CATCHMENT

DESCRIPTION

4. CLIMATE

4.1 INTRODUCTION

Climate is one of the main determinants of landuse options, along with soils and topography. This is certainly the situation in the Little River Catchment, where the higher southern parts of the district are best suited to grazing, based on temperate pasture species. This area is well suited to introduced pastures, although a diversity of species, allowing growth in all seasons, is essential to avoid deep drainage.

The area to the north and east is well suited to cereal cropping and is potentially suited to the introduction of subtropical perennial grasses and legumes such as bambatsi panic and purple pigeon grass. There is reportedly more C4 grasses (usually subtropical) occurring naturally in the north where it is warmer, while C3 grasses (usually temperate) are more common to the south. (pers. comm. A. Nicholson, DLWC)

Although very few summer crops are currently grown, the rainfall and temperate patterns suggest this may be feasible. A more even spread of crops and pasture growth throughout the year would have a beneficial impact on deep drainage.

Climate, and its inseparable relationship with plant growth, is the driving force in land degradation issues. Rainfall intensity, along with plant growth and ground cover, is the key determinant in erosion; excess rainfall, along with rooting depth and active growth, determines the amount of deep drainage; and periods of low rainfall or drought, along with stock management, determine ground cover and erosion potential.

Many landholders cite climate variability as a major area of concern in their management. This is the nature of the Australian climate, and successful and progressive managers will be rewarded when they adopt risk management strategies in production and marketing that utilise tools that help predict the coming season. Managing climate is a form of risk management and should be regarded as a set of probabilities, in much the same way as marketing a crop.

4.2 RAINFALL AND INTENSITY

The average annual rainfall in the Little River Catchment ranges from approximately 560 mm in the west to 700 mm at Molong in the south. The primary maximum of rainfall occurs during summer and there is a weaker secondary maximum occurring during winter. Wellington has 55% of its rain in summer and even Molong is very slightly summer dominant on average (52%). The driest part of the year is autumn, and September is also a period of little moisture. (See Figures 3a and 3b.)

The rainfall pattern is also closely associated with elevation. The higher rainfall areas are found in areas of higher elevation ie. to the south of the catchment. Rainfall in the Little River Catchment is often associated with the inland passage of tropical cyclones or low pressure cells which have been located over the Pacific or Indian Oceans or with the passage of cold fronts across New South Wales.

The average number of rain days per year is 77 at Wellington and Dubbo, 85 at Cumnock, but only 73 at Yeoval and 67 days p.a. at Obley. The highest average number of rain days in all centres occurs during June, July and August. Yeoval appears to be in a rain shadow, with a significantly lower rainfall than surrounding areas, especially when compared to its elevation.

A drought is considered to be an extended period during which there is insufficient rainfall to maintain soil moisture at a level necessary to meet the requirements of pastures and crops. Yeoval is more likely to have one or more consecutive dry months in summer than Molong or Dubbo (3).

Appendix 3 provides climatic data for a number of villages in the area and the surrounding towns.

Runoff and soil loss is highly correlated with rainfall intensity. Erosion risk is greatest during summer due to high intensity rainfall. Therefore there is a need to ensure adequate levels of ground cover (>70%) are maintained during the summer months. In areas with steeper slopes, soil conservation works may be required to help prevent erosion. It is particularly important that pastures are not overgrazed during the dry autumn, as low temperatures and restricted plant growth means there is very little opportunity to improve ground cover until the spring flush which doesn't generally appear until October.

Table 3: Average and Median Annual Rainfall in locations near the Little River Catchment.

	Average Annual Rainfall (mm)	Median* Annual Rainfall (mm)	Mean Rainfall Event (mm)	Average Annual Rain days	Elevation (m)
Dubbo	588	585	7.64	77	275
Wellington	614	605	7.97	77	304
Obley	646	642	9.64	67	340
Yeoval	583	563	7.99	73	381
Cumnock	644	652	7.58	85	518
Molong	706	702	7.51	94	529

*The median rainfall value is the middle value when all annual rainfalls are ranked.

4.3 TEMPERATURE AND EVAPORATION

The district experiences four definite seasons with warm to hot summers and cool to cold winters. Elevation and topography influence temperature. Air currents, proximity to water, depressions in landscape and other natural features also cause temperature variations.

There is not a great deal of variation in average maximum temperatures across the catchment. The annual average maximum daily temperature ranges from approximately 22^0C at Molong to 24^0 C at Dubbo. However, daily minimum temperatures are more significantly influenced by altitude.

The annual average minimum daily temperature ranges from approximately 6^0C at Molong to 12^0C at Peak Hill. The average daily temperature range in January is 17.1^0C to 31.9^0C at Wellington and 13.3^0C to 31.0^0C at Molong. The average daily temperature range in July is 2.8^0C to 14.5^0C at Wellington and -0.1^0C to 12.9^0C at Molong. Molong is colder at night and during winter as a result of local topography, as well as much higher elevation. See Figure 4.

Frosts usually occur in May, with light frosts early in May and severe frosts by the end of May. These frosts continue until late September or early October. Wellington has an average

of 65 frosts per year. The mean frost-free period at Wellington is 152 days. The number of frosts per year increases with altitude. Molong has the potential for more than 200 frosts per year, and the mean frost-free period is only 147 days. Molong experiences a larger number of frosts due to cold air drainage caused by local topographical characteristics, as well as generally lower temperatures due to elevation and latitude differences.

Table 4: Average Maximum and Minimum Temperature for locations near Little River.

	Average Annual Maximum (^{0}C)	Average January Maximum (^{0}C)	Average July Maximum (^{0}C)	Average Annual Minimum (^{0}C)	Average January Minimum (^{0}C)	Average July Minimum (^{0}C)
Peak Hill	24.1	32.7	15.1	11.6	18.7	4.6
Dubbo	24.5	33.0	15.2	10.2	17.8	2.6
Wellington	23.4	31.9	14.5	9.8	17.1	2.8
Molong	22.3	31.0	12.9	6.2	13.3	-0.1

Wind direction tends to be from the north-east and south-west. Easterlies are common between October and April and southerlies are common from April to July, further reducing the temperature in winter. Winds are generally light to moderate; however, they may occur all day.

Plant growth is dependent on nutrient levels, light, temperature and soil moisture levels. Temperature promotes the maximum rate of plant production in the area during late spring and early autumn. Moisture is the main limiting factor for optimum growth during the spring/autumn growth period. Temperature is the main limitation to the growth of cool season species during winter.

Cool season species growth is at its maximum during spring, while the growth of warm season species peaks during summer. Warm season plants (subtropicals or tropicals) grow better in the northern and central areas of the catchment with restricted growth towards the southern parts near Molong. Plant growth indices at Molong, shown in Figure 4, highlight that warm season species are not a good option in the south; they don't achieve as much growth as the temperate species at any time in the year, and show no growth at all between May and September.

Evaporation varies due to seasonal variations, wind, exposure to sunlight and elevation. The mean evaporation for Wellington for a year is 1750 mm (4.8 mm/day). Evaporation is lowest in all areas during June and July, increasing during spring and greatest in December and January.

Table 5: Average daily evaporation at Wellington Research Centre

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mean	8.7	7.6	6.2	4.2	2.5	1.6	1.7	2.4	3.4	5.2	7.0	8.8	
Mean (max)	11.0	9.4	7.5	5.7	3.2	2.3	2.2	3.5	5.5	7.2	9.6	11.4	
Mean (min)	6.5	5.9	4.5	2.8	1.9	1.3	1.3	1.7	2.8	3.2	4.9	6.5	
Month Total	270	213	192	126	75	48	53	70	102	161	210	273	1792

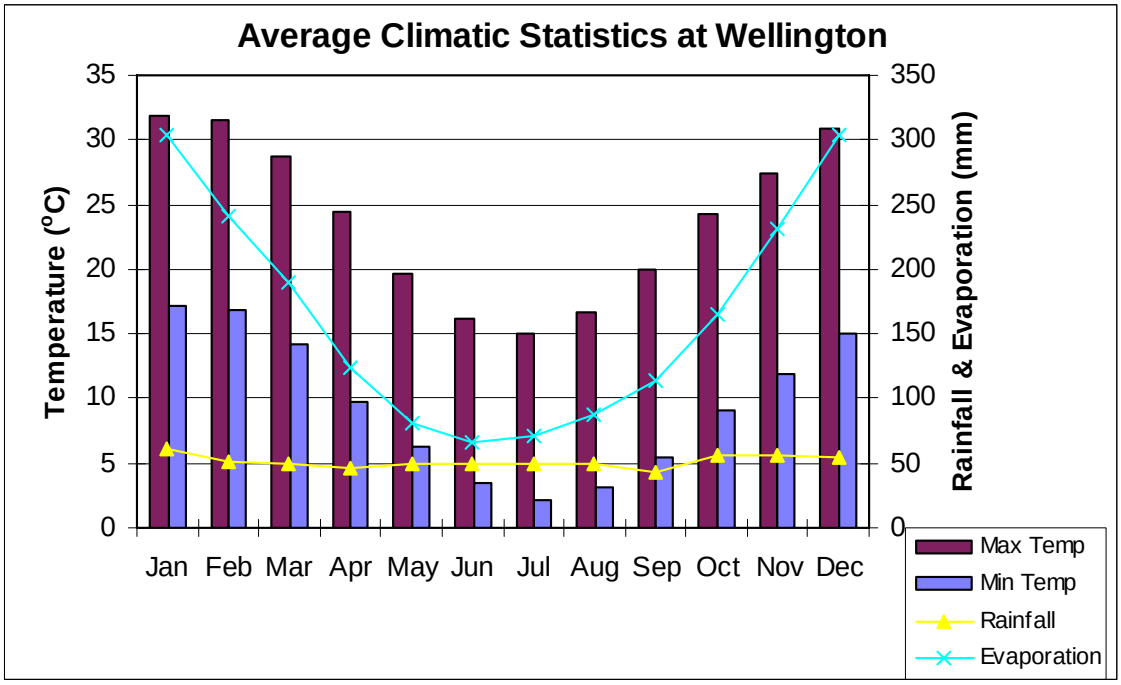

Figure 3a: Average Rainfall, Evaporation and Temperatures at Wellington

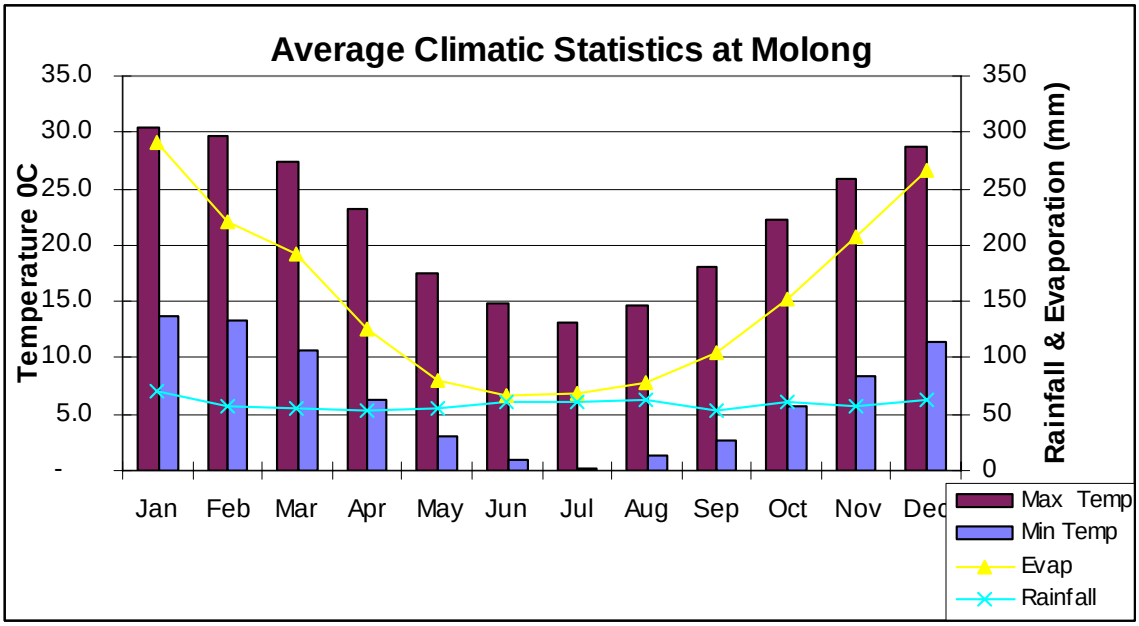

Figure 3b: Average Rainfall, Evaporation and Temperature at Molong

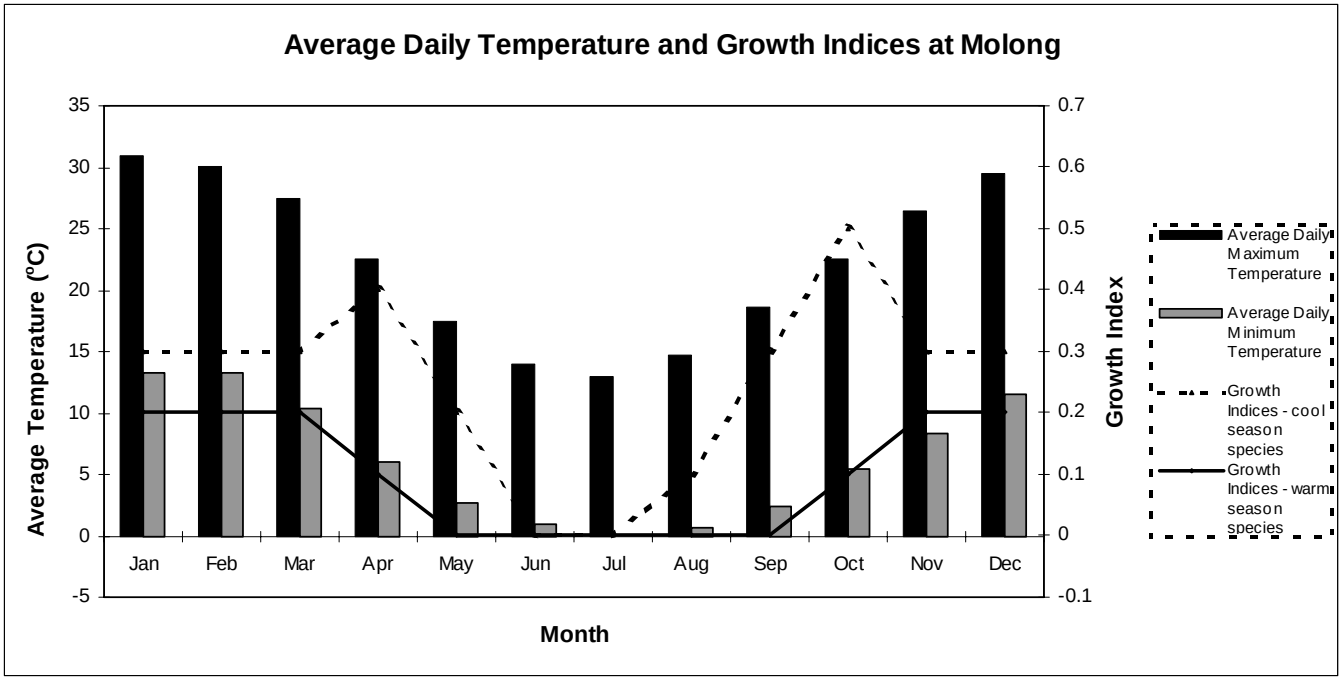

Figure 4 : Minimum and Maximum Temperatures and Plant Growth Indices at Molong

4.4 CLIMATE MANAGEMENT SERVICES

There are a number of services available to help make management decisions that consider probable climatic influences. These include:

- Bureau of Meteorology homepage (www.bom.gov.au)
- SILO (www.bom.gov.au/silo)
- Rainman
- Wheatman and Barleyman
- LWRRDC Climate Variability in Agriculture R&D Program (www.lwrrdc.gov.au)
- NSW Agriculture (www.agric.nsw.gov.au)
- Roger Stone's Weekly Climate Note DPI Farmfax 1902 220 042

SILO is a subscription agro-meteorological information service for rural communities. It provides information, reports and maps for use. The objectives of SILO are to provide a rich source of national meteorological data within a coordinated information service and a framework to encourage future additions to the agrometeorological data bank.

Rainman and Wheatman are software packages, which use seasonal forecasts and long term rainfall data to assist growers and advisers making cropping decisions. Rainman provides a better understanding of rainfall probability using rainfall information from over 3000 locations around Australia, the Southern Oscillation Index (SOI) and Sea Surface Temperature (SST).

Other packages are available free of charge on the Internet.

References:

(3) Soil Conservation Service (1982) *Wellington District Tech Manual Ch. 4*

(2) T. Callan *The Hydrogeology of a Dryland Salinity Affected Catchment and Recommendations for Site Specific Remediation - Suntop, Wellington, NSW*

(29) Bureau of Meteorology (1999) *Website - www.bom.gov.au - Climatic summaries*

(24) Soil Conservation Service (1978) *Orange Tech Manual Ch 4*

(28) LWRRDC (1999) *Climag Issue 1 Feb 1999*

(47) GRDC (1999) *Northern Update Issue 4 Sept 1999*