

CLIMATE SAVVY FOR GRAZING MANAGEMENT

## **Kimberley & Pilbara**



## Madden-Julian Oscillation

**What:** A large band of clouds that influence alternating wet/dry conditions during the wet/summer season. The MJO can increase the availability of moisture in the area during an MJO 'wet' phase, leading to an increased chance of rain.

**When:** Year-round, but mainly during wet season (December to April).

**Where:** Kimberley, with minimal impact in the Pilbara.

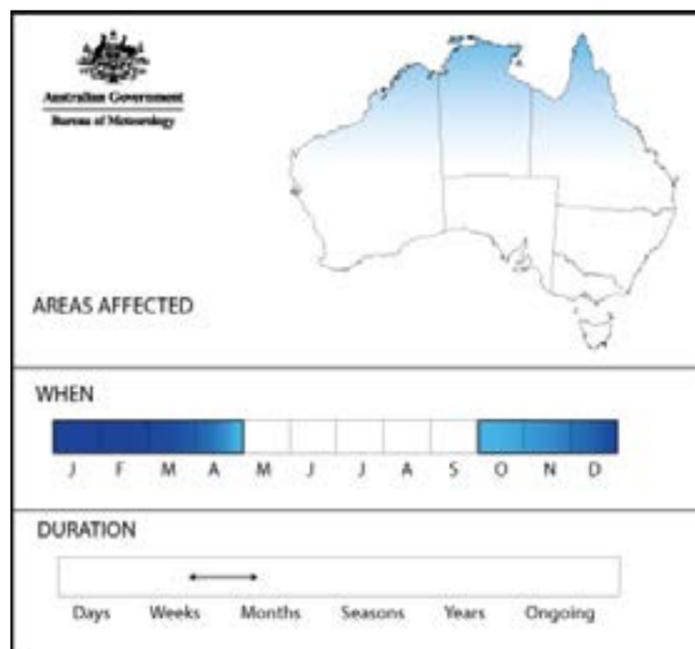
**How:** Impact varies by season and location. Note, during the summer, an active MJO in phases 4 & 5 can influence cyclone development.

Period (KIMBERLEY)	Wet Phases	Dry Phases
June, July, August (minimal impact)	7	1, 3, 4
September, October, November (minimal impact)	3, 6, 7	1
December, January, February	5 & 6	8, 1, 2
March, April, May	5 & 6	1
Period (PILBARA)	Wet Phases	Dry Phases
June, July, August (minimal impact)	None	8
September, October, November (minimal impact)	1 & 2	7 & 8
December, January, February	3, 5, 6	2
March, April, May	5 & 6	7

### Prediction lead time:

The MJO can be predicted up to 21-28 days in advance. The MJO forecast on the BOM website is for 21-days in advance and the CPC/NOAA MJO forecast is issued 14-days in advance.

**Note:** Looking at the MJO forecast starting in early December can be useful, as an active 'wet' MJO phase in December can bring on the first of the summer rains.



The diagram above shows the area most affected by the Madden-Julian Oscillation (MJO), the seasons during which the MJO's influence on Australia is greatest, and for how long each active phase of the MJO typically lasts.

### Where to find information:

BOM: <http://www.bom.gov.au/climate/enso/#tabs=Tropics>  
 NOAA: <https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml>

## Monsoon

**What:** An annual change in the direction of the prevailing winds to be from west to east associated with the start of the northern wet season.

**When:** November/December to March/April

**Where:** All of the Kimberley, somewhat into the northern part of Pilbara.

**How:** Areas in northern Australia are subject to influence from the monsoon trough, which moves south with the Intertropical Convergence Zone during Austral summer.

### Prediction lead time:

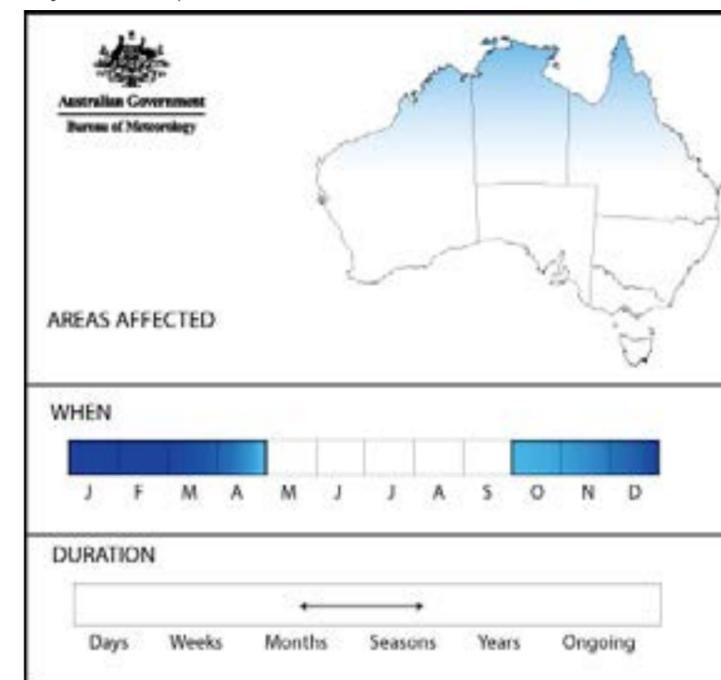
BOM currently issues a 'Northern Rainfall Onset' forecast and also has information about timing of monsoon onset during El Niño and La Niña events, but there is not specific 'Monsoon Onset' forecast.

**Note:** The Monsoon can be delayed by El Niño and brought forward by La Niña.

### Different definitions:

**Monsoon:** Seasonal reversal of winds over the tropics, from mostly easterly winds to westerly winds; has 'active' (rain) and 'inactive' (dry) phases. Active and inactive phases can be associated with the MJO.

**Northern Rainfall Onset:** The day after 1 September that an area receives an accumulated total of 50mm of rain.



The diagram above shows the area affected by the monsoon, when it occurs and how long it may last.

### Where to find information:

BOM Monsoon: <http://www.bom.gov.au/climate/about/?bookmark=monsoon>  
 BOM Northern Rainfall Onset Forecast: <http://www.bom.gov.au/climate/rainfall-onset/>  
 BOM Weekly Tropical Climate Note: <http://www.bom.gov.au/climate/tropical-note/>

## Indian Ocean Dipole

- What:** The IOD has two active phases, Positive and Negative, and an inactive/neutral phase.
- When:** Phase locked to occur between June/July and the end of December.
- Where:** IOD has negligible impact in the Kimberley, but likely has a bit of impact on the Pilbara, especially in the positive phase. On the BOM website that has information about the IOD, it does show a particularly strong Northwest cloudband associated with an IOD negative event impacting strongly on the Kimberley but missing the Pilbara.
- How:** IOD Positive events tend to bring warmer temperatures and drier conditions; IOD Negative events are the opposite, with cooler temperatures and an increased chance for rain.

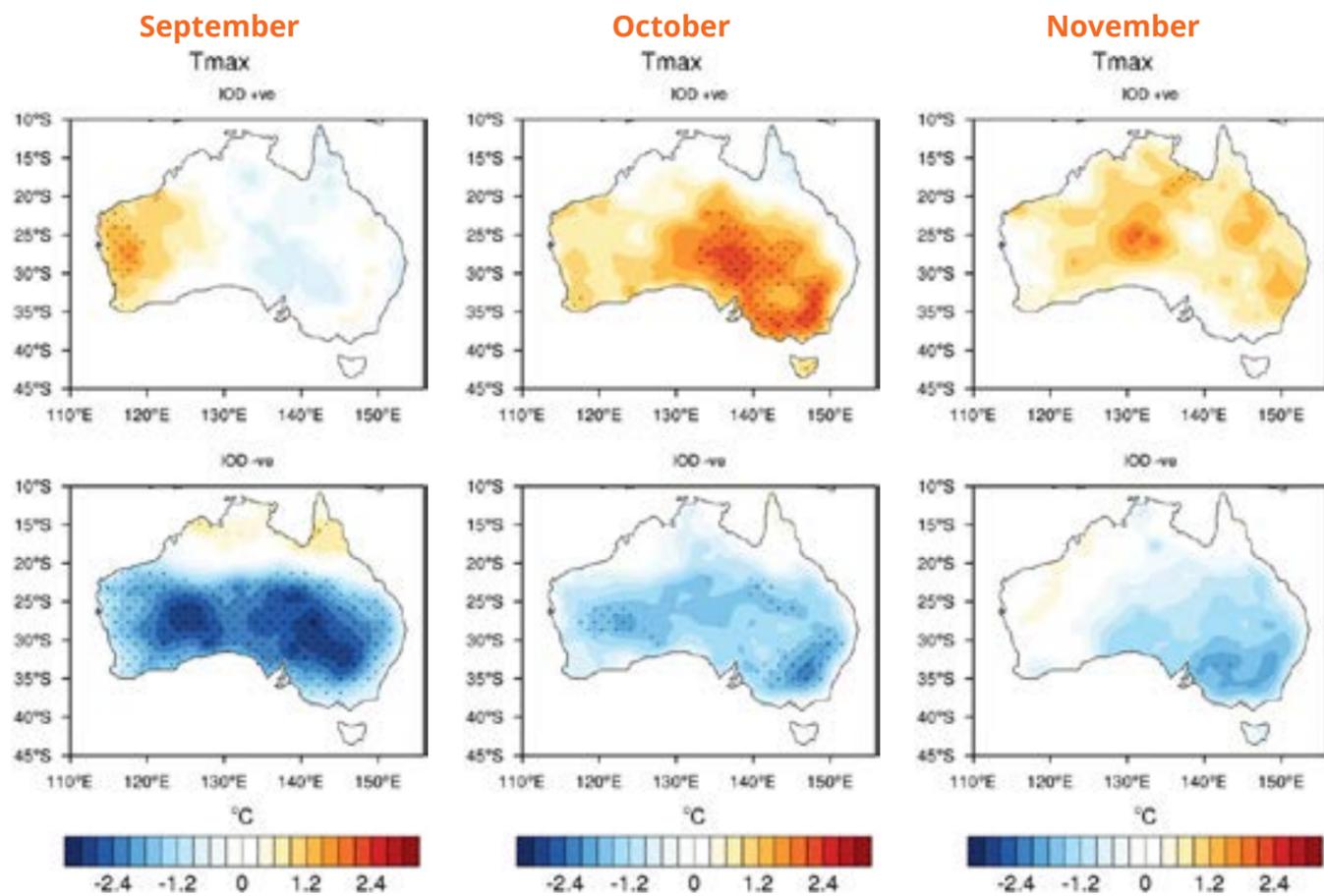
### Prediction lead time:

The IOD can be predicted about 2-3 months in advance. Forecasters start looking for signs of an IOD event around May/June. The forecast will be more accurate from July onwards.

**Note:** Because IOD is active during the dry season, it won't have much of an impact either way in regard to rainfall, but it can impact temperatures (refer to maps below – These maps show changes – warmer or cooler – to usual maximum temperature).

### Other:

Very strong IOD Positive events, like what was observed in 2019, can indirectly delay the start of the monsoon.



Deviation of Maximum Temperatures from the mean during September (left), October (middle), and November (right) for IOD Positive (top row) and IOD Negative (bottom row) phases.

### Where to find information:

BOM IOD information and forecast: <http://www.bom.gov.au/climate/enso/#tabs=Indian-Ocean>

## Other Climate Drivers

### El Niño – Southern Oscillation

- What:** ENSO has two active phases, El Niño and La Niña, and an inactive or neutral phase.
- When:** Any time between June (start) to April (end). Main impacts of ENSO are usually from December to March. Events can span multiple years, which is more common with La Niña events.
- Where:** Minimal impacts across region.
- How:** El Niño tends to cause warmer days and less rainfall, fewer cyclones, and there is likely to be a later start to the wet season. La Niña tends to cause wetter weather, increased humidity, and an increased risk of cyclones and flooding, with an earlier start to the wet likely. Day time temperatures are usually lower due to cloud cover.

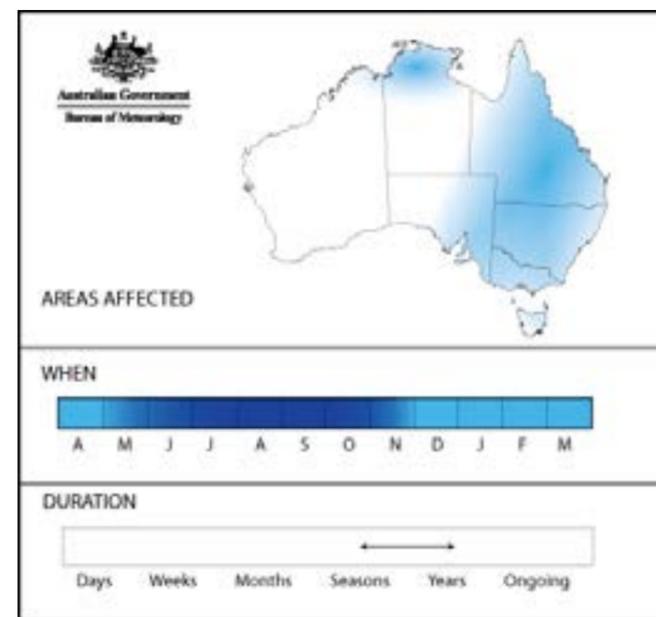
### Prediction lead time:

About 2-3 months for a more reliable forecast, up to 6 months in advance for an indication of a possible ENSO event. Start looking for a possible ENSO event in April/May, but become more confident in the forecast in June/July.

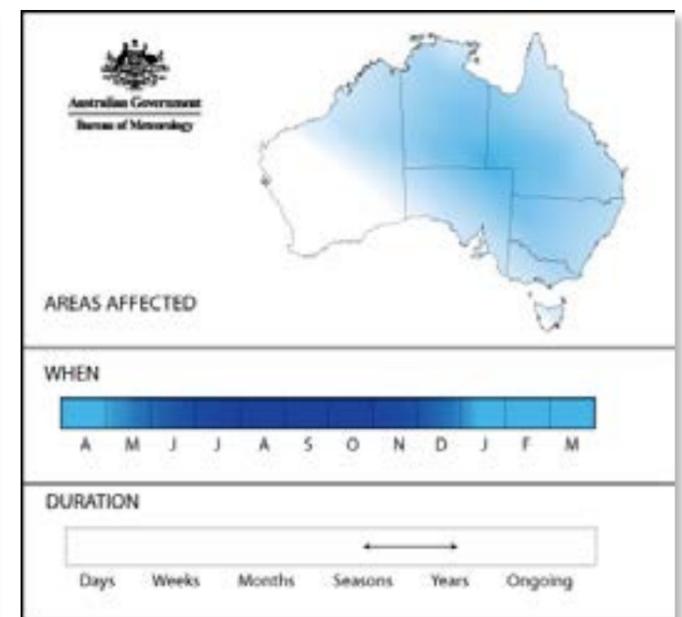
**Note:** There is a 'prediction gap' from about January to April when it is very difficult to know whether or not an ENSO event will develop in the coming winter. The Southern Oscillation Index, a measure of ENSO, can be a poor indicator from January to April due to the monsoon trough creating low pressure (unrelated to ENSO) over Darwin.

### Other Information:

During an El Niño Modoki, there is a warm pool of water in the central Pacific Ocean near the dateline (180°) and the equator (0°), which is different to a 'traditional' El Niño where the warm water is closer to South America (eastern Pacific). Recent research shows that Modoki events may have more dry/warm impacts on northern Australia, including the Kimberley and Pilbara, than a 'traditional' El Niño event and may occur more regularly in the future.



The diagram above shows the area affected by **El Niño**, when it occurs and how long it may last.



The diagram above shows the area affected by **La Niña**, when it occurs and how long it may last.

### Where to find information:

- BOM: <http://www.bom.gov.au/climate/enso/>  
 NOAA: <https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml>  
 ESRL: <https://www.esrl.noaa.gov/psd/enso/>  
 SOI: <https://www.longpaddock.qld.gov.au/soi/>

## Cyclones

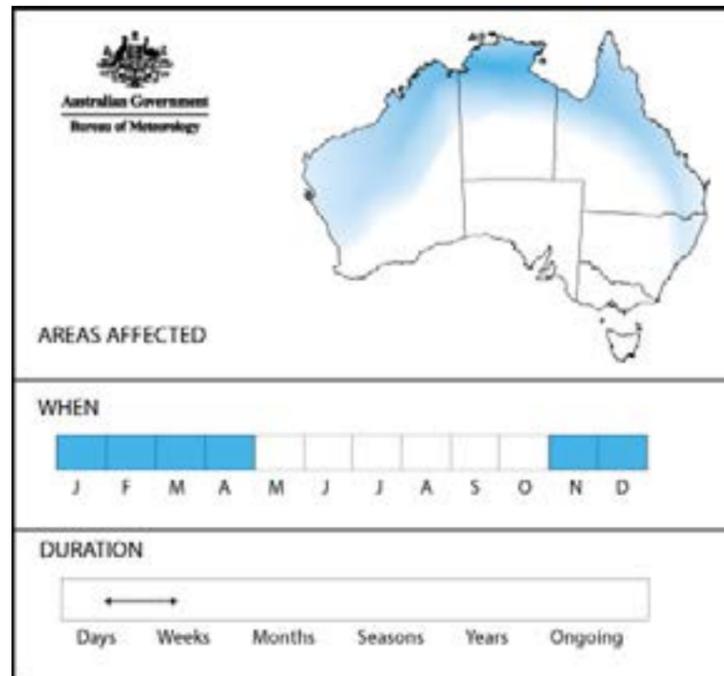
**When:** November/December to April/May

**Where:** All of the Kimberley and Pilbara

**How:** Useful rain which can lead to flooding or infrastructure damage.

**Prediction lead time:**

Minimal - General storm tracks can be predicted up to 7 days in advance, but actual path is hard to determine more than a day in advance.



The diagram above shows the area affected by tropical cyclones, when they occur and how long they may last.

**Where to find information:**

- BOM, Current Cyclones: <http://www.bom.gov.au/cyclone/index.shtml>
- BOM, General Info: <http://www.bom.gov.au/climate/about/?bookmark=tc>
- ECMWF: <https://www.ecmwf.int/en/forecasts/charts/latest-tropical-cyclones-forecast>
- Links to other cyclone websites: <https://www.cawcr.gov.au/research/cyclone-exchange/>

## Local Convection/Thunderstorms

**When:** Late Spring, Summer, Autumn

**Where:** All over northwest QLD, though impact can be very patchy, with one area getting rain and another area 1km away not getting rain.

**How:** The land heats up faster than surrounding air, causing warming of the air near the surface. Warm air always wants to rise and is considered to be an unstable airmass. As the air rises, any water vapor condenses and cools. If there is sufficient moisture and condensation nuclei (such as dust particles), it will rain.

**Prediction lead time:**

Minimal. Sometimes a few days (general prediction), but only a few hours for a more precise prediction.

**Other:**

Currently, convection is extremely hard to forecast in general circulation models due to the spatial resolution required, which limits forecasting ability/lead time.

**Where to find information:**

BOM MetEye: <http://www.bom.gov.au/australia/meteye/>



# On Property Decisions related to Climate

## DESTOCK EARLY – PENDING PREDICTED WET SEASON ONSET

*In a dry year, it is important to adjust stocking rates according to feed availability and to have a plan as to which you sell first.*

### Timing of decision:

August to October (second round muster); prior to wet season start.

### Climate drivers to watch for this decision:

ENSO (El Niño), IOD (Positive Phase), MJO

*El Niño Year and/or Strong Positive IOD* – Increased chance of a late start to summer rains and a drier than usual summer – hoping for rain is unlikely to be realistic. Feed is likely to be short due to a later start to pasture growth and reduced chance of rain and it may be opportunistic to reduce stock numbers early while cattle are still in OK condition.

*MJO* – An active ‘wet’ MJO phase in December can bring the first seasons’ rains. If there is no active wet phase in December, there is unlikely to be meaningful rain until January.

Even in El Niño/IOD Positive years, there can still be storms and cyclones that bring a ‘normal’ amount of rain during the wet season; however, the odds of this are reduced and they are likely to start later in the season.

### Information needed for decision:

ENSO and/or IOD forecast; Northern Rainfall Onset Forecast; reliable rainfall predictions.

### Information sources:

ENSO/IOD Forecast: <http://www.bom.gov.au/climate/enso/>  
Northern Rainfall: <http://www.bom.gov.au/climate/rainfall-onset/>  
Rainfall outlook: <http://www.bom.gov.au/climate/outlooks/#/rainfall/summary>

## CONTROLLED MATING – WHEN SHOULD PEAK CALVING OCCUR?

*Ideally, peak calving should occur around the break of season (Green Date), with peak lactation requirements occurring at the same time as you reach your pasture Production Date, which is about 2-6 weeks after the Green Date. Out-of-season calves are expensive to feed and often don’t grow as well as in-season calves leading to productivity losses. Also, there are animal welfare implications due to poor breeder condition and higher calf mortality rates.*

### Timing of decision:

November – January

### Climate drivers to watch for this decision:

IOD, ENSO

*El Niño* – While El Niño may not directly affect WA, it will affect NT and Qld cattle markets, which may affect prices for boat cattle and the number of stock turned off.

*Strong IOD Positive* – Increased risk of a dry and hot spring, with greater risk of temperature extremes, which can impact early calves. Also, a very strong event can delay the start of the wet season.

*La Niña and/or Negative IOD* – Increased chance of cooler spring conditions and better/earlier rainfall, so limited issues with out of season calves.

### Information needed for decision:

ENSO and/or IOD forecast; Northern Rainfall Onset Forecast; reliable rainfall predictions.

### Information sources:

ENSO/IOD Forecast: <http://www.bom.gov.au/climate/enso/>  
Northern Rainfall onset: <http://www.bom.gov.au/climate/rainfall-onset/>  
Rainfall outlook: <http://www.bom.gov.au/climate/outlooks/#/rainfall/summary>

## WHETHER TO CULL OR RETAIN BREEDERS

*The timing of the onset of the wet will determine if a breeder is in-season or out-of-season. Factors to consider when making the decision include current forage available (will it last till the break?), cashflow considerations, whether in a herd building, herd reduction or steady herd phase.*

### Timing of decision:

July/August

### Climate drivers to watch for this decision:

ENSO, IOD

*El Niño Year and/or Strong Positive IOD* – Increased risk of delayed start to the wet and a dry/hot spring. If cows are out-of-season with an El Niño/IOD positive event, decisions will need to be made whether to liquidate the animal and risk losing a fertile breeder and a proportion of future years sale animals or keep her knowing you will have to feed her and the calf (see out-of-season calf issues above).

*La Niña Year and/or Strong Negative IOD* – There may be more rain in WA, particularly in the south which may make marketing easier. If other regions are also having a good season and are re-stocking, what may be a liability in your herd could be a peak season calver elsewhere, leading to marketing opportunities.

### Information needed for decision:

ENSO/IOD forecast; Northern Rainfall Onset forecast

### Information sources:

Rainfall outlook: <http://www.bom.gov.au/climate/outlooks/#/rainfall/summary>  
Northern Rainfall onset: <http://www.bom.gov.au/climate/rainfall-onset/>

## STAFF MANAGEMENT

*Planning when to start staff allows for an effective recruitment process and gives more certainty to both employers and employees as to most probable start date and duration of employment.*

### Timing of decision:

September – February

### Climate drivers to watch for this decision:

IOD, ENSO, MJO

*El Niño Year and/or Strong Positive IOD* – A later start to the wet season is more likely and the overall season may be drier, including a reduced chance of cyclones. This may allow for a longer season for workers, for more jobs to be completed, and/or a later start for staff in the new work year.

*La Niña Year and/or Strong Negative IOD* – An early onset of the wet season is more likely and may mean an early finish to the mustering season and a re-evaluation of priorities. There is an increased chance of roads becoming impassable earlier in the wet season.

*MJO* – An active ‘wet’ phase bring on the first season rains and onset of cyclones, which can affect staff movements.

### Information needed for decision:

Reliable wet season onset forecast; duration of the wet season; heat wave forecasts.

### Information sources:

Northern Rainfall onset: <http://www.bom.gov.au/climate/rainfall-onset/>  
Rainfall outlook: <http://www.bom.gov.au/climate/outlooks/#/rainfall/summary>  
Temperature outlook: <http://www.bom.gov.au/climate/outlooks/#/temperature/summary>

## WHEN AND WHERE TO IMPLEMENT PRESCRIBED BURNS

*Looking at short term and longer-term weather and climate forecasts is key to effective burning. Fires to control woody thickening need to be hot fires late in the year, but when there is minimal wind and a good chance of follow-up rain. Fires to address patch grazing need to cool burns early in the wet season with good follow up rain. Wildfire mitigation burns need to be cool fires early in the dry season, before the south-easterlies kick in.*

### Climate drivers to watch for this decision:

IOD, ENSO, MJO

*El Niño Year and/or Strong Positive IOD* – Producers will likely get a hot burn, but follow-up rain may be more variable, resulting in the possibility of less pasture response. If it has been a dry wet season, wildfire mitigation may need to be undertaken with extra caution.

*La Niña Year and/or Strong Negative IOD* – Hot fires may need to occur earlier in the spring due to an increased likelihood of the rains start early. During one of these events could be a good time to control woody thickening, as there is an increased chance for follow-up rains.

*MJO* – An active wet MJO in the late spring/early summer may give an opportunity for cooler conditions to burn. The MJO forecast can also be useful when planning a mosaic/patch burn.

### Information needed for decision:

Reliable wet season onset forecast; duration of the wet season; heat wave forecasts; daily forecasts to plan optimum time for a fire.

### Information sources:

Rainfall outlook: <http://www.bom.gov.au/climate/outlooks/#/rainfall/summary>  
Northern Rainfall onset: <http://www.bom.gov.au/climate/rainfall-onset/>  
7-day Meteye forecast: [www.bom.gov.au/australia/meteye](http://www.bom.gov.au/australia/meteye)  
MJO Forecast: <https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml>

## IF AND WHEN TO START SUPPLEMENTATION PROGRAMS

### Climate drivers to watch for this decision:

ENSO

*El Niño Year and/or Strong Positive IOD* – There are likely to be drier conditions with an increased likelihood of a delayed start to the wet season and possibly an early finish. Producers should consider planning for additional dry season supplementation considering likely costs and issues such as urea poisoning when the season is late.

*La Niña Year and/or Strong Negative IOD* – Increased chance of wetter conditions, which can reduce access to/on properties. Producers should consider any likely access problems and moving supplements to areas not affected by access issues.

### Information needed for decision:

Reliable wet season onset forecast; duration of the wet season; probability of out of season rain events.

### Lead time required:

9 months

### Information sources:

Rainfall outlook: <http://www.bom.gov.au/climate/outlooks/#/rainfall/summary>  
Northern Rainfall onset: <http://www.bom.gov.au/climate/rainfall-onset/>

## IS DRY-LAND CULTIVATION A VIABLE OPTION TO DROUGHT-PROOF MY BUSINESS?

*Consistent rainfall is required to ensure a viable crop and the crop must be accessible at peak harvest time.*

### Climate drivers to watch for this decision:

IOD, ENSO, MJO

*El Niño Year and/or Strong Positive IOD* – Generally, there is a lower chance of success during these events. Consider not planting and saving on the cost of seed and time of labour required.

*La Niña Year and/or Strong Negative IOD* – Increased likelihood of a successful cropping season, though depending on time of year, access may become an issue if rains bog roads.

*MJO* – Watching the MJO may give an indication of when a rainfall event may occur to plant the crop and/or to cut for hay if it is a fodder crop.

### Information needed for decision:

Reliable wet season onset forecast; duration of the wet season; heat wave forecasts; historical climate records.

### Information sources:

Rainfall outlook: <http://www.bom.gov.au/climate/outlooks/#/rainfall/summary>  
7-day Meteye forecast: [www.bom.gov.au/australia/meteye](http://www.bom.gov.au/australia/meteye)  
MJO Forecast: [www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml](http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml)  
Soil Water balance: [www.bom.gov.au/water/landscape/](http://www.bom.gov.au/water/landscape/)

## DETERMINING A 'GREEN DATE' AND 'PRODUCTION DATE'

*The Green Date is the date after 1 September that you can expect to get 50mm of rainfall within 3 consecutive days in 7 out of 10 years (or 70% of the time). This is generally considered to be the amount of rain required to start pasture growth. Note that the Green Date will vary by soils (type and current moisture), land cover and type, and other climatic considerations (like high temperatures and high winds). A Production Date is when there is enough pasture growth to translate into kg gains and occurs about 2-6 weeks after the Green Date.*

### Timing of decision:

Has the Green Date changed? Is it coming later than in previous years? It is often a lot later than managers think! Looking at the Green Date will give an indication as to the best time to aim for returning stock to particular paddocks and when you want calves hitting the ground to ensure there is sufficient feed available to last the dry season.

### Climate drivers to watch for this decision:

Historical Climate Records; ENSO, IOD

*El Niño Year and/or Strong Positive IOD* – Green Date likely to be later than usual.

*La Niña Year and/or Strong Negative IOD* – Green Date likely to be earlier than usual.

Is there enough feed to carry cattle through to the Green Date or, even better, the Production Date? Are cows at peak lactation around the Production Date?

### Information needed for decision:

Data to determine when the Green Date is and if it has changed over time. There is concern around the change/late pasture response due to the later onset of rainfall occurring more often.

### Information sources:

CliMate App: <https://climateapp.net.au/>  
Climate data on-line: <http://www.bom.gov.au/climate/data/>  
Climate change: <https://www.climatechangeinaustralia.gov.au/en/>

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