Building Farmer & Advisor Knowledge in Carbon Farming

The Carbon Farming Knowledge Project involves a series of workshops to increase the understanding of 30 independent agricultural advisers in south-east Australia on reducing greenhouse gas emissions, carbon in farming systems and the Emissions Reduction Fund – where farmers can earn credits for storing carbon or reducing greenhouse gas emissions on their properties. The project helps advisors prepare their clients for potential environmental, economic and social benefits of future carbon management policy.

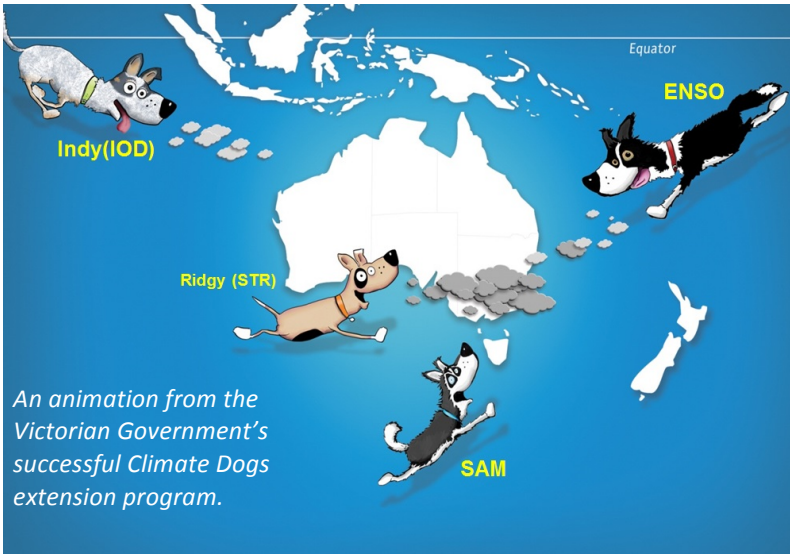
Summary of Session 1: Using models to make informed climate decisions – a Victorian example

Summary of March workshop presentation by Dale Grey and Graeme Anderson, Department of Economic Development, Jobs, Transport and Resources Victoria (formerly DEPI).

Background

Understanding the factors which affect annual climate conditions experienced in southern Australia has greatly improved in the past decade. However knowing what tool to use when or which indicator to consider at which time is the key to making forecasts useful when it comes to decision making.

Growers looking to use forecasting tools should consider a suite of models to gain a consensus of what they are all predicting about the season ahead. It is also important to look at the forecasting timeframes of the models – for example whether they are analysing one month or three. It is not possible to choose one model to rely on because they do not all perform the same function with the same accuracy.



An animation from the Victorian Government's successful Climate Dogs extension program.

Climate influencers

There are four key drivers of seasonal variability in Victoria's climate and rainfall. The Victorian Government has represented these in a useful series of animations, called the Climatedogs. The seasonal drivers include:

- <u>El Nino Southern Oscillation (ENSO)</u>

The position of warm and cool water, wind strength and atmospheric pressure in the Pacific Ocean over northern Australia can influence climate in southern Australia. ENSO describes the likelihood of the Pacific Ocean being a rainfall source. It has three phases:

- El Nino. Warm water closer to South America and weak trade winds toward Australia causes less atmospheric moisture around Australia, increasing the chances of a dry spring. The Southern Oscillation Index (SOI) is negative in this phase.
- La Nina. Warm waters close to Australia's northern coastline and stronger trade winds coming from South America causes there to be more moisture in the atmosphere over eastern Australia. The SOI is positive in this phase.
- Neutral. A neutral SOI means there is neither a swing to a negative or positive SOI phase.

- <u>Indian Ocean Dipole (IOD)</u>

The IOD is an indicator of the proximity of warm surface water to Australia and the potential for large north-west cloud bands and strong winds to deliver rainfall to south-eastern Australia. It has three phases:

- IOD Positive. This reduces tropical moisture to Victoria when the Indian Ocean is warmer in the west, near Kenya, than it is in the east, near Sumatra.
- IOD Negative. This increases moisture closer to Australia through northwest cloud bands. It occurs when the Indian Ocean is warmer in the east than it is in the west. The IOD was negative in 2010.

- IOD Neutral. Positive and neutral IOD phases have been linked with drought in Australia.

- Southern Annular Mode (SAM)

The SAM influences the position of fronts moving over the Southern Ocean which are valuable triggers to rainfall and moisture transport from the tropics. Its main influence is along coastal south-east Australia. SAM has two phases:

- Positive SAM. Chances of rainfall during winter from fronts are lower when westerly winds circulate closer to Antarctica and are stronger. Frontal systems are dragged away from the Australian coast.
- Negative SAM. Chances of above-average rain in winter are higher when westerly wind belts expand due to slower winds and come closer to southern Australia. Frontal systems are pushed closer to Australia.

- Sub-Tropical Ridge (STR)

The STR is a natural high pressure belt that affects the way cold fronts and low pressure systems move across southern Australia. In winter, the STR is further north centered near the top of the Bite, allowing fronts to pass underneath, and then it drops south in summer, centered over Melbourne, which blocks fronts from moving through. For autumn and winter, watch for abnormal summer positions which are not helpful for allowing rainfall triggers through.

Other factors to watch

- Sea surface temperatures. These are measured by permanently moored buoys along the Equator to give a profile of the ocean, drifting buoys that move with ocean currents, satellites that compile infrared temperature date and by ships that take regular measurements. El Nino and La Nina phases are driven by temperatures 400m below the surface and will occur 3-5 months before they reach the surface. At the Pacific surface, a temperature change from +/- 0.2-0.8°C is only deemed slightly warmer or cooler but greater than +/- 0.8 is the threshold where El Nino or La Nina phases could be expected. For the Indian Ocean, IOD, the thresholds are much less. Between +/- 0.2-0.4°C is only slightly warmer or cooler. Above +/- 0.4°C is IOD positive or negative.

- World cloudiness. This indicates how the moisture sources are behaving and is one of the major indices for ENSO behaviour. For example, during the 2002 El Nino, conditions became cloudier at the junction of the dateline with the Equator. Cloud over northern Australia was less than normal. This is contrasted with the 2007 La Nina where there was a lack of cloud at the dateline and a horseshoe of cloud above Australia and over Indonesia and Papua New Guinea.

- Southern Oscillation Index. The SOI is the difference in air pressure between Tahiti and Darwin. This indicator is not useful in autumn, but at other times, a difference of +/-8 can indicate a La Nina or an El Nino phase. The SOI is a surrogate measure of ENSO activity and needs to be in sync with Pacific Ocean temperatures to be believed.

- Trade winds. Permanently moored buoys give hourly measurements of trade wind direction and strength. These are important in pushing cool or warm water closer to Australia, which is a driver in ENSO conditions causing El Nino or La Nina. Under El Nino, in the western Pacific easterly trade winds weaken and switch to the west, while under La Nina the easterlies strengthen.

Useful resources

DEPI Climate Risk, The Break and Climate Dogs – www.depi.vic.gov.au/climaterisk
Bureau of Meteorology Climate Outlooks – www.bom.gov.au/climate/ahead/
Sea surface temperature anomaly charts - www.ospo.noaa.gov/Products/ocean/sst/anomaly
Very Fast Break YouTube Channel https://www.youtube.com/channel/UClDCIII7gRZhUs03opGqH1g
Building Farmer and Advisor Knowledge in Carbon Farming Project – www.carbonfarmingknowledge.com.au

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