Climate Data

South West Slopes Forestry Hub

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1. Introduction

The SWS Slopes Forestry Hub (the Hub) is responsible for identifying constraints facing the forestry and wood products sectors within the Hub boundaries. Based on sound analysis, the Hub can then make recommendations to mitigate such constraints.

The Hub is keen to explore where plantation areas within the Hub boundary are likely to be significantly impacted by anticipated climate change, such as: increased surface temperatures, drought, rainfall, and potentially bushfire.

To support this for the Hub, a series of climate related views of their region showing the current and projected futures have been prepared. The presentation of recent observation information has also been prepared to assist and improved understanding of the changes that have already been experienced in recent decades.

2. Climate Variables

A list of 13 climate variables have been prepared for the South West Slope Forestry Hub Region. This is presented in Table 1 alongside whether it is presented as an annual or monthly variable.

Table 1. Climate variables for the south West Slopes Forestry Hub Region

#	Climate Variables	Annual	Monthly
	Temperature		
1	Mean Daily Maximum Temperature (Temp Max)		Yes
2	Mean Daily Minimum Temperature (Temp Min)		Yes
	Extreme Temperature - Max		
3	Days with Temp Max gt 40C – very hot days		Yes
4	Days with Temp Max gt 35C – hot days		Yes
5	1:100 Daily Max Temp for month across period		Yes
	Extreme Temperature - Min		
6	Days with Temp Min lt 2C – frost days		Yes
7	Days with Temp Min lt 0C – very cold days		Yes
	Extreme Temperature - Heatwaves		
8	Three or more consecutive days with Temp Max gt 35C – Heatwaves	Yes	

#	Climate Variables	Annual	Monthly
9	Days with Temp Max gt 35C and Temp Min gt 20C – Heat stress days		Yes
	Rainfall		
10	Total Precipitation (mm) for period	Yes	Yes
11	Days with Daily Rainfall gt 10mm – very wet days		Yes
12	1:100 Rainfall for month across period		Yes

3. Understanding Likely Change

To better plan for likely climate change related impacts growers and investors need to better understand the anticipated changes in the climate, and the associated flow of effects such as likely drought and extreme weather events. This change in the climate can be expressed in terms of climatic variables, such as days over 35C per month.

Spatial views of where change is likely to occur, such as which areas are more likely to be subjected to a greater number of heatwaves, are required to identify the likely impact of the anticipated changes.

By using the latest climate projections from CSIRO the level of change across the Hub extent can be identified. Critically this change needs to be defined relative to an appropriate baseline or reference time period so that future exposure to change and associated impacts can be accurately identified.

Hence, a key first step in this project will be the suitable collation and standardisation of data, including climate and climate projection data.

The following sections will explore each of these variables in more detail, primarily around the use of data and available sources that can be leveraged in the process of a climate impact and vulnerability assessment.

Climate Models and Climate Scenarios

The most recent climate modelling prepared by CSIRO as an outcome to the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (AR5) has been made available, as application-ready data, as part of the Victorian Climate Projections 2019 Project (VCP19) under the Department of Environment, Land, Water and Planning.

To model and project climate change at a national or global scale, various organisations world-wide have created a suite of General Circulation Models (GCM) to model the likely changes in climate for various variables. These GCMs are spatially presented at a very coarse scale, sometimes upwards of 100km^2 gridded resolution. These models, and the larger modelling initiative, form part of the Coupled Model Inter-comparison Project Phase 5 (CMIP5).

Further to the base GCMs that are available for use, there are various scenarios explored within a GCM. This is done by establishing an emissions pathway that explores worldwide responses to greenhouse gasses and other pollutants. These are grouped and modelled under Representative Concentration Pathway (RCP) emissions scenarios. Typically, four RCPs called RCP2.6, RCP 4.5, RCP 6.0 and RCP 8.5 explore a non-fossil fuel future (RCP 2.6) to a fossil fuel intensive future (RCP 8.5), with scales in between.

This updated modelling, from DELWP, includes downscaled modelling to a resolution of 5km^2 Victoria-wide (and partial NSW), within the suite of projections initially made available through CSIRO at a coarse resolution in 2015. These have been updated based on new understandings and modelling techniques and are available for the entire study area.

From the VCP19 program, up to six GCMs for the projected years of 2030, 2050, 2070 and 2090 are available at two differing RCP emissions scenarios of 4.5 and 8.5. These six models can provide a range of projected climate changes and impact assessments ranging from a warmer and minimal rainfall change to a hotter and drier projected future.

Of these six models, none are more likely to occur than another. Each future model projection is as likely as another. However, each model can be suited to expressing a particular change more so than another, or they can be more suited for a particular region. The six chosen by DELWP, as part of the VCP19 program look at six possible future scenarios for models that are more so attuned for the Victorian region, and southern NSW.

However, for the South West Slopes Forestry Hub region, we have used two models to carry forward the work and visualisation of climate. These two models express projected climate in differing fashions and typically represent;

1. A Median or ‘Maximum consensus’ future climate model
2. A Hotter and drier future climate

These two models have been applied for this project to express an envelope of potential changes from a current baseline. For forestry operations, rainfall deficiencies are a key variable to focus upon. Hence, a drier future can help explore the extreme changes that may occur under climate projections.

The two models selected to represent a range of likely futures for both temperature and rainfall projections include the HadGEM2-CC and ACCESS 1.0 GCMs, where these models have been developed by:

1. ACCESS 1.0 - CSIRO and BoM
   a. representing a maximum consensus future
2. HadGEM2-CC - Met Office Hadley Centre
   a. representing a hotter and drier future

The projection data is based on a baseline climate represented by the period from 1981 to 2010 and any change determination can be made by assessing the difference between the current time point and any future projections.

These two models will be presented at both RCP scenarios which encompass an ideal scenario of curtailing changes to warming less than 1.5°C (RCP 4.5) and a conservative, high emissions ‘business as usual’ scenario (RCP 8.5).

The years 2030, 2050, 2070 and 2090 were used to evaluate the likely climate futures with climate change parameters and analysis based on these dates. The estimated climate parameters for these years were based on the average of modelled climate parameters (such as maximum daily temperatures) for the following periods:

- 2030 – based on average for period 2016 to 2045
- 2050 – based on average for period 2036 to 2065
- 2070 – based on average for period 2056 to 2085
- 2090 – based on average for period 2076 to 2106

It is noted that for the period to 2030 changes in the projections between any GCM at both RCP 4.5 and 8.5 may be minimal, but periods after will have larger differences (see Figure 1).

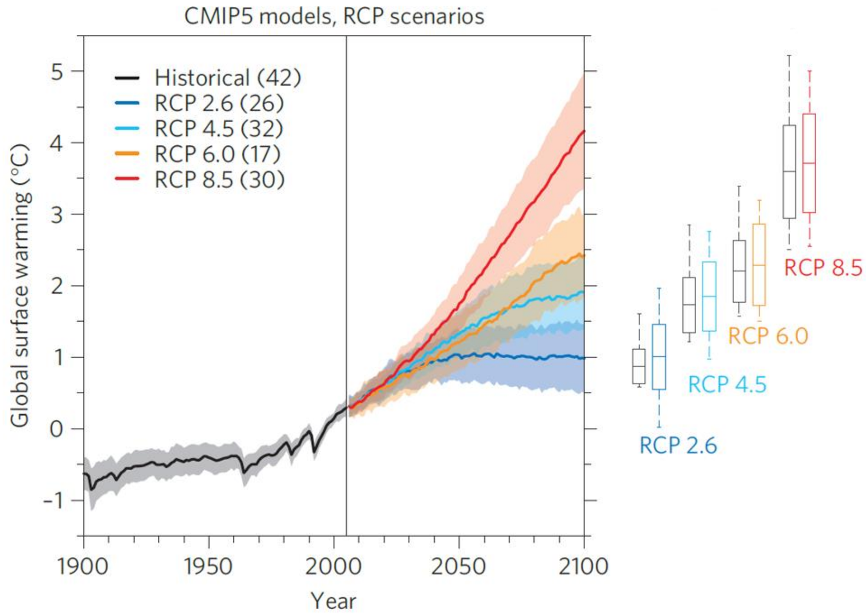

Figure 1. Relationship between four new scenarios, denoted Representative Concentration Pathways (RCPs), where RCPs provide standardised greenhouse gas concentration inputs for running climate models.

Use of Historical Observation Data

Historical existing climate observation data can be a useful source of knowledge to help understand and communicate what we are already experiencing changes in the climate.

Historical climate data obtained from weather observations for the last 50 years has been obtained for the South West Slopes Forestry Hub region. This information provides context and a baseline to the future change projected. The information has been summarised for each of the last five decades and represents monthly and annual values, as per the variables.

Historical climate data has been obtained from weather observations has been sourced from the SILO[1] Long Paddock Project. This project utilises Bureau of Meteorology weather observational data and models it into a continuous gridded surface. This is presented at a 5km^2 gridded resolution, similar to the future projected climate scenarios.

The historical climate observation data shows how since the 1970, the average daily maximum and minimum temperatures have increased, with the last decade (2010 to 2019) being the warmest. This warming is also expressed in terms of an increase in the number of days greater than 35°C and 40°C, as well as a number of other variables.

[1] SILO is a database of Australian climate data from 1889 to the present. It provides daily meteorological datasets for a range of climate variables in ready-to-use formats suitable for biophysical modelling, research and climate applications.