NATIONAL ARBOVIRUS MONITORING PROGRAM NAMP 2017–2018 REPORT

OBJECTIVES OF THE NATIONAL ARBOVIRUS MONITORING PROGRAM

The National Arbovirus Monitoring Program (NAMP) has three specific objectives:

1. **Market access** – to facilitate the export of live cattle, sheep, goats and camelids, and their reproductive material, to countries that apply import conditions to mitigate the risk of introduction of bluetongue, Akabane and bovine ephemeral fever (BEF) viruses.

2. **Bluetongue early warning** – to detect incursions of exotic strains of bluetongue virus (BTV) and vectors (*Culicoides* species biting midges) that have the potential to adversely affect livestock production in Australia and trade by surveillance of the northern BTV-endemic area.

3. **Risk management** – to detect changes in the seasonal distribution in Australia of endemic bluetongue, Akabane and BEF viruses and their vectors, to inform livestock producers and support trade.

The NAMP coordinators and program management would like to thank everyone who assisted in gathering the valuable monitoring data that underpin this report. This assistance is critical in maintaining and developing market access.

NAMP monitors the distribution of economically important arboviruses (insect-borne viruses) of livestock (cattle, sheep, goats and camelids), and associated insect vectors in Australia.

Arboviruses monitored by NAMP include bluetongue, Akabane and BEF viruses. BTV infection does not adversely affect production in Australian livestock, and disease has not been reported from areas of known viral transmission.

Australia's economy benefits from the export of ruminant livestock and their reproductive material (semen and embryos). This trade depends on a mutual confidence between Australia and its trading partners that risks to the animal health status of the importing country can be accurately assessed and properly managed. NAMP provides credible data on the nature and distribution of important, specific arbovirus infections in Australia for use by the Australian Government, its trading partners and livestock exporters. NAMP underpins Australian Government export certification that Australian ruminants are sourced from areas that are free from transmission of these specified arboviruses. In addition, NAMP data is used during market access negotiations.

NAMP is jointly funded by its primary beneficiaries: the cattle, sheep and goat industries; the livestock export industry; and the state, territory and Australian governments.

OPERATION OF NAMP

NAMP data are gathered throughout Australia by serological monitoring of cattle in sentinel herds, strategic serological surveys of other cattle herds (serosurveys), and trapping of insect vectors.

Blood samples from groups of young cattle that have not previously been exposed to arbovirus infection are tested at regular intervals for evidence of new infection with the bluetongue, Akabane and BEF viruses. The frequency of blood sampling relates to the probability of arbovirus transmission — that is, the greater the likelihood of viral transmission, the more frequent the sampling. Insect traps to detect

Culicoides species are positioned near the monitored herds during the period of testing or near herds where conditions are favorable for *Culicoides* species survival.

The number and locations of herds (Figure 1) are selected to enable the distribution of the specified arboviruses to be determined (e.g. sentinel sites located along the border between the area where infection is expected and not expected, and sentinel sites in areas where infection occurs sporadically), and the arbovirus-free area is monitored to verify freedom. Areas that are known to be endemically infected are sampled to detect any new strains of virus and to assess the seasonal intensity of infection with each arbovirus.

Beatrice Hill, in the far north of the Northern Territory, is a focus for exotic BTV surveillance, and virus isolation is routinely undertaken on blood samples collected at this location. Serotyping, virus isolation and molecular testing are applied strategically in other herds in New South Wales, the Northern Territory, Queensland and Western Australia after seroconversions are detected. NAMP surveillance data relating to early warning of bluetongue infection are supplemented by targeted surveillance activities conducted by the Northern Australia Quarantine Strategy of the Australian Government Department of Agriculture and Water Resources in remote coastal regions of northern Australia (Northern Territory, northern Queensland and Western Australia), including the Torres Strait Islands.

EPIDEMIOLOGY

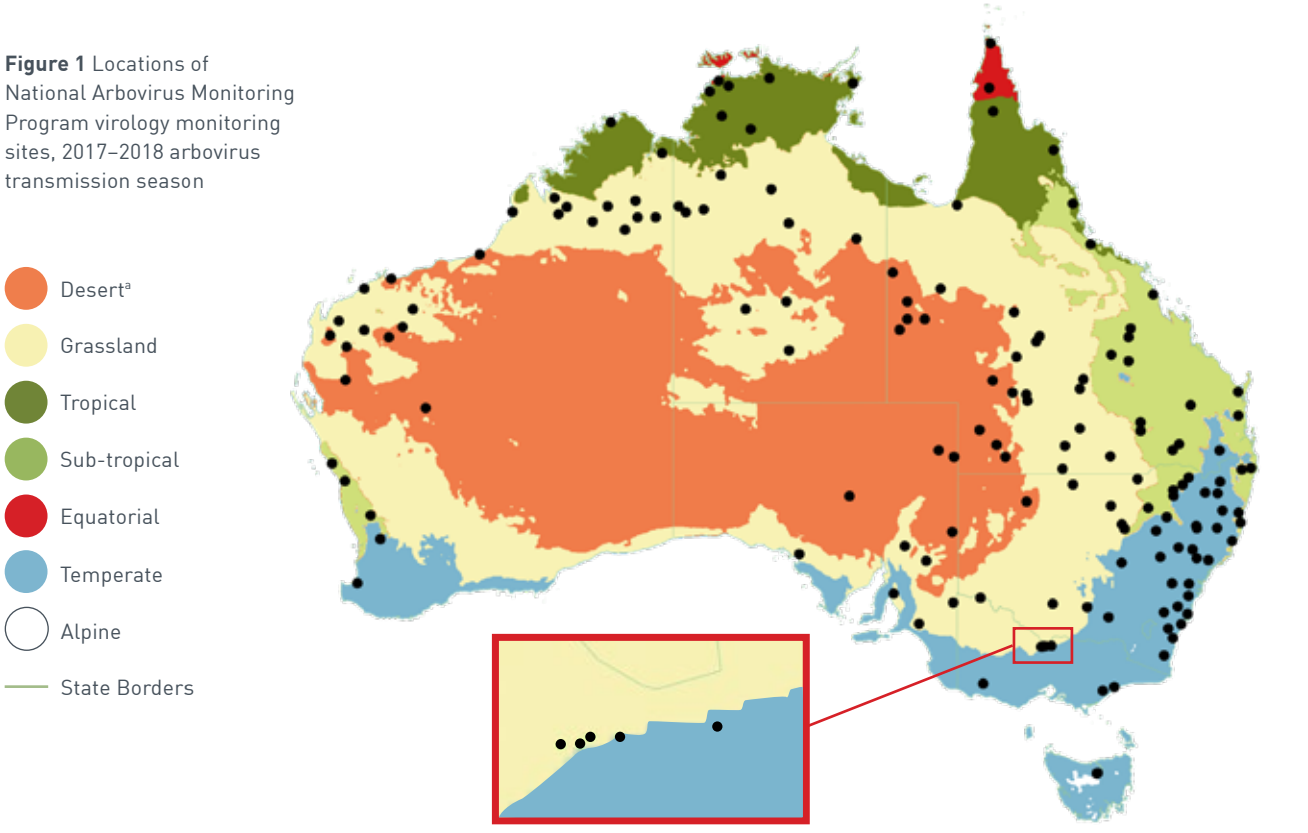
Bluetongue, Akabane and BEF viruses are non-contagious and are biologically transmitted by their insect vectors. Climatic factors (rainfall, temperature, and prevailing wind speed and direction) determine the distribution of potential vectors. The arboviruses are transmitted only if vectors are present in sufficient density.

Culicoides brevitarsis is the main vector of both BTV and Akabane virus. There is a close correlation between the southern limits of *C. brevitarsis* and the distribution of the two viruses, although the viruses are less widely distributed than their vectors. Other vectors of BTV in Australia that are less widely distributed than *C. brevitarsis* are *C. actoni*, *C. dumdumi*, *C. fulvus* and *C. wadai*.

The main vector of BEF virus in Australia is generally considered to be the mosquito *Culex annulirostris*. *Culex annulirostris* has different ecological thresholds from *C. brevitarsis*, particularly its tolerance to lower temperatures, which accounts for its wider distribution and its occurrence in regions not affected by BTV or Akabane virus, such as southern Australia.

Research in Australia since the mid-1970s has provided a detailed understanding of the epidemiology of Australian BTV strains and their *Culicoides* midge vectors. Vector species enter northern Australia

Figure 1 Locations of National Arbovirus Monitoring Program virology monitoring sites, 2017–2018 arbovirus transmission season



a Köppen climate classification
www.bom.gov.au/climate/averages/climatology/gridded-data-info/metadata/md_koppen_classification.shtml

infrequently and entry is associated with significant weather events. This is a feature of the epidemiology particularly of BTV and explains the infrequent detection of new serotypes in northern Australia.

Many regions in Australia have never recorded the presence of transmission-competent *Culicoides* vectors and are therefore free from viral transmission of arboviruses that can only be spread by these vector species (BTV and Akabane virus). Climatic conditions have a significant effect on vector distribution and account for changes that occur to the boundary between areas where viral transmission occurs and areas free of transmission.

MONITORING RESULTS FOR 2017–2018

This section summarises and explains the results of vector and virus monitoring and describes the limits of distribution of the bluetongue, Akabane and BEF viruses in the 2017–2018 arbovirus transmission season (September 2017 to August 2018).

The numbers of monitoring sites for sample collection in each state and territory are shown in Table 1.

Table 1 Number of NAMP virology monitoring sites, by state and territory, 2017–2018

Jurisdictions	Sentinel herds	Serosurveys	Insect traps
New South Wales	40	0	33
Northern Territory	9	9	11
Queensland	21	9	18
South Australia	4	2	3
Tasmania	1	0	1
Victoria	9	0	7
Western Australia	14	10	18
TOTAL	**98**	**30**	**91**

BLUETONGUE VIRUS DISTRIBUTION

The limits of BTV transmission in Australia are shown on the interactive Bluetongue Virus Zone Map[1] which defines areas in which no viral transmission[2] has been detected for the past two years.

BTV transmission is endemic in northern and northeastern Australia (New South Wales, Northern Territory, Queensland and Western Australia), and remains undetected in South Australia, Tasmania and Victoria (Figure 2). No new serotypes were detected in Australia from samples collected during 2017–2018; however, the first occurrence of BTV serotype 4 was identified from research on archived samples collected in the Northern Territory in 2006 and 2014. Testing of additional archived samples indicates that BTV serotype 4 has been present in Australia since 1995 and confirms the presence of 13 strains of BTV (serotypes 1, 2, 3, 4, 5, 7, 9, 12, 15, 16, 20, 21 and 23).

In the Northern Territory, the monsoon season rainfall was well above average in the northwest and parts of the Arnhem and Carpentaria districts, above average in the southwest, and average in other locations. Daytime and night-time temperatures were above average for much of the Northern Territory from October 2017 through to April 2018.

In the Northern Territory, *C. brevitarsis* was collected at all the northern sites, and *C. actoni*, *C. fulvus* and *C.wadai* at most northern sites.

BTV transmission in the Northern Territory was very active and serotypes 1, 2 and 16 were detected in samples collected between November 2017 and May 2018. The BTV transmission zone was expanded near the mid-eastern border following evidence of BTV transmission detected in the adjacent far mid-North West region of Queensland.

In northern Western Australia, rainfall was well above average from December 2017 to February 2018, with the passage of a significant tropical low and four tropical cyclones (Hilda, Joyce, Kelvin and Marcus). As a result, many Kimberley water catchments flooded for much of January and February and some Pilbara catchments flooded in January. Musters were typically delayed in the Kimberley and some of the Pilbara. The southwest of Western Australia experienced a normal climate — a hot, dry summer and cool winter with average rainfall.

No exotic species of *Culicoides* were found at trapping sites in Western Australia. Three sites along the coastal region stretching from the Kimberley to the Pilbara collected only a single *C. brevitarsis* insect (in mid-to-late January, coinciding with the passage of Cyclone Joyce as it moved down the coast from the northern point of Western Australia).

BTV transmission was detected in the north and southeastern Kimberley region of Western Australia but not in the western Kimberley. The BTV serotypes detected this season were BTV-1, BTV-16 and BTV-21.

In Queensland, during spring 2017, the north and east of the state experienced above-average rainfall and the southeast received record high rainfall. The daytime temperature in eastern Queensland was average, and

1 namp.animalhealthaustralia.com.au
2 Viral transmission is defined as detection of evidence of viral infection based on serological monitoring of cattle.

above average for most of western Queensland. During summer, Queensland experienced the lowest rainfall since 1889–1890. Concurrently, most of the state experienced above-average temperatures, with some western areas having their warmest summer on record. Autumn 2018 was the wettest for Queensland since 2012 but the rain fell mostly in northern and interior areas, leaving central and southern areas with below-average rainfall. At the end of the arbovirus transmission season, drought covered about 60% of Queensland.

In Queensland, *Culicoides* vector species were detected at predominantly coastal sites in the state's north and southeast. *C. brevitarsis* was the most prevalent and abundant vector species. *C. wadai* was collected at several sites and *C. fulvus* was detected at a single site. Other vector species, *C. actoni* and *C. dumdumi*, were not detected during this season.

BTV transmission in Queensland occurred in the northern, central and southern regions, and at only one site in the central region. Serotypes detected in Queensland include BTV-1, BTV-2, BTV-16 and BTV-21 — all previously known to occur in Queensland.

During the transmission season in Queensland, the BTV transmission zone was expanded after evidence of BTV infection was detected twice at NAMP sites in the far mid-North West region and once in the central-southern Darling Downs region.

In New South Wales, rainfall for the season was below to well-below average and by the end of the period almost all of the state was in drought.

C. brevitarsis was detected extensively along the east coast of New South Wales, in high numbers in the northeast and generally low numbers elsewhere. *C. wadai* was detected south to Kempsey.

In New South Wales, BTV transmission was limited to the far northeast coast at Lismore and Casino, the mid-north coast at Taree and on the northwest slopes of the Great Dividing Range at Coolatai. In contrast to the 2016–2017 season, only two serotypes of BTV were detected (BTV-1 and BTV-21). BTV-16, which occurred for the first time in New South Wales in 2016–2017 was not detected in 2017–2018.

In Victoria, spring rainfall was below average in the east and average to above average in the west. Both daytime and night-time temperatures were much warmer than average and Victoria recorded its fourth-warmest spring. Summer daytime and night-time temperatures were well above average across much of the state. Nights were especially warm, with Victoria having its third-warmest summer on record for minimum temperatures. After the record wet start (some areas had their highest recorded rainfall in early December) the season ended with drier than average conditions in February. Overall, rainfall was around 6% above the mean when averaged over the state as a whole. Victoria had a very warm autumn, with the state's mean temperature the fourth-warmest on record. Rainfall totals for autumn were below average across most of Victoria, with large areas of very much below average rainfall in the north and east of the state.

No competent vector species were detected in South Australia, Tasmania or Victoria, consistent with the serological evidence of virus absence.

Enhanced BTV surveillance in Victoria in late 2017

The detection of BTV antibodies in three, purportedly homebred, 12 month-old dairy heifers during pre-export testing in October 2017 resulted in the establishment of a temporary BTV transmission zone in northern Victoria. This action was taken as a precautionary measure while investigations and surveillance activities, involving sampling and laboratory testing of samples from approximately 2,500 dairy and beef cattle in the area of concern, were undertaken.

Some Victorian cattle (one animal on each of three individual properties, including the index property) returned positive tests for virus antibodies which may indicate previous exposure to BTV strains. These strains (BTV-1 and BTV-21) are recognised as being present in other parts of Australia. However, there was no evidence of vector-initiated viral transmission in the area.

Further investigation confirmed that the animals that initiated the investigation originated in the recognised bluetongue transmission zone in New South Wales, where it is likely they were exposed to the virus and developed BTV antibodies.

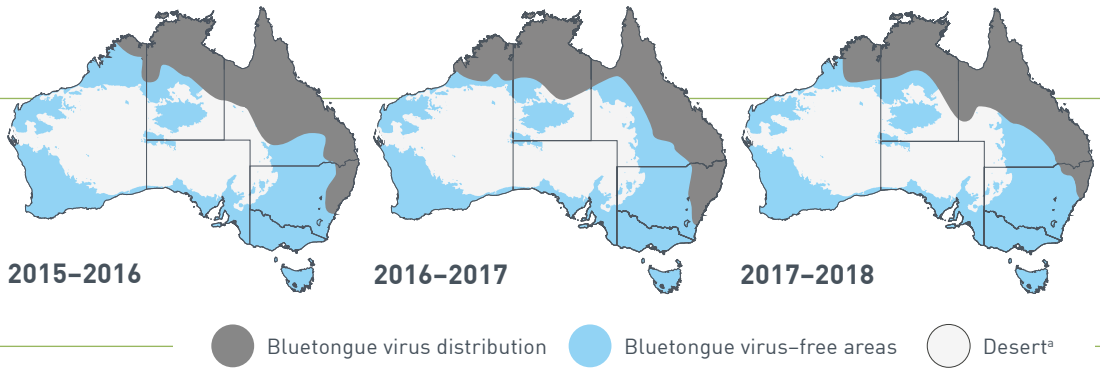


Figure 2 Distribution of bluetongue virus in Australia, 2015–2016 to 2017–2018

a Köppen climate classification

The likelihood of BTV transmission in Victoria is considered remote, and as a result the zone was lifted on 6 December 2018.

As part of Australia's commitment to providing strong assurances to trading partners, following the decision to remove the zone, four additional sentinel herds and trapping sites were established for the 2017–2018 season.

Fifteen animals from each new sentinel herd were recruited and were sampled once in each month of the arbovirus season in southern Australia (i.e. between January and June 2018). Fifty-six sentinel animals were available for the final bleed in June. Over the course of the season 390 samples were tested and none of the animals seroconverted at any sampling. Vector traps were set at appropriate sites and were also sampled monthly between January and June 2018. More than 43,000 insects were collected and examined. No recognised insect vectors of bluetongue viruses were identified.

AKABANE VIRUS DISTRIBUTION

The distribution of Akabane virus (Figure 3) varies within the limits of its vector, *C. brevitarsis*, occurring endemically in northern Australia and showing a distinct seasonal spread in New South Wales and southern parts of Queensland.

In Western Australia, Akabane virus was detected at all the Kimberley NAMP sites, consistent with the previous season. However, there was no evidence of Akabane virus transmission in the Pilbara or southwest of Western Australia.

In the Northern Territory, no Akabane virus testing was performed in the northern endemic herds. Activity was detected at Alice Springs, in contrast to the previous season.

In Queensland, records of seroconversion at sentinel sites and of seropositive animals at survey sites indicated that Akabane virus infection had been broadly distributed across all regions. Generally, only first and last samples were tested at sentinel sites. Disease due to Akabane virus infection was not reported with general surveillance disease investigations conducted by Biosecurity Queensland.

In New South Wales, Akabane virus transmission was more extensive than BTV, being detected in the Hunter Valley and in the Far South Coast regions (which are not considered endemic for this virus). Its distribution was mostly consistent with this season's distribution of the vector *C. brevitarsis*.

Akabane virus remains undetected in South Australia, Tasmania and Victoria.

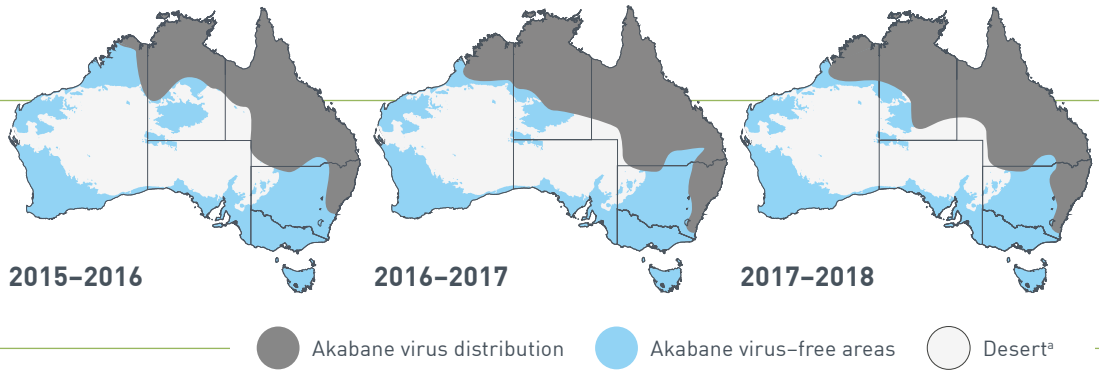


Figure 3 Distribution of Akabane virus in Australia, 2015–2016 to 2017–2018

a Köppen climate classification

BOVINE EPHEMERAL FEVER VIRUS DISTRIBUTION

BEF virus is endemic in northern Australia, where fever can occur in both the dry and wet seasons (spring, summer or autumn). In New South Wales and parts of southern Queensland, occurrence of the virus is limited by the effect of cold winters, restricting the distribution of its mosquito vector (Figure 4).

In Western Australia during the transmission season, BEF virus distribution was limited to the Kimberley region. Clinical disease in cattle was observed in the southern Kimberley region.

In the Northern Territory, BEF virus distribution was moderate, with detection in all the northern NAMP herds and in most months.

Sampling from NAMP sentinel and survey herds in Queensland indicated that the BEF virus was widely distributed across the state, extending to the southeast and far southwest. This finding was supported by disease investigation general surveillance data collected by Biosecurity Queensland.

In New South Wales, BEF virus activity was again not detected in any of the monitored NAMP herds (inland New South Wales and south coast regions). Clinical cases of BEF in New South Wales were detected from the far north coast to the south coast (near Nowra), in the Northern Tablelands regions, and the Hunter Valley extending to Rylstone on the Central Tablelands. Cases occurred from mid-summer to early autumn.

BEF virus and BEF clinical diseases were not detected in South Australia, Tasmania or Victoria.

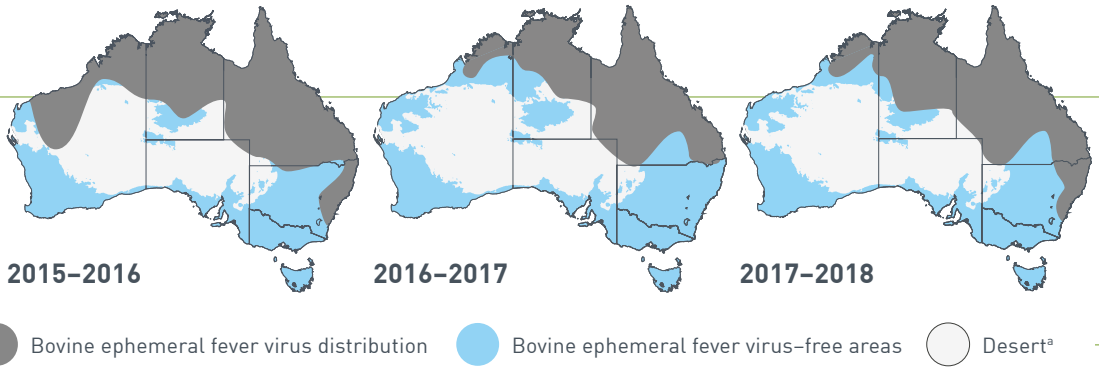


Figure 4 Distribution of bovine ephemeral fever virus in Australia, 2015–2016 to 2017–2018

a Köppen climate classification

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