mixed with raspberry jam in great quantities was dropped by the poison carts in the cool of the evening when the rabbits came out to feed. It was no exaggeration to say that a four foot wide strip of rabbit carcases was spread for two to three miles wherever baits had been laid.” (Hetty Laws 1987)

Rabbit numbers peaked around 1912 and then fell over the next four years. On 26/1/1918 the Bega Standard reported that;

“the rabbit problem is practically a thing of the past now”.

Whether poisoning and trapping, flood, disease or foxes affected the population is unclear. Despite their decline from plague proportions, rabbits remained common throughout the 1920s and by the early 1930s numbers began to rise again. In 1933 the Bega District News (11/12/1933) commented that “the menace is again alarming”. Another rise in numbers occurred in the late 1940s.

“We remember the terrible damage done by the enormous number of rabbits in the area. During the Depression and after World War II, trapping rabbits was often the only means of making a living for many of the locals. After the war when electricity was put through the village, a rabbit freezer began operating in the village.” (Betty and Sam Taylor, residents of Quaama, January 2000)

The introduction of myxomatosis in 1950 effectively controlled the rabbit population for the next decade. However by 1961 the Bega Daily News (16/6/61) noted that;

“the increasing immunity of rabbits to myxomatosis would force landholders back to the conventional destruction methods”.

Sodium fluoracetate (also known as 1080) was introduced locally in 1957 when it was noticed that rabbits were developing resistance to myxomatosis. Destruction of cover, ripping of warrens and shooting are now the most commonly used methods, assisted since 1996 by the introduction of the biological control agent, Calicivirus.

8.3 Geomorphic changes to rivers and streams in the Bega Valley

At the time of European settlement, many river courses in the Bega valley were discontinuous, with extensive swamps, chains of ponds and flow-outs along middle and upper courses, and a continuous, low capacity channel along the lowland plain (Brierley 1998). The Bega River was
characterised by deep pools with extensive rushes (probably *Phragmites australis*) along the base of the high, relatively cohesive, vegetated banks. An extensive stand of large (30m+) river oaks (*Casuarina cunninghamiana*) lined the banks along the lowland reaches (Brooks and Bierley 1997, Lunney and Leary 1988).

Changes to streams in the middle and upper catchment would have commenced almost as soon as settlers started farming. Agricultural activities such as the drainage of upland swamps, vegetation clearance (in particular along riparian zones), ploughing of alluvial flats, and the construction of tracks and roads, all contributed to the initiation of headcut incision into extensive valley fills (Brierley 1998). Incision was quickly followed by channel expansion, supplying massive volumes of sediment to the lower catchment. Some incised channels are now more than 10 m deep and 100 m wide. Within a few decades of European disturbance, river courses became continuous, transforming river character and behaviour throughout the catchment.

The channel along the lower Bega River widened from around 40m to 140m in response to removal of coarse woody debris and clearance of the riparian vegetation cover. Pools that used to provide platypus habitat along the lowland plain were infilled with the large quantities of sediment flushed downstream from the upper catchment. Up to 2 metres of sand accumulated on floodplains which were previously dominated by silt (Brierley 1998). A photo of Bega bridge, taken in about 1890 clearly shows the broad sandsheet comprising bed material within the channel (Brooks 1994). The photograph also shows active erosion of the right bank floodplain just upstream of the bridge, an observation consistent with the channel expansion that was occurring at this time. A dated sediment core from the floodplain near Bega indicated relatively slow vertical accretion of predominantly silt and clay sized material from 4700 years ago to around 140 years ago (Brooks and Brierley 1997). Over the last 140 years floodplain accretion has been dominated by a series of relatively thick (up to 50cm) fine to medium grained sand deposits associated with flood events.

The profound changes to river character in Bega catchment took place in the latter half of the 19th century and by the 1920s the channel of the lower Bega River had expanded to the maximum extent it has achieved in post European times (Brooks and Brierley 1997). Archival photographs from the turn of the century show the river much as it is today. Similarly, the earliest air photograph runs, from the 1940s, show little change to river morphology in the second half of this century. There have been localised changes associated with major floods during the last 70 to 80 years, in particular the 1971 flood (Brooks 1994), but by the 1920s the river seems to have adjusted its width to depth ratio to the new hydrologic and sediment supply conditions associated with catchment disturbance.

Headwater streams in the escarpment zone or in dissected plateau country atop the escarpment have been the least affected parts of Bega catchment in the period following European settlement. These streams are located in areas that have not been cleared and although forestry practices have been active since the turn of the century, buffer strips of riparian vegetation remain, and river structure is much more intact than elsewhere in the catchment (Brierley 1998).

---

**Swampy meadow in early 20th century**

*Roy Howard, a retired farmer from Bega, could recall a swampy meadow on his father’s property that got washed away in the 1919 flood. As a kid he remembers throwing stones over the large erosion gully that was formed. Roy explained that early this century farmers cut channels down through the swamps to drain them and dry them out so that they could be grazed. But in 1917 and 1918 there was a drought, and this was followed by a big flood in 1919 which washed large quantities of soil away.* (Roy Howard, pers. comm., 1999)
Gully Erosion in Upper Wolumla Creek – a case study

Valley fills in the upper Wolumla Creek catchment comprise a series of alternating horizontally bedded sand and mud units, reflecting reworking of detritus from deeply weathered granites of the Bega Batholith. Radiocarbon dates indicate that the majority of valley fill has accumulated in the last 6000 years. Portion plans dating from 1865 show that the valley floor was occupied by ‘Big Wolumla Flat’, a feature characterised by open, well-grassed swamps. Soon after European settlement of the area in 1851, valley flats and adjacent hillslopes were cleared, swamps drained and cultivated, and access roads were cut across the valley flats.

Anecdotal evidence suggests that incision into Wolumla Big Flat began around 1900, while incision into the Anderson Creek tributary occurred between 1938 and 1944. It is inferred that incision into the upstream valley fills was initiated at South Wolumla Road, where the 1865 portion plan indicate that a track cut across ‘Wolumla Big Flat. By 1900 the flats upstream of this road had been incised; upper Wolumla creek now has a channel up to 10 m deep and 100 m wide. Up to 3 m of coarse sands, with occasional gravel clasts up to 270mm, presently lie atop the bedrock floor, indicating that the incised channel has partially refilled.

Aerial photographs from 1962 to 1994 show little change in the geomorphic character of Upper Wolumla creek. This indicates that the largest flood on record, on 6 Feb 1971, when 324.9 mm of rain fell in 24hrs at Candelo, had remarkably little impact on channel condition. The phase of incision and lateral expansion of the channel had effectively been completed by the middle of this century. (Brierley and Fryirs 1998)

8.4 Geomorphic changes in the Cobargo valley

European settlement of the Cobargo area commenced in the early 1830s. Little ringbarking of trees took place until the 1860s, but the majority of Cobargo catchment was cleared by the turn of the century (Tarlinton 1986). Apart from designated forestry land in upper catchment areas, and Wallaga Lake National Park and Bermagui State Forest at downstream fringes, virtually the entire catchment is now devoted to either dairying or beef production (Brierley and Murn 1997).

In the early days of settlement no creek was evident along Murrabrine (Tarlinton 1986) and local sources indicate that Wilgo Creek exhibited characteristics of ‘chain-of-ponds’ as late as the early 1890s (Brierley and Murn 1997). Erosion was noted following droughts in the 1880s when cattle tracks became pronounced between waterholes, leading to incision and draining of swamp flats (Tarlinton 1986). A continuous channel developed along Murrabrine and Wilgo Creeks but the channel remained discontinuous along Bredbatowra Creek.

“From what he (Alexander Tarlinton) and my father told me of early Murrabrine, it comprised a beautiful long flat with no creek evident, being very thickly coated with grass, including much white clover. …. As one progressed up the valley there were several large and small swamps that were connected to each other by a chain of water holes. Wild ducks of many species and numerous other water birds found sanctuary in this area, which extended almost to the slopes of the steep, granite and diorite, Murrabrine Mountain. …. Droughts were … experienced, almost every decade and were the main cause of the terrific erosion, breakaways and swamp draining that has resulted in the destruction of much of this beautiful flat in later years. My father said that the cattle wandered from one water hole to another in dry times, thus making a bare track that became a gully or watercourse when the flood followed. This eventually cut deeper and deeper, till today the creek that was formed in this manner is 30 feet deep in places and the erosion has drained all the swamps and destroyed acres and acres of the best flat land.” (Tarlinton 1986)
In Bredbatowra Creek incised valley fills are transitional downstream to an intact grassed swamp, in which occasional pools are separated by saturated ground. Up to 2m of floodout sedimentation has occurred on this swamp in the last 40 years (Brierley and Murn 1997). The floodout comprises shallow sand sheets that have accumulated downstream of the discontinuous channel. Aerial photographs indicate that the accumulation zone has extended several hundred metres upstream since 1957, infilling the former channel which is now outlined by willows (Brierley and Murn 1997).

The downstream margin of the swamp in Bredbatowra subcatchment is defined by a headcut 2 m high. Anecdotal evidence, supported by aerial photographs suggests that the headcut started in the 1971 flood and has subsequently retreated more than 1 km. Flushed sands have buried fence posts on the floodplain about 500 m downstream (Brierley and Murn 1997).

In the lowland 12km reach of Narira Creek, channel and valley width increase considerably. Sand sheets and splays up to several metres thick have been deposited over fine grained sediments in sections of discontinuous floodplain. Brierley and Murn (1997) studied aerial photos from 1944 and 1969, and these indicated that during this period a narrow lobe of Narira Creek delta extended 150m into Wallaga Lake. A second lobe, 225 m long developed between 1969 and 1994.

### 8.5 Geomorphic changes in the Murrah/Dry River catchment

Evidence from neighbouring Bega and Cobargo catchments (Fryirs and Brierley 1998, Brierley and Fryirs 1998, Brierley and Murn 1997) suggests that the surfaces of the upland valley fills within the Murrah/Dry River catchment, which had accumulated over thousands of years, were characterised by intact swamps at the time of European settlement. Vegetation clearance and drainage of the valley flats induced channel incision. Deep and wide, continuous channels have developed in response to nick point (or headcut) retreat through these valley fill deposits. As a result, extensive volumes of material have been removed from this part of the catchment over the past 100 years or so (Fryirs and Brierley 1998). Along the lowland reaches of the Murrah River, pulses of sand moving downstream during large floods, referred to as sand slugs, have resulted in the deposition of sand sheets on the floodplain.

---

**Changing appearance of the Quaama River**

“My husband, Sam Taylor... is the eldest of the local people still alive. He is 80 and was born on the Brooklyn property at Quaama where he lived until a few years ago when we moved to Bega for retirement. He spent all those years, with the exception of World War II, on the two adjoining properties, Brooklyn and Roseville. The Dry River passed through each of the properties. As a boy, Sam well remembers how much water used to flow through the Dry River and how he loved to go fishing both there and in Pipe Clay Creek further to the east of Quaama. In particular he spoke of how rocky the area of the creek below Quaama bridge was. Now it is all rubbishy trees and sand. A little way below the village down the Dry River there was a particular lovely picnic spot called “Slippery Rocks” where the locals used to do most of their swimming. It is all sand now. Just behind the school in the Cadjancarry River I remember where I and my schoolmates used to swim. I am 70, a little younger than my husband.

During our married life when living at Brooklyn, Sam and I used to do the measurements for the flow of the Dry River. Just down the river from our farm house was a lovely cool spot, under the willows where we would take our children on a hot day for them to play in the creek. Unfortunately the 1971 floods did much damage to the creek banks, washing away many of the trees, leaving deep banks, completely destroying that previous beautiful spot.

...continued
We noticed the biggest changes to the river when the farmers up along the Dry River began irrigating in the 1960s. We found that many a time our section of the creek would be barely running and we would have to dig deep for water to be pumped to our dairy and cattle troughs. We had to approach the Water Conservation Department and have roster days and times for the irrigation. By the 1980s the river had begun to grow much of the rubbishy trees which are so abundant today. Now we barely recognise the river as the one we knew so well.” Betty Taylor, January 2000

8.6 Soil Erosion in State Forests

A survey of 44 forest compartments with a total area of 3064 ha, which had been harvested over a 6 year period (1986 to 1992), was made by State Forests within the Eden Management Area (State Forests 1994). The soils in these compartments were the more erodible granite soils. Between 1986 and 1992, there were eight major storm events (>100mm/24hrs). Most of the instances of erosion occurred on access roads with lesser amounts on snig tracks and log dumps. Of the 44 compartments surveyed, 28 (64% of the total) required some form of remedial erosion control works. Most of this work was to minimise potential erosion rather than to redress active erosion. Sites of active erosion were localised and few in number. A breakdown of the erosion control problems in the 28 compartments was as follows; 22 involved access roads, 12 involved snig tracks, and 10 involved log dumps.

Various studies (Erskine 1992, Mackay et al 1985, Wallbrink et al 1997) have shown that, while soil erosion occurs on slopes during and following timber harvesting, the eroded material is generally transported over short distances and deposited in situ on the forest floor, with little sediment leaving the harvested slope. Tongues of deposited coarse sediment were observed by Myint (1990) downslope of snig track drainage points on undisturbed areas. The filtering action of areas of undisturbed ground-cover vegetation, where snig track drainage is directed, prevented most of the material from entering the natural drainage. Where sediments in overland flow did enter the natural drainage, these mobilised sediments were fine grained material (silts and clays).

Generally, minor access roads, snig tracks and harvesting areas are not long term active sources of sediments. In most instances, the forest regrowth restores vegetation and litter cover, which in turn stabilises the site before active erosion sites develop.

8.7 Erosion continues today

Active gully and sheet erosion continue to be a problem in the rural areas of the Bega District. Recent data for the Bega Valley catchment estimated that there was 4,306 ha of land affected by sheet and rill erosion (A preliminary draft of the South Coast Land degradation survey for the Bega catchment was circulated by the Department of Land & Water Conservation and cited in the 1997-98 SOE supplementary report). There was also 13 km of gully erosion, including 128 ‘headcuts’, and 89 km of streambank erosion. In addition, there were 106 farm dams with eroding spillways.

Anecdotal evidence from local farmers indicates that similar erosion problems exist in the Murrah/Dry River catchment. For instance, bad gully erosion below a large farm dam first started in the 1971 flood soon after the dam had been built, and the gully has been growing in size ever since (Tony Redmond, Landcare Co-ordinator of Quaama district, 1999). Some creeks
in the catchment are also active erosion sites, such as the small creek on the northern side of Upper Verona Rd, just west of the bridge over Katchencarry Ck (this creek enters Katchencarry Creek from the west, immediately north of the bridge). Some of the older residents remember many of the creeks being swampy meadows but most of these are now incised (Tony Redmond pers. comm. 1999).

Another cause of erosion is the trampling of river banks by cattle; only a few farmers in the catchment have fenced off the riparian zone. Some farmers are reluctant to fence off the riparian zone, since they prefer to keep this land grazed in order to reduce weeds and eliminate refuges for pests (such as rabbits and foxes).
An eroding gully on a farm in the Murrah/Dry River catchment, April 1999.

Large sand deposits exist in the lower reaches of the Murrah River. This photo was taken looking upstream from the Murrah Bridge. April 1999.
9. Conclusions

Prior to European settlement, many of the watercourses in the upper reaches of the Murrah/Dry River catchment were discontinuous, with extensive swamps and chains of ponds. Large scale clearing of the valleys and lower hillslopes occurred from the 1860s onwards, and within a few decades the resulting gully erosion had released massive quantities of material, creating steep-sided continuous channels. Eroded material was flushed downstream, and the river channels became wider and shallower as large quantities of sand were deposited in the channel and on the adjacent floodplain. The worst erosion within the catchment was associated with large flood events, particularly if the flood was preceded by drought conditions. The rabbit and hare plagues in the early 20th century accentuated erosion problems by removing grass cover on hillslopes.

Erosion continues today, but probably at a lower rate than 80-100 years ago. However, the large quantities of sediment that have accumulated along the middle and lower reaches of the Murrah/Dry River, will probably take many more decades to move completely through the system.

While soil erosion also occurs in forested areas of the catchment, both during and following timber harvesting, the eroded material is generally transported over short distances and deposited in situ on the forest floor, with little sediment leaving the harvested slope. Minor access roads, snig tracks and harvesting areas are not major sources of sediments on a catchment-wide basis. In most instances, the forest regrowth quickly restores vegetation and litter cover, and this stabilises the site following disturbance.
References


Tathra Historical Society (date unknown) Sawmills of Tathra, Tanja, Wallagoot and Bega. Tathra Historical Society, Tathra.


Watson, F (ed.) (1923) Historical Records; Series 1, Governor’s Dispatches to and from England, Volume 17, 1833- June 1835. The Library Committee of the Commonwealth Parliament, Sydney, pp468-469.