NATIONAL ARBOVIRUS MONITORING PROGRAM NAMP 2019–2020 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 Australian livestock production 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.

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. Clinical disease has never been reported in cattle and has only rarely been observed in sheep.

Australia's economy benefits from the export of ruminant livestock and their reproductive material (semen and embryos). This trade depends on mutual confidence between Australia and its trading partners that any 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.

Animal Health Australia and all NAMP coordinators and partners would like to warmly farewell Dr Adrian Nicholas from the program this year. Dr Nicholas is Senior Research Entomologist with the NSW Department of Primary Industries and has served as a NAMP Coordinator and an entomology expert to the program for 12 years! We thank you for your enormous service to the program, Adrian, and wish you well in your future.

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.

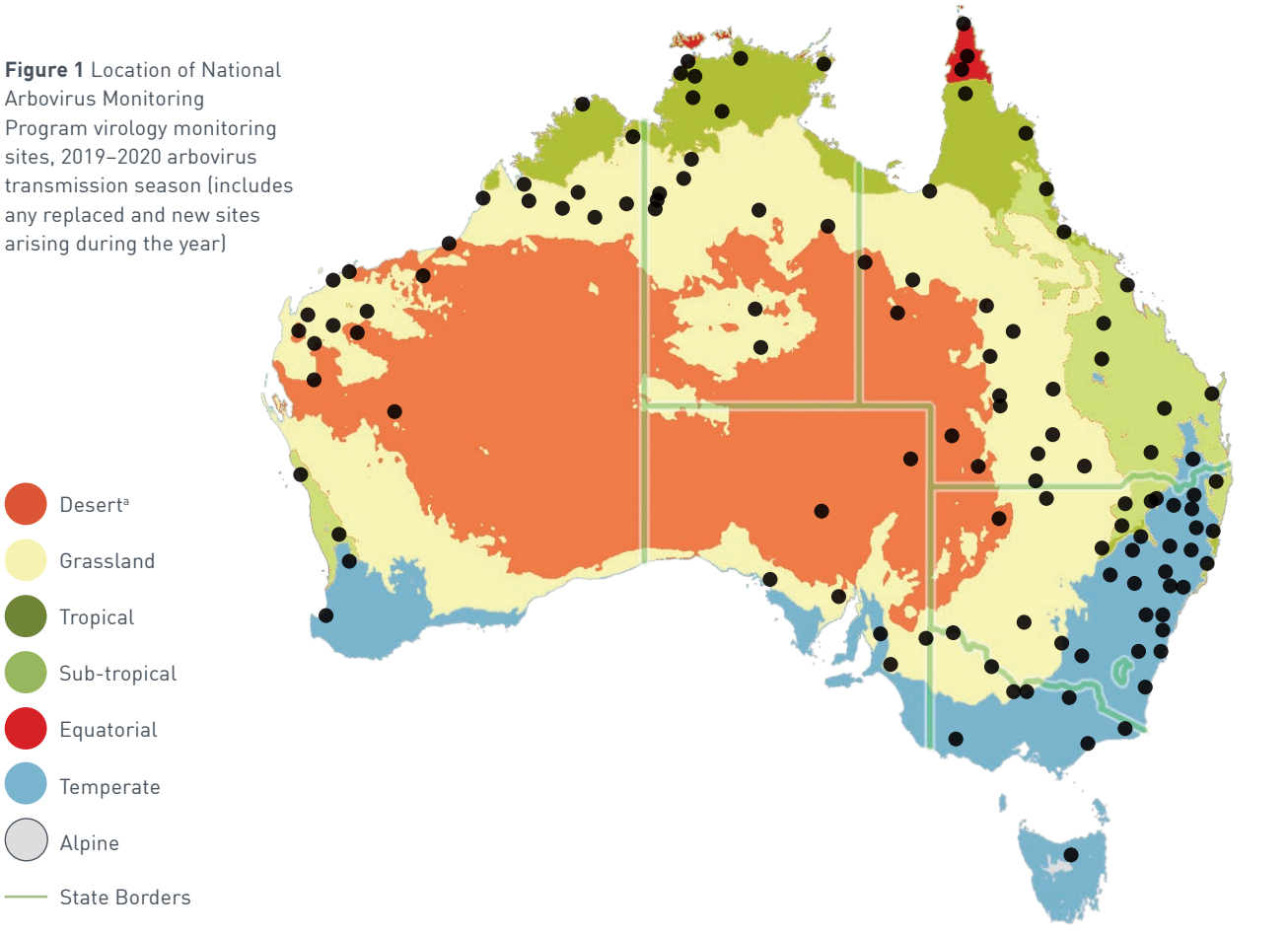
Blood samples from groups of young cattle that have not previously been exposed to arbovirus infection are tested at regular intervals for evidence of new infection with bluetongue, Akabane and BEF viruses. The frequency of blood sampling relates to the probability of arbovirus transmission – that is, 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 favourable for *Culicoides* species survival.

The number and locations of monitoring sites (Figure 1) are selected to enable the distribution of the specified arboviruses to be determined (e.g. sites located along the border between areas where infection is expected and not expected, and sites in areas where infection occurs sporadically), and the arbovirus-free area is monitored to verify freedom from infection.

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. 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, Water and the Environment in remote coastal regions of northern Australia (Northern Territory, northern Queensland and Western Australia).

Figure 1 Location of National Arbovirus Monitoring Program virology monitoring sites, 2019–2020 arbovirus transmission season (includes any replaced and new sites arising during the year)



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

EPIDEMIOLOGY

Bluetongue, Akabane and BEF viruses are non-contagious and are biologically transmitted by their insect vectors. Various 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 numbers.

The biting midge *Culicoides brevitarsis* is the main vector for 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 for BEF virus in Australia is generally considered to be the mosquito *Culex annulirostris*. *Culex annulirostris* has different ecological thresholds from *Culicoides brevitarsis*, particularly in 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* biting midge vectors. Vector species enter northern Australia infrequently, and entry is associated with significant weather events. This is a feature of the epidemiology of BTV in particular, and it 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 variations in the boundary between the areas where viral transmission occurs and areas free of transmission.

MONITORING RESULTS FOR 2019–2020

This section summarises and explains the results of vector and virus monitoring and describes the limits of distribution of bluetongue, Akabane and BEF viruses in the 2019–2020 arbovirus transmission season (September 2019 to August 2020). The numbers of monitoring sites for sample collection in each state and territory are shown in Table 1.

Table 1 Number of NAMP monitoring sites, by state and territory, 2019–2020

Jurisdictions	Sentinel herds	Serosurveys	Insect traps
New South Wales	35	2	33
Northern Territory	8	7	18
Queensland	20	10	19
South Australia	5	0	3
Tasmania	1	0	1
Victoria	8	0	6
Western Australia	15	11	17
TOTAL	**92**	**30**	**97**

BLUETONGUE VIRUS DISTRIBUTION

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 2019–2020; types detected during the period were BTV-1, BTV-4, BTV-7, BTV-15, BTV-16 and BTV-21.

In the Northern Territory, the monsoon season rainfall was again well below average except in the east. Territory-wide, the rainfall total was 20% below the long-term wet season average. Daytime and night-time temperatures were the second warmest on record for much of the Northern Territory from October 2019 through to April 2020.

In the Northern Territory, *C. brevitarsis* was collected at all northern sites, and *C. actoni*, *C. fulvus* and *C. wadai* at most northern sites. *Culicoides nudipalpis* was detected at several far northern insect collections from November 2019. These are the only detections of *C. nudipalpis* in Australia since a single specimen was collected at Kalumburu, Western Australia in 2012. Continued monitoring will determine if these detections are novel introductions or part of an established population. *C. nudipalpis* is reported to occur in Indonesia, Timor-Leste, New Guinea and the Philippines. *C. nudipalpis* is closely related to *Culicoides imicola* – the main vector of BTV in Africa, Europe and Asia – however, it is not a proven vector of BTV.

BTV transmission in the Northern Territory was relatively inactive, and serotypes BTV-1 and BTV-16 were detected in samples collected between July and October 2019. BTV-7 was detected in January 2020.

In Western Australia, the climate was warmer and drier than average, particularly in the Pilbara, resulting in a reduced number of cattle stocked and supporting survival of *Culicoides* through the winter. Four cyclones crossed the Western Australian coast during summer and autumn, bringing weather from the Kimberley into the Pilbara. Rain resulting from the cyclones provided a reasonable wet season for the Kimberley and east Pilbara region but did not lessen the dry season experienced in the west Pilbara and Gascoyne regions. Limited rainfall and wind conditions experienced this year are not expected to increase dispersal of vectors.

No exotic species of *Culicoides* were found at trapping sites in Western Australia. *C. brevitarsis* was detected at several sites in the Kimberley and at only one site south of the Kimberley (in the BTV transmission-free zone). *C. actoni* was detected in Kununurra in January and at Kalumburu in May.

BTV transmission was detected in the Kimberley region of Western Australia (within the BTV transmission zone). Serotypes detected were BTV-4, BTV-16 and BTV-21.

In Queensland, spring 2019 was the fourth driest on record (state average) and summer was warmer than average. Rainfall was high in summer in the Gulf Country, the central and southern interior and the southeast coast of Queensland. Mean maximum and mean minimum temperatures were above average across the state.

Autumn 2020 brought heavy rain to western Queensland in March because of ex-tropical cyclone Esther; this resulted in flooding in the Georgina, Diamantina, Bulloo, Paroo and Warrego rivers and the Cooper Creek catchment. Heavy rainfall in February over the Balonne and Maranoa rivers also resulted in flooding in early March. A below-average mean temperature was recorded for the state as a whole.

During the winter months of June, July and August 2020, the mean temperature was above average across Queensland. In June, rainfall was mostly confined to the eastern half of the state. In July, apart from a drier corridor from the northwest through the central interior and the southeast districts, most parts of the state had above-average rainfall. In August, average rainfall was recorded in the eastern half of the state, but the western and northern regions had above-average rainfall.

In Queensland, *Culicoides* vector species were found further inland than the previous year. *C. brevitarsis* was the most prevalent and abundant vector species, absent from only a couple of inland sites. *C. actoni* and *C. fulvus* were only detected in the north of the state, and, similar to the previous year, *C. wadai* was detected along the coast. The other vector species previously reported, *C. dumdumi*, was not detected during this season.

BTV transmission in Queensland occurred in all regions except the central and southwestern regions. Serotypes detected in Queensland include BTV-1, BTV-4, BTV-15 and BTV-16 – all previously known to occur in Queensland. BTV-2 was not detected in Queensland this season.

For the period July to December 2019 in New South Wales, drought was ongoing across the state with lowest-on-record rainfall across the northern tablelands, northwest slopes and southern tablelands, coinciding with maximum temperatures that were very much above average across the state from July 2019 to February 2020. Catastrophic bushfires occurred on the Great Dividing Range and coastal plain from the Queensland to Victorian borders from September 2019 through to January 2020. Conditions improved from mid-late January as rainfall was recorded across the northern and central tablelands and coastal plain. From January to June 2020, rainfall was above average across the eastern two-thirds of the state with significant rainfall (and flooding) recorded in February along the coastal plain, northern tablelands and northwest slopes.

C. brevitarsis, the principal vector of BTV in New South Wales, was again detected extensively along the east coast – from Moruya in the south to Casino in the north and further inland from there than in previous years. *C. wadai* was detected in the south, at Kempsey. BTV transmission was detected between February and July 2020 and extended along the coastal plain as far south as Milton on the south coast, and west to Moree and the

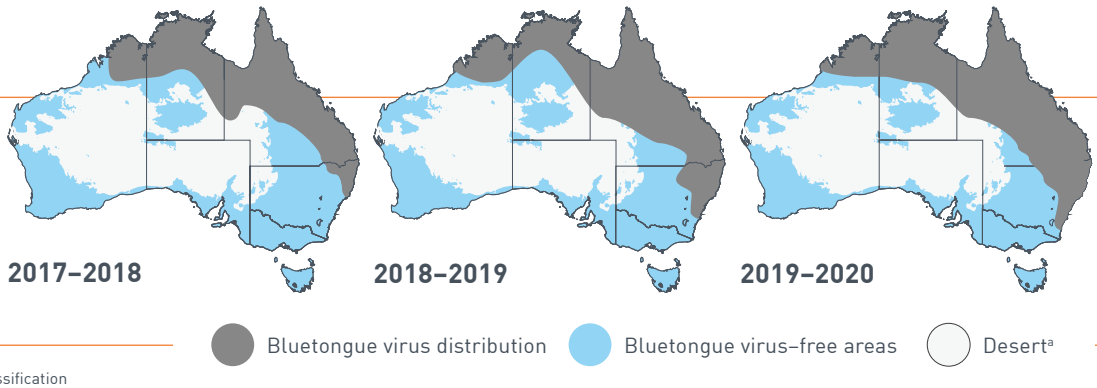


Figure 2 Distribution of bluetongue virus in Australia, 2017–2018 to 2019–2020

a Köppen climate classification

northern tablelands. BTV-1 was detected at all sites, and BTV-16 at Lismore and Paterson. Other serotypes were not detected.

Victoria again experienced a dry spring and above-average temperatures during summer. Autumn and winter were wetter and cooler than average for much of the state, breaking a run of six consecutive seasons of drier and warmer-than-average conditions.

No competent vector species were detected in South Australia, Tasmania or Victoria, consistent with the serological evidence of virus absence. Enhanced BTV surveillance and vector trapping in northern Victoria, initiated in 2017–2018, continued during the period. There was no evidence of vector-initiated viral transmission in the area.

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 most of the Kimberley NAMP sites – consistent with the previous season. In the Northern Territory, no Akabane virus testing was performed in the northern endemic area herds. In contrast to the previous season, Akabane virus was not detected at Alice Springs.

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. Disease due to Akabane virus infection was not reported during general surveillance disease investigations conducted by Biosecurity Queensland.

In New South Wales, Akabane virus transmission was similar to that of BTV, again being detected from the far north coast to Milton on the south coast, west onto the northern tablelands, and in the Hunter Valley.

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

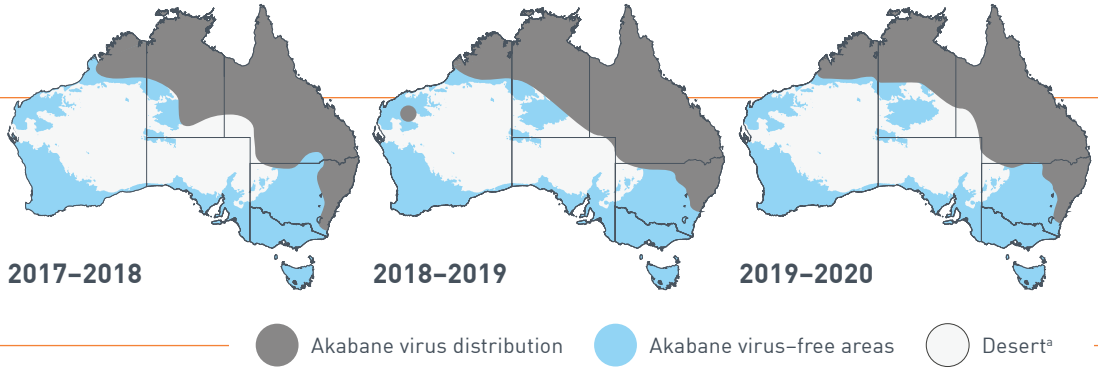


Figure 3 Distribution of Akabane virus in Australia, 2017–2018 to 2019–2020

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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 effects of cold winters, restricting the distribution of its mosquito vector (Figure 4).

In Western Australia, there was only one detection in sentinel herd monitoring and no observations of clinical disease in cattle this season. In the Northern Territory, BEF virus distribution was again very limited, with detections only at northerly NAMP sites. Sampling from NAMP sentinel and survey herds in Queensland indicated that BEF virus was widely distributed across the state, extending to the southeast and far southwest. This distribution finding was supported by disease investigation general surveillance data collected by Biosecurity Queensland. During the period, BEF was diagnosed on 44 occasions: 31 from shires in the southeast of the state, and the remaining 13 from widely distributed shires.

In New South Wales, BEF virus monitoring is undertaken at NAMP sites on the south coast and inland region. Significant rainfall during February 2020 was sufficient to support BEF virus transmission in coastal and inland New South Wales with detections in sentinel herds in the northwest slopes and at southern coastal regions. Clinical cases of BEF in New South Wales were detected during late summer through to autumn from the north coast to Milton in the south, the Hunter Valley, the northern tablelands, the northwest slopes region west to Bourke and inland south to the northern Riverina.

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

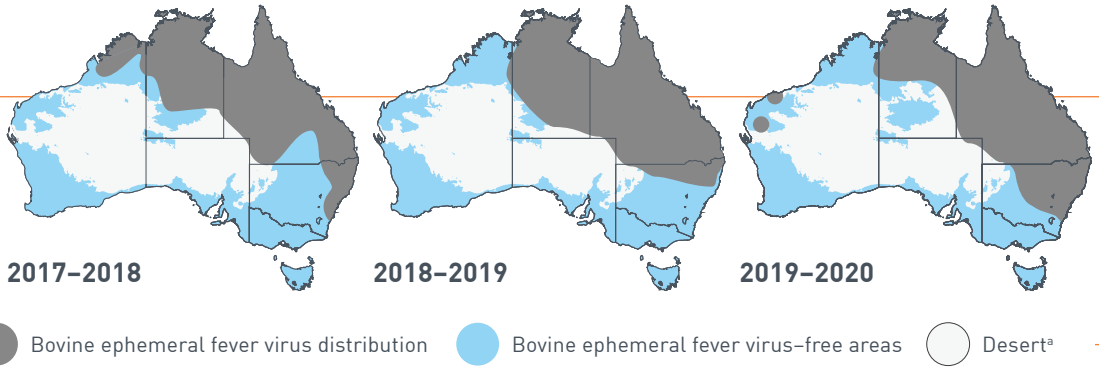

Figure 4 Distribution of bovine ephemeral fever virus in Australia, 2017–2018 to 2019–2020

a Köppen climate classification

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