NATIONAL ARBOVIRUS MONITORING PROGRAM NAMP 2020–2021 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 specific important 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.

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 developing and maintaining market access. We would also like to thank Dr Ian Langstaff and Ms Karen Moore for their work with the program and wish them the best for future endeavours.

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.

Serotyping, virus isolation and molecular testing are applied strategically in herds in New South Wales, the Northern Territory, Queensland, and Western Australia after seroconversions are detected. 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. NAMP surveillance data relating to early warning of bluetongue infection is 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).

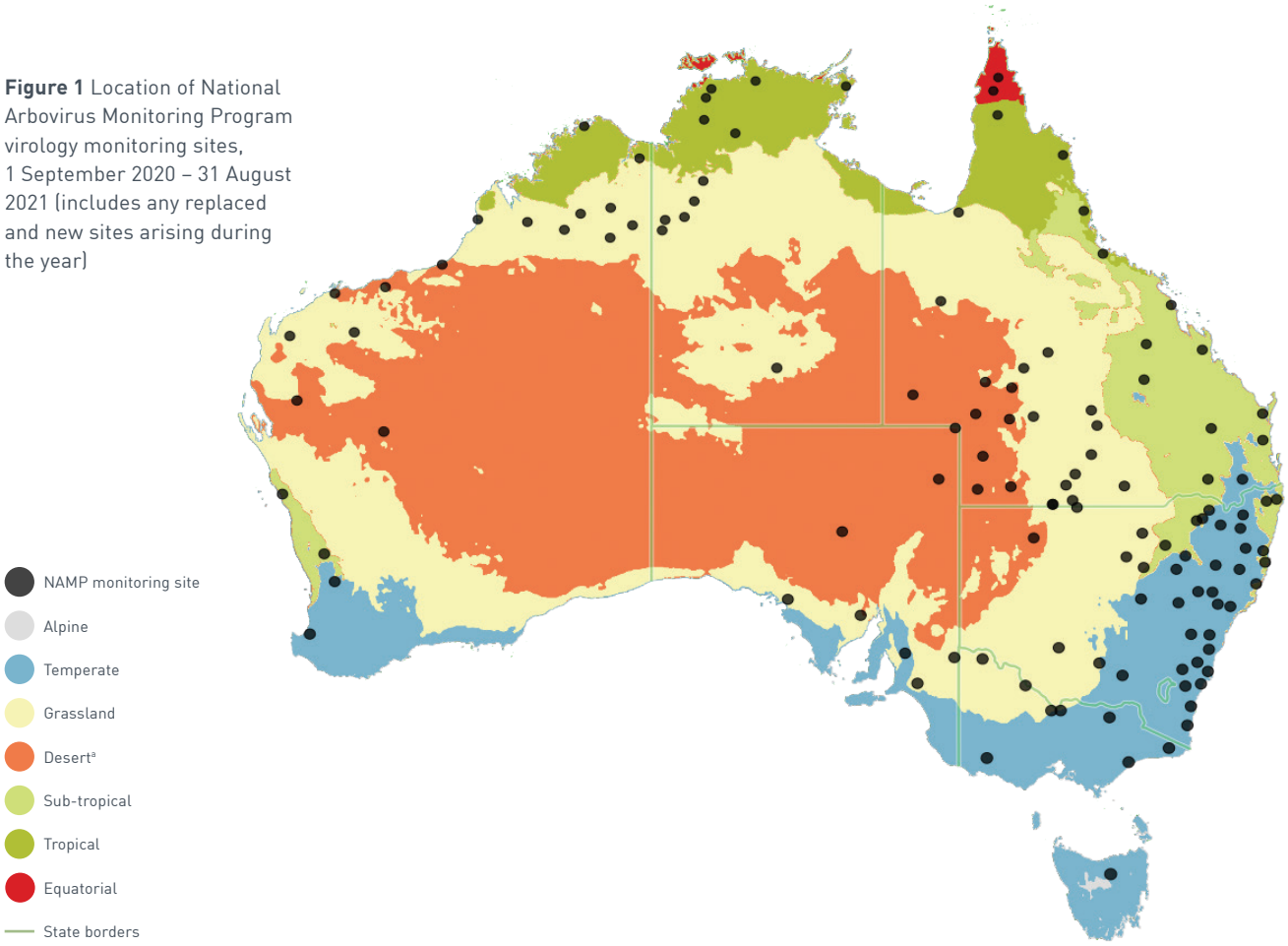

Figure 1 Location of National Arbovirus Monitoring Program virology monitoring sites, 1 September 2020 – 31 August 2021 (includes any replaced and new sites arising during the year)

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. 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 their 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 the 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 areas where viral transmission occurs and areas free of transmission.

MONITORING RESULTS FOR 2020–2021

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 September 2020 – August 2021 arbovirus transmission season (the arbovirus season). 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, 1 September 2020 – 31 August 2021

Jurisdictions	Sentinel herds	Serosurveys	Insect traps
New South Wales	37	2	35
Northern Territory	8	4	19
Queensland	22	14	21
South Australia	7	1	4
Tasmania	1	0	1
Victoria	8	0	6
Western Australia	13	7	15
TOTAL	**96**	**28**	**101**

BLUETONGUE VIRUS DISTRIBUTION

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

BTV transmission is endemic in northern and north-eastern 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 the 2020–2021 arbovirus season; types detected during the period were BTV-1, BTV-15, BTV-16, and BTV-21.

In the Northern Territory, rainfall in the northern half of the territory was below average during March, with slightly above-average rainfall for the southern and western areas. Most parts of the Northern Territory recorded above-average rainfall during the wet-season months of October to April, with an early monsoon onset in Darwin in December. Daytime and night-time temperatures across the territory were marginally above the long-term average from July 2020 – June 2021.

In the Northern Territory, the numbers of *C. actoni* were significantly higher than in previous years, with *C. fulvus* and *C. wadai* significantly lower, while numbers of *C. brevitarsis* were similar to previous years. The target species *C. nudipalpis* was detected at Cobourg Peninsula and Croker Island. Continued monitoring will determine whether 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 *C. imicola* – the most important vector of BTV in Africa, Europe and Asia.

1 namp.animalhealthaustralia.com.au

There was very little BTV transmission in the Northern Territory during the arbovirus season, and serotypes BTV-1 and BTV-16 were detected in samples collected.

In Western Australia, rainfall was above average for the Kimberley and West Pilbara due to thunderstorms towards the middle of the season. December saw three to four times the average rainfall in the north and east of the state and tropical lows in January for the north and east, which caused flooding and damage to the northwest. Damage caused by these weather patterns delayed mustering at some northern and eastern Pilbara NAMP sites. The cattle stations in the western Pilbara have been drought-affected for several seasons, but due to this rainfall the stations have started restocking, and are expected to have suitable homebred cattle to monitor next year.

No exotic species of *Culicoides* were found at trapping sites in Western Australia. *C. brevitarsis* was detected at several sites in the Kimberley. *C. wadai* and *C. actoni* were detected in Kalumburu, and *C. actoni* was also detected near Fitzroy Crossing. No vectors were detected outside of the Kimberley this year.

BTV transmission was detected in the Carlton Hill and Southern Kimberley region (within the BTV transmission zone). Serotypes detected were BTV-1, BTV-16 and BTV-21.

In Queensland, temperatures were above average for spring and there was below-average rainfall for the far north and western areas of the state. Summer temperatures were warmer than average across the state. Rainfall was above average during the summer of 2020–2021 for inland districts. Autumn 2021 brought average to above average rainfall to much of the state. For winter 2021, far northern and southeastern areas experienced average rainfall, and western Queensland recorded above-average rainfall. Temperatures were average to above average.

In Queensland, *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 but the southwestern region. Serotypes detected in Queensland include BTV-1, BTV-15, BTV-16, and BTV-21 – all previously known to occur in Queensland.

In New South Wales, rainfall from July to December 2020 was generally above average along the coastal plain and tablelands and very much above average on the far north coast, in the Hunter Valley and on the south coast. From January to March 2021, above-average rainfall was recorded, including significant flood events on the northwest slopes, and areas of the north coast and Sydney Basin. Rainfall was average for April to June 2021. Maximum temperatures were generally average to below average over summer and below average at the start of autumn. Minimum temperatures were below average during April, and average to above average into late autumn and winter.

C. brevitarsis, the principal vector of BTV in New South Wales, was again detected extensively along the east coast – from Casino in the north to Moruya in the south. *C. brevitarsis* was detected in Coonamble for the first time, making it the westernmost point in NSW. Overall, the numbers of *C. brevitarsis* detected were down compared to the prior season. *C. wadai* was detected later in the season in Casino, Bellingen and Ballina, with almost twice as many specimens collected compared to the previous season.

BTV transmission in NSW was limited to the far-north coast at Lismore and Casino, and Singleton in the Hunter Valley. BTV-1 was detected at all these sites, and BTV-16 at Lismore only. BTV activity was not detected at any other sentinel sites during the season.

Victoria experienced close to average rainfall during spring, and cooler than average temperatures during summer. Rainfall over summer was above average, owing to a wetter than average January. Rainfall into

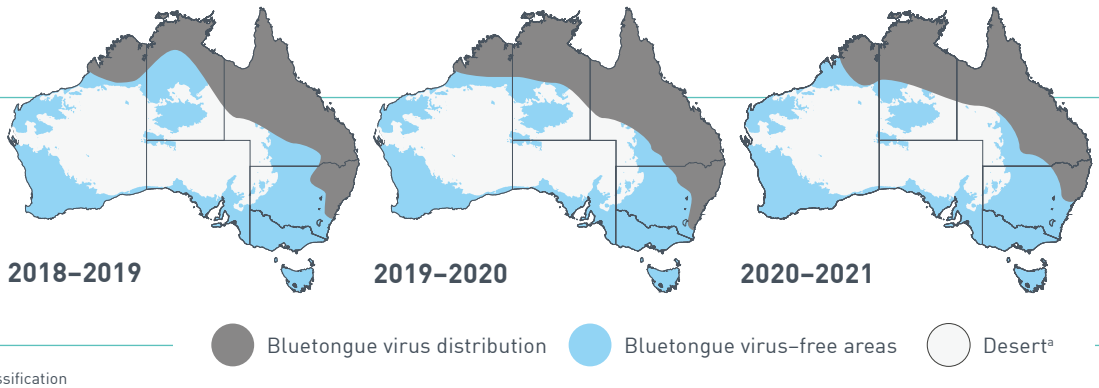

Figure 2 Distribution of bluetongue virus in Australia, 2018–2021

a Köppen climate classification

autumn was generally below average, with western and northwest Victoria receiving less than half of its mean autumn rainfall. In South Australia, average to above-average rainfall was experienced in December.

No competent vector species were detected in Tasmania or Victoria, consistent with the serological evidence of virus absence. In northeast South Australia, a single *C. brevitarsis* specimen was detected in a collection in February 2021. Follow up entomology sampling and a serosurvey did not detect further *C. brevitarsis* specimens or BTV. An additional sentinel and entomology site has been added in the region for ongoing monitoring during the 2021–2022 arbovirus season. 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 prior seasons. In the Northern Territory, no Akabane virus testing was performed in the northern endemic herds. Akabane virus was detected in the central region, but not in the south at Alice Springs.

In Queensland, records of seroconversion at sentinel sites and of seropositive animals at survey sites indicated that Akabane virus 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 more extensive than that of BTV, being detected from the far-north coast to Camden in the Sydney Basin, west onto the northern tablelands, and also in the Hunter Valley.

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

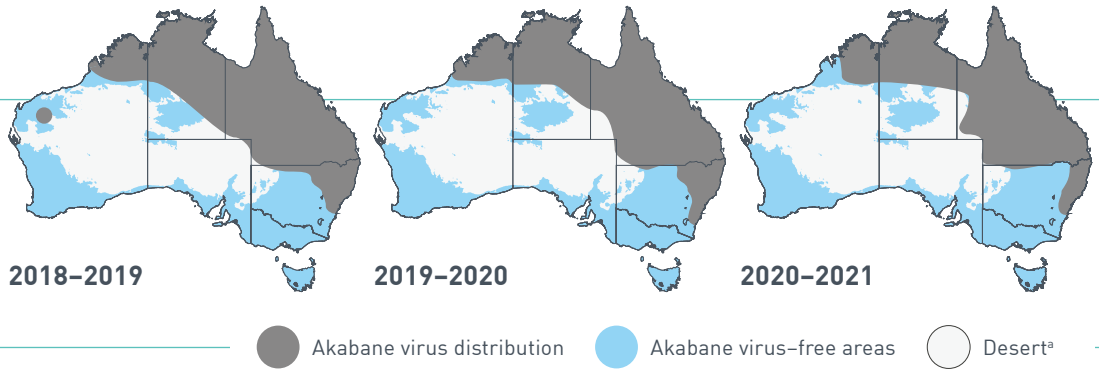

Figure 3 Distribution of Akabane virus in Australia, 2018–2021

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

In Western Australia, BEF was detected at two sentinel sites in the Kimberley and one in the Pilbara, with no observations of clinical disease in cattle this season. In the Northern Territory, BEF virus activity was widespread in the north, with most animals in northern herds seroconverting. 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 general disease investigation surveillance data collected by

Biosecurity Queensland. During the period, BEF was diagnosed on 11 occasions, predominantly in cattle from local government areas in the southeast corner of the state.

In New South Wales, BEF virus monitoring is undertaken at NAMP sites on the south coast and in the inland region. A single seroconversion was detected in the sentinel herd near Walgett in the state's north at the end of season bleed. No clinical cases were confirmed through diagnostic testing at the Elizabeth Macarthur Agricultural Institute.

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

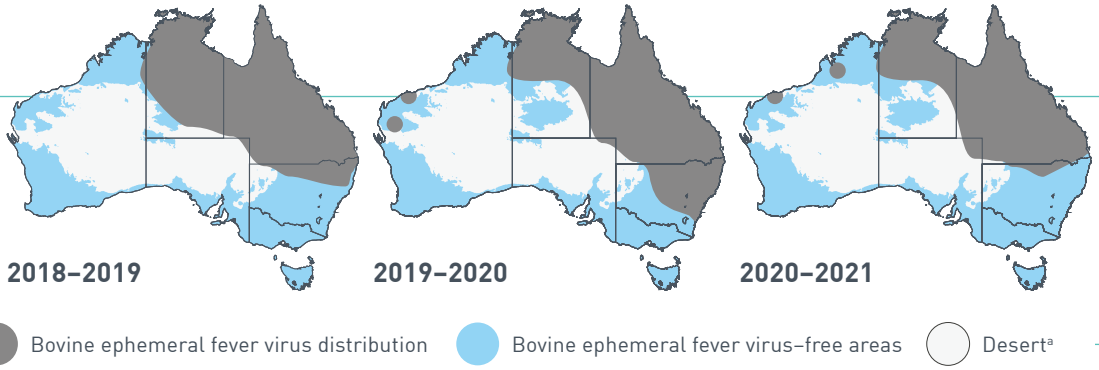

Figure 4 Distribution of bovine ephemeral fever virus in Australia, 2018–2021

a Köppen climate classification

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