

NSW ARBOVIRUS SURVEILLANCE & MOSQUITO MONITORING PROGRAM 2016-2017

Weekly Update

Date: 23/Jan/2017

SUMMARY

- **Climate:** over the last week, precipitation was limited to few regions and was light. For December, rainfall was average for most of the state with parts of the coast and northern inland being drier than normal, and parts of the west being wetter than average. Maximum and minimum temperatures for December were 2-3 degrees above average.
- **Three Month Forecast:** for January to March 2017, rainfall predictions for NSW are for below average precipitation, with a higher probability of eastern areas being drier than average. Maximum and minimum temperatures are predicted to be above normal and warmer in eastern areas. According to the BOM as of 17/Jan/17, the El Niño-Southern Oscillation remains neutral.
- **Tidal:** the recent high tides produced a series of tides over 2m and extension *Aedes vigilax* hatching is expected to occur, with adult numbers rising over the next two weeks. The next series of high tides that may result in larval hatching are occurring now over 27-31/Jan/2017.
- **MVEV models:** the data relevant to both the Forbes' and Nichols' hypotheses have been updated to the end of December 2016 and both theories remain inconsistent with past MVEV outbreaks.
- **Mosquito Numbers Inland:** mosquito collections were slightly lower this week. Griffith collections continue to be 'very high', while Leeton and Albury yielded 'high' mosquito numbers. Elsewhere, collections were mostly 'low'.
- **Mosquito Numbers Coast:** most locations produced 'low' mosquito numbers, although Ballina and Tweed produced 'high' collections.
- **Mosquito Numbers Sydney:** the sites where *Aedes vigilax* dominate notably the Georges River sites and Homebush, continue with the 'high' mosquito collections. At other locations, collections were 'low'.
- **Arboviral Isolates:** new isolates included 1RRV from Albury, 1RRV from Leeton, and 1RRV, 1BFV and 7SINV from Griffith.
- **Chicken Sentinel Seroconversions:** one chook seroconverted to KUNV at Macquarie Marshes from the bleed taken on 15/Jan/2017.
- **Human Notifications:** there were 77 Ross River virus notifications over 8-14/Jan/2017

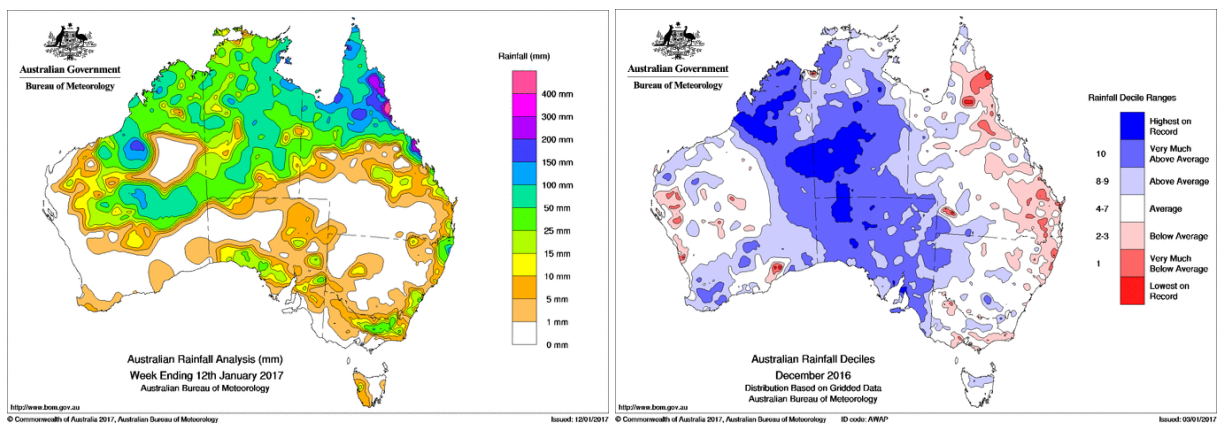
Comment: the big news for this week are the large number of Ross River notifications, the continuing arboviral detections from the mosquitoes, and the seroconversion to Kunjin in the sentinel flock at Macquarie Marshes.

It is now quite evidence that the Ross River virus outbreak is in full swing. The 77 notifications over the last week is greater than the long term average for the entire month of January (65)! For the calendar year of 2017, there have been 112 RRV notifications; in comparison for the same period over recent years there were 17 in 2016 and 38 in 2015. Plus the viral isolates continue. The one Kunjin virus seroconversion in central NSW has prompted increased media warnings to the local community. So far no human cases have been reported.

ENVIRONMENTAL CONDITIONS

Rainfall

Rainfall across Australia for the week ending 12/Jan/2017 is depicted on the left and monthly rainfall deciles for December 2016 are on the right. Over the last week, precipitation was limited to few regions and was light. Rainfall during December (right graph below) was average for most of the state with parts of the coast and northern inland being drier than normal, and parts of the west being wetter than average. Maximum and minimum temperatures for December were 2-3 degrees above average.



Three Month Rainfall & Temperature Forecast

For January to March 2017, rainfall predictions for NSW are for below average precipitation, with a higher probability of eastern areas being drier than average. Maximum and minimum temperatures are expected to be above normal across the state and warmer in eastern areas. The following pages contain graphics of the seasonal outlook:

www.bom.gov.au/climate/outlooks/#/rainfall/median (Rainfall outlook).

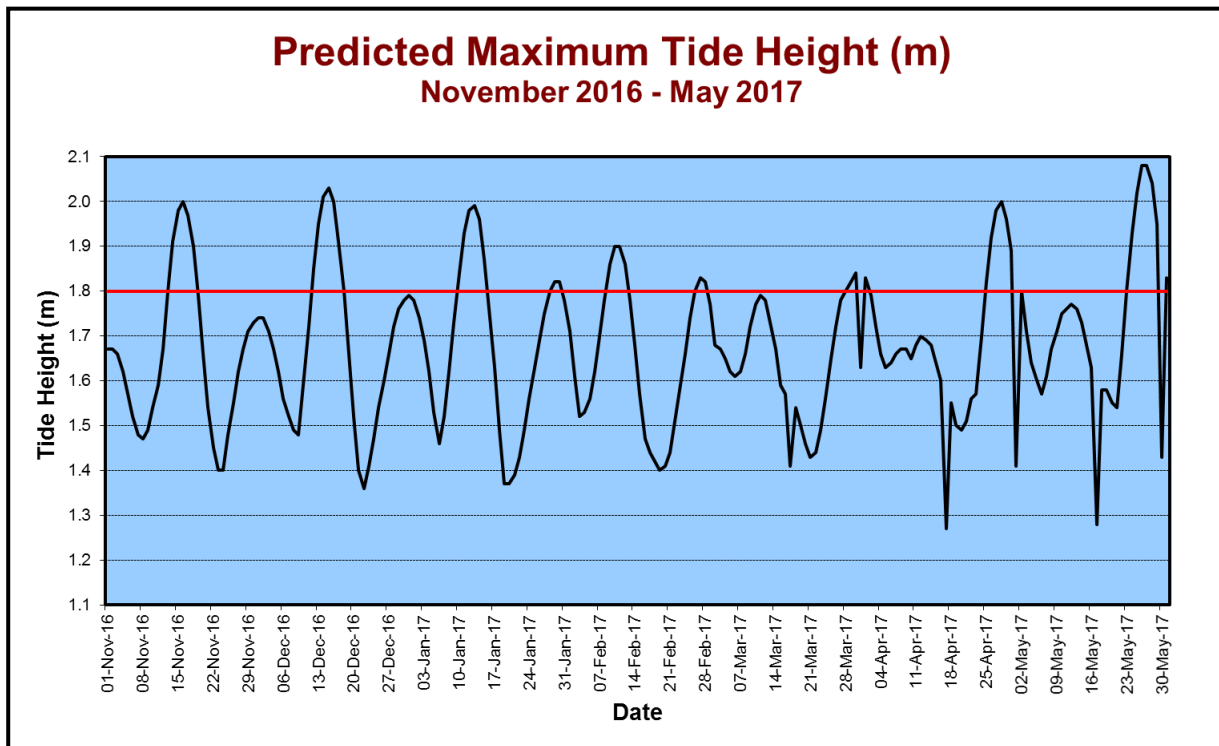
www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 17/Jan/17 the El Niño-Southern Oscillation remains neutral (a La Niña event is typically associated with wetter than average conditions and an El Niño with drier conditions).

For more information: www.bom.gov.au/climate/enso/ and, <http://www.bom.gov.au/climate/iod/>

Tidal

Tidal information is relevant for the prediction of the activity of the salt marsh mosquito, *Aedes vigilax*. Typically for NSW, tides of over 1.8m can induce hatching of *Aedes vigilax* larvae and the graph below of predicted tide heights can provide some indication of when this is likely to occur.



The recent series of high tides produced six consecutive days of tides of over 2m along the Parramatta River (C. Webb, pers. comm.) and adult *Aedes vigilax* numbers are expected to increase over the next two weeks. As a result, a mosquito treatment was undertaken at Homebush.

The next series of high tides that may lead to *Aedes vigilax* larval hatching are over due to occur over 27-31/Jan/2017, although these are not predicted to be overly high.

Note that actual tide heights can vary by 0.3m (or more in unusual circumstances) due to variations in atmospheric pressure, rainfall, wind and other climatic phenomena. Thus predicted tide height should be used as a gauge only for potential *Aedes vigilax* activity. The larvae of the saltmarsh mosquito relies on a inundation/drying cycle for the mudflats in which it lives; continual wet weather prevents the drying cycles thereby reducing larval production.

MVEV Climatic Models

Three predictive environmental based models for MVEV activity have been developed; the Forbes (which relies on rainfall in the river catchment basins of Eastern Australia), Nichols (based on the Southern Oscillation), and the Bennett theory (based on the Indian Ocean Dipole). The latter theory is poorly developed (and unreliable), and is not considered below. Note that all the predictive models have been developed on a limited data set and do not always forecast activity. There can also be unusual environmental conditions that may lead to the introduction of the virus to southeastern Australia, such as the movement of low pressure cells from the north to the south of the country during 2008 and 2011. Vertical transmission of the virus (from adult to the egg in *Aedes* species) can result in restricted activity following localised heavy precipitation (as per 2003 at Menindee).

i. Forbes' Hypothesis

Rainfall was not above Decile 7 in all of the river catchment basins in eastern Australia for the last quarter of 2015 or the majority of the catchments for the first quarter of 2016 (Table 1). For the Oct-Dec 2016 period, rainfall was not above Decile 7 in all of the catchment basins.

Table 1. Rainfall indices for the main catchment basins of eastern Australia as per Forbes' hypothesis, relevant to the 2016-2017 season. Note that a value of 1 equals Decile 7 rainfall.

Catchment Basin	Oct-Dec 2015	Jan-Mar 2016	Oct-Dec 2016	Jan-Mar 2017
Darling River	0.72	0.67	0.58	
Lachlan/Murrumbidgee/Murray Rivers	0.70	1.14	0.92	
Northern Rivers	1.35	0.57	0.98	
North Lake Eyre system	1.35	0.63	1.09	

ii. Nichol's Hypothesis

Table 2. The seasonal atmospheric pressures (in mm) according to Nichol's hypothesis, relevant to the 2016-2017 season.

	Autumn 2016	Winter 2016	Spring 2016
2015 Value	1010.30	1012.57	1010.07
Pre past MVEV seasons	<1009.74	<1012.99	<1009.99

Only the Winter period pertaining to the Nichol's hypothesis is in line with past MVEV active years.

ARBOVIRAL ISOLATES

LOCATION - Site	Date Trapped	Mosquito Species	Virus
ALBURY – Kremur St	16/Jan/17	*	Ross River
GRIFFITH – Hanwood	16/Jan/17	*	Barmah Forest
GRIFFITH – Hanwood	10/Jan/17	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Hanwood	10/Jan/17	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	10/Jan/17	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	10/Jan/17	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	10/Jan/17	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	10/Jan/17	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	10/Jan/17	<i>Culex annulirostrisw</i>	Sindbis
GRIFFITH – Lake Wyangan	10/Jan/17	<i>Culex annulirostris</i>	Sindbis
LEETON – Almond Rd	9/Jan/17	<i>Culex annulirostris</i>	Ross River
LEETON – Almond Rd	9/Jan/17	*	Ross River
LEETON – Farm 347	9/Jan/17	*	Sindbisw
GEORGES RIVER – Alford's Point	29/Dec/16	*	Ross River
ALBURY – Kremur St	19/Dec/16	*	Ross River
ALBURY – Kremur St	19/Dec/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	19/Dec/16	<i>Culex annulirostris</i>	Sindbis
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Sindbis
LEETON – Farm 347	13/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	12/Dec/16	*	Ross River
GRIFFITH – Barren Box	12/Dec/16	<i>Anopheles annulipes</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Barren Box	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	12/Dec/16	<i>Culex annulirostris</i>	Sindbis
GEORGES RIVER – Illawong	8/Dec/16	*	Ross River
LEETON – Farm 347	7/Dec/16	*	Ross River
LEETON – Farm 347	7/Dec/16	<i>Culex annulirostris</i>	Sindbis
MURRAY – Moama	6/Dec/16	*	Ross River

ALBURY – Kremur St	5/Dec/16	*	Ross River
ALBURY – Kremur St	5/Dec/16	<i>Culex annulirostris</i>	Ross River
ALBURY – Kremur St	5/Dec/16	<i>Aedes bancroftianus</i>	Ross River
FORBES – STP	5/Dec/16	*	Ross River
FORBES – STP	5/Dec/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	5/Dec/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	5/Dec/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	5/Dec/16	<i>Culex australicus</i>	Ross River
GRIFFITH – Barren Box	5/Dec/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	5/Dec/16	<i>Culex australicus</i>	Ross River
GRIFFITH – Lake Wyangan	5/Dec/16	<i>Culex australicus</i>	Ross River
GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	31/Nov/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Lake Wyangan	31/Nov/16	<i>Anopheles annulipes</i>	Ross River
GRIFFITH – Lake Wyangan	31/Nov/16	<i>Anopheles annulipes</i>	Ross River
GRIFFITH – Lake Wyangan	31/Nov/16	*	Ross River
FORBES – STP	29/Nov/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	29/Nov/16	<i>Culex australicus</i>	Ross River
FORBES – Toms Lagoon	29/Nov/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	29/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Anopheles annulipes</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	<i>Culex annulirostris</i>	Sindbis
GRIFFITH – Hanwood	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Hanwood	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Hanwood	21/Nov/16	<i>Culex annulirostris</i>	Ross River
GRIFFITH – Barren Box	21/Nov/16	*	Ross River
LEETON – Farm 347	16/Nov/16	<i>Culex annulirostris</i>	Ross River
LEETON – Farm 347	16/Nov/16	<i>Anopheles annulipes</i>	Ross River
LEETON – Farm 347	16/Nov/16	*	Ross River
FORBES – Toms Lagoon	15/Nov/16	<i>Culex annulirostris</i>	Ross River
FORBES – STP	15/Nov/16	<i>Culex annulirostris</i>	Barmah Forest
FORBES – STP	15/Nov/16	*	Barmah Forest
GRIFFITH – Lake Wyangan	14/Nov/16	<i>Aedes sagax</i>	Barmah Forest
GRIFFITH – Lake Wyangan	14/Nov/16	*	Barmah Forest
MURRAY – Moama	8/Nov/16	*	Ross River
MURRAY – Moama	8/Nov/16	<i>Aedes sagax</i>	Ross River
FORBES – Toms Lagoon	7/Nov/16	<i>Aedes sagax</i>	Sindbis
GRIFFITH – Lake Wyangan	1/Nov/16	<i>Aedes theobaldi</i>	Ross River
GRIFFITH – Lake Wyangan	1/Nov/16	<i>Anopheles annulipes</i>	Ross River

*Detection via Honey-Baited Cards, the mosquito species cannot be determined.

<http://medent.usyd.edu.au/arbovirus/results/virusisolates.htm>

The Victorian Arbovirus Surveillance Program has also had a further series of Ross River virus detections at sites along the Murray, including four from Mildura and one from Kerang. These were detected during mid-December (information courtesy Stacey Rowe, DHHS, Victoria).

Arboviral Isolates 2016-2017, Summary Table

LOCATION	Date Trapped	Virus			
		BFV	RRV	SINV	Total
ALBURY	16/Jan/17		1		1
ALBURY	19/Dec/16		2		2
ALBURY	5/Dec/16		3		3
FORBES	5/Dec/16		5		5
FORBES	29/Nov/16		3		3
FORBES	15/Nov/16	2	1		3
FORBES	7/Nov/16			1	1
GEORGES RIVER	29/Dec/16		1		1
GEORGES RIVER	8/Dec/16		1		1
GRIFFITH	16/Jan/17	1			1
GRIFFITH	10/Jan/17		1	7	8
GRIFFITH	19/Dec/16			9	9
GRIFFITH	12/Dec/16		3	7	10
GRIFFITH	5/Dec/16		2	1	3
GRIFFITH	31/Nov/16		4	3	7
GRIFFITH	21/Nov/16		7	1	8
GRIFFITH	14/Nov/16	2			2
GRIFFITH	1/Nov/16		2		2
LEETON	9/Jan/17		2	1	3
LEETON	13/Dec/16		2	2	4
LEETON	7/Dec/16		1	1	2
LEETON	29/Nov/16		1		1
LEETON	16/Nov/16		3		3
MURRAY	6/Dec/16		1		1
MURRAY	8/Nov/16		2		2
TOTAL		5	48	34	86

HUMAN NOTIFICATIONS

Weekly notifications of human mosquito-borne diseases infections are available from the NSW Ministry of Health, Communicable Disease Weekly Report and summarised in the Table below*: www.health.nsw.gov.au/Infectious/reports/Pages/CDWR.aspx

Notifications of Mosquito-Borne Disease in NSW, 2016-2017*

Week Ending	RRV	BFV	DENV [†]	Malaria [†]	CHIKV [†]	ZIKV [†]	Total
3-Jul-16	3	0	1	1	0	0	5
10-Jul-16	2	0	5	2	0	0	9
17-Jul-16	4	1	6	0	0	0	11
24-Jul-16	3	3	9	2	0	0	17
31-Jul-16	2	0	6	4	0	0	12
7-Aug-16	2	0	6	3	0	0	11
14-Aug-16	1	0	5	1	0	0	7
21-Aug-16	4	0	1	1	1	0	7
28-Aug-16	2	0	4	0	1	0	7
4-Sep-16	3	0	4	0	0	0	7
11-Sep-16	1	0	3	2	0	0	6
18-Sep-16	3	0	3	1	0	1	8
25-Sep-16	9	0	4	1	0	1	15
2-Oct-16	2	0	0	0	0	1	3
9-Oct-16	3	0	5	2	0	0	10
16-Oct-16	2	0	8	4	1	0	15
23-Oct-16	3	0	9	0	1	0	13
30-Oct-16	6	0	5	0	1	0	12
6-Nov-16	4	0	4	2	2	0	12
13-Nov-16	2	0	9	0	1	0	12
20-Nov-16	6	0	10	0	1	0	17
27-Nov-16	8	0	4	2	1	0	15
4-Dec-16	13	0	6	2	1	0	22
11-Dec-16	18	0	8	3	0	0	29
18-Dec-16	21	0	2	0	2	0	25
25-Dec-16	31	0	0	2	0	0	33
1-Jan-17	8	0	3	1	0	0	12
7-Jan-17	35	0	2	2	1	0	40
14-Jan-17	77	1	3	1	1	0	83
Total	201	5	135	39	15	3	475

[†]All of these viruses are acquired overseas, although some DENV cases may be from North Queensland. *The data in this table is updated once available from the NSW Ministry of Health.

Comment: the notifications of Ross River virus for 2016-2017 are continuing to rise and now only slightly below the long term average. During December there were 91 Ross River virus notifications being more than double the average. For January, the 32 notifications from the first week are equivalent to around half the average for the month. To date, most of the notifications are from central NSW. In contrast, Barmah Forest virus notifications have been few, being less than one tenth of the longer term average. However, the decline is probably artificial and due to the withdrawal of the commercial test that was over diagnosing patients.

It should also be noted that notifications are for NSW residents and that infection may have been acquired elsewhere.

For more data on Ross River virus notifications in NSW see:

<http://www0.health.nsw.gov.au/data/diseases/rossriver.asp>

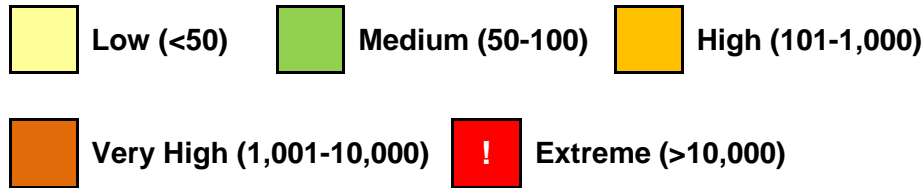
For more data on Barmah Forest virus notifications in NSW see:

<http://www0.health.nsw.gov.au/data/diseases/barmahforest.asp>

MOSQUITO RESULTS

All the full mosquito results can be obtained from:
<http://medent.usyd.edu.au/arbovirus/results/results.htm#site>

Mosquito abundances are best described in relative terms, and in keeping with the terminology from previous NSWASP Annual Reports, mosquito numbers are depicted on the tables below as:



Each location represents the average for all trapping sites at that location.

Inland

Location	Mosquito	Oct-16					Nov					Dec					Jan-17					Feb					Mar				
		2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26				
Albury	<i>Cx. annul</i>																														
	Total Mosq.																														
Bourke	<i>Cx. annul</i>																														
	Total Mosq.																														
Forbes	<i>Cx. annul</i>																														
	Total Mosq.																														
Griffith	<i>Cx. annul</i>																														
	Total Mosq.																														
Leeton	<i>Cx. annul</i>																														
	Total Mosq.																														
Mathoura	<i>Cx. annul</i>																														
	Total Mosq.																														
Menindee	<i>Cx. annul</i>																														
	Total Mosq.																														
Wagga	<i>Cx. annul</i>																														
	Total Mosq.																														

Coastal

Location	Mosquito	Nov				Dec				Jan-17				Feb				Mar				Apr					
		6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26	2	9	16	23	30
Ballina	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Coffs Harbour	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Gosford	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Lake Macquarie	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Port Macquarie	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Tweed	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Wyong	<i>Ae. vigilax</i>																										
	Total Mosq.																										

Sydney

Location	Mosquito	Nov				Dec				Jan-17				Feb				Mar				Apr					
		6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26	2	9	16	23	30
Banks-town	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Blacktown	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Georges River	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Hawkes-bury	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Hills Shire	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Penrith	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Sydney Olympic Park	<i>Ae. vigilax</i>																										
	Total Mosq.																										
Ryde	<i>Ae. vigilax</i>																										
	Total Mosq.																										

Sentinel Chicken Seroconversions

http://medent.usyd.edu.au/arbovirus/results/chicken_results_all_sites.htm

Location	Oct-16					Nov				Dec				Jan-17					Feb				Mar							
	2	9	16	23	30	8	13	20	27	4	11	18	22	1	8	15	22	29	5	12	19	26	5	12	19	26				
Bourke																														
Deniliquin						15N	15N	13N		13N	13N	13N	13N	12N	10N															
Forbes				15N	15N	15N	15N	15N	15N	15N	15N	15N		15N	15N															
Griffith			15N	15N	15N	15N	15N	15N	15N	15N	13N	14N		14N	14N															
Hay			15N	15N	15N	15N	15N	15N	15N		15N	15N	15N	15N	15N															
Leeton			15N	15N	15N	15N	15N	15N	15N		15N	14N	15N	15N		15N														
Macquarie Marshes								15N	15N		15N			15N	15N	¹ KUNV, 13N														
Menindee					15N	15N	15N	14N	14N	15N	13N	13N	13N	13N		13N														
Moama								15N	15N			15N																		
Moree										15N	15N	15N	12N	15N	15N															
Wee Waa							15N	13N	15N	15N	15N		15N	15N																

N= Negative for MVEV & KUNV

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