NATIONAL ARBOVIRUS MONITORING PROGRAM 2021–2022 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 their 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, Australia's trading partners and livestock exporters. NAMP underpins Australian Government export certification that Australian ruminants are sourced from areas 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.

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

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.

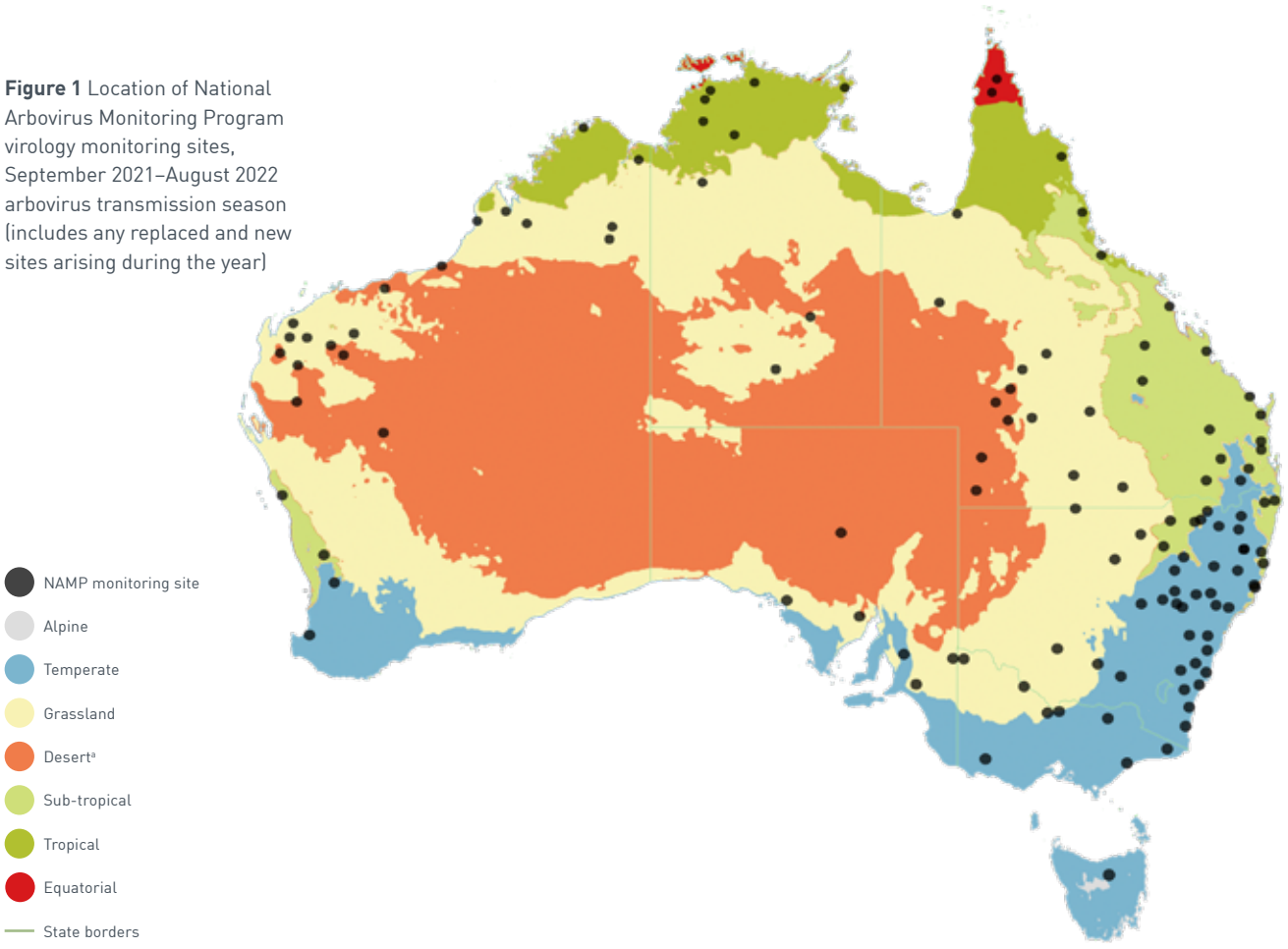
Blood samples from groups of young cattle that have not previously been exposed to arbovirus infection are tested at regular intervals for evidence of new infection with bluetongue, Akabane and BEF viruses. The program seeks to align blood sampling frequency to the probability of arbovirus transmission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

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). 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 are supplemented by targeted surveillance activities conducted by the Northern Australia Quarantine Strategy of the Australian Government Department of Agriculture, Fisheries and Forestry[1] 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, September 2021–August 2022 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

1 From 1 July 2022 the Department of Agriculture, Water and the Environment became the Department of Agriculture, Fisheries and Forestry.

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 the occurrence of BEF 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 areas where viral transmission occurs and areas free of transmission.

MONITORING RESULTS FOR 2021–2022

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 2021–2022 arbovirus transmission season (September 2021 to August 2022). The numbers of monitoring sites for sample collection in each state and territory are shown in Table 1.

Table 1 Number of active NAMP monitoring sites, by state and territory, September 2021 – August 2022

Jurisdictions	Sentinel herds	Serosurvey sites	Insect traps
New South Wales	37	4	32
Northern Territory	8	1	9
Queensland	24	6	23
South Australia	6	0	4
Tasmania	1	0	1
Victoria	8	0	6
Western Australia	13	9	16
TOTAL	**97**	**20**	**91**

BLUETONGUE VIRUS DISTRIBUTION

The limits of BTV transmission in Australia are shown on the interactive Bluetongue Virus Zone Map,[2] which defines the areas in which no viral transmission 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 the 2021–2022 season; types detected during the period were BTV-1, BTV-7, BTV-15, BTV-16, BTV-21 and BTV-23.

Across the **Northern Territory**, the dry season saw warmer than average temperatures, with July being the warmest on record. The wet season was warmer than average across most of the territory, except for the far south. Rainfall was mixed, with below-average rainfall in a large part of the north, while above-average rainfall was observed in the south, particularly around Alice Springs. A monsoon trough and low-pressure system developed in late December, with widespread falls. Tropical Cyclone Tiffany crossed the southeastern Gulf of Carpentaria coast in January and the system moved across the Top End towards the Kimberly. Intensive thunderstorms and heavy rainfall were experienced across late January and early February.

In the Northern Territory, the number of sites at which key *Culicoides* species were detected decreased compared to previous years. Numbers of *C. actoni*, *C. brevitarsis* and *C. fulvus* were lower than in prior seasons, while *C. wadai* was relatively the same. The target species, *C. nudipalpis*, was detected at Cobourg Peninsula. Further genetic analysis is planned to help determine whether this is the

2 https://namp.animalhealthaustralia.com.au

result of a new incursion or if a small population has established.

This year seroconversions were seen in all animals within the territory's northern herds. No seroconversions were detected in the BTV transmission–free zone. Serotypes detected were BTV-1 and BTV-16.

Seasonal conditions across the **Western Australian** grazing area were favourable over the season, which enabled some Pilbara properties to restock after several years of dry conditions. Above-average rainfall was observed throughout spring, with this continuing in the Kimberly region in summer. Kalumburu recorded its highest summer daily rainfall on record in February.

No exotic species of *Culicoides* were found at trapping sites in Western Australia. *C. brevitarsis* was detected at several sites across the Kimberley. Despite the Kalumburu site being renowned for its *Culicoides* abundance and species diversity, only *C. brevitarsis* was detected this year. No vectors were detected outside of the Kimberley this year.

BTV transmission was detected in the Kimberly region within the known BTV Transmission Zone. Serotypes detected were predominantly BTV-1, BTV-16 and BTV-21. This season BTV-7 and BTV-23 were detected at Kalumburu. This is the first time that BTV-23 has been detected in Australia since 1989, and the finding was isolated to the one site. Given the genetic variation in this sample, it was most likely a novel incursion. Clinical disease was not observed with these detections.

Queensland saw above-average rainfall across the state throughout spring 2021, followed by below-average rainfall for most of the state during summer, except for the southeast, which saw record-breaking rainfall in the later part of the season. Temperatures during summer and spring were warmer than average for most regions. Autumn 2022 brought above-average rainfall for most of the state, with daytime temperatures warmer than average for most of the state. This was followed by above-average rainfall in the northern and western districts in winter, continuing with above-average rainfall through the north and eastern parts of the state throughout July.

Consistent with prior seasons, monitoring throughout Queensland found that *C. brevitarsis* was the most prevalent and abundant vector species. *C. actoni* and *C. fulvus* were only detected in the far northeast of the state. *C. wadai* was detected along the entire Queensland coast.

BTV transmission was detected across Queensland, except for the central and southwestern regions. Serotypes detected in Queensland included BTV-1, BTV-15 and BTV-16 and BTV-21 – all previously known to occur in Queensland.

Rainfall for **New South Wales** across the 2021–2022 season was very much above average for the central and eastern thirds of the state and above average for the western third. A La Niña weather pattern resulted in several significant rainfall and flooding events throughout much of New South Wales. The first events were experienced in November 2021 in the Hunter Valley region and inland New South Wales; followed by events in January throughout the South Coast, Riverina and Murray regions; the Far North Coast in February; and along the coastal plain in March. Maximum temperatures were generally below average in association with significant rainfall events. Minimum temperatures were below average in April, becoming 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. Compared to the prior season, *C. brevitarsis* was detected in higher numbers at inland sites, including along the Great Dividing Range and through the Hunter Valley. *C. wadai* was only detected at the Casino site this year.

BTV transmission in New South Wales was extensive, reaching its previous western limits in the North West Slopes region near Pilliga and expanding, with first detections near Dunedoo in the Central West and Mudgee in the Central Tablelands. Serotypes detected were BTV-1, BTV-16, BTV-21; and for the first time BTV-15 was detected in the Far North Coast region.

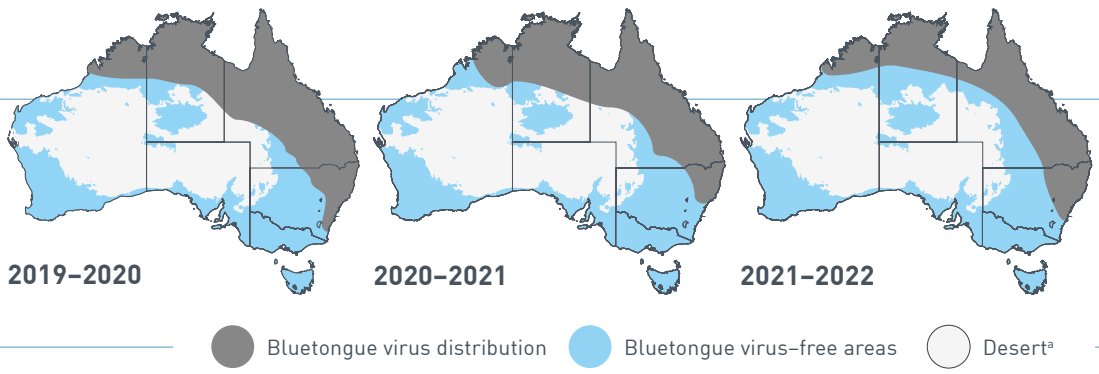


Figure 2 Distribution of bluetongue virus in Australia, 2019–2022

a Köppen climate classification

Victoria experienced above-average rainfall during spring, and warmer than average night-time temperatures during summer and autumn. Rainfall over summer and autumn was above average in central and eastern Victoria, but the south and west were drier than average. In **South Australia**, average to above-average rainfall was experienced across the northwest of the state, with the wettest November on record. **Tasmania** experienced above-average rainfall in spring, followed by a dry summer with warmer than average temperatures.

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

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 in the Kimberley – consistent with prior seasons. In the **Northern Territory**, testing for Akabane virus was concentrated on the central and southern regions. Consistent with the prior season, Akabane virus was detected in the north, where it is endemic, but not in the south at Alice Springs.

In **Queensland**, Akabane virus was detected widely across the state, extending to the far southeast and far southwest.

In **New South Wales**, Akabane virus transmission was more extensive than BTV transmission. Akabane was detected on the Northern Tablelands, as far south as Milton on the coast, and extending into the Hunter Valley at Merriwa and the Central West near Dunedoo and Wellington.

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

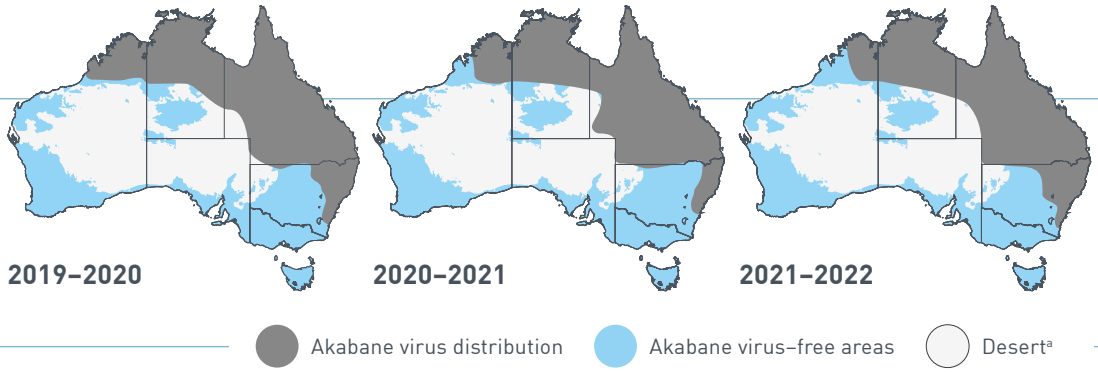


Figure 3 Distribution of Akabane virus in Australia, 2019–2022

a Köppen climate classification

BOVINE EPHEMERAL FEVER VIRUS DISTRIBUTION

BEF virus is endemic in northern Australia, where it can occur in both the dry and wet seasons (spring, summer or autumn). Significant rainfall and flooding events throughout much of southeast Australia provided optimal conditions for BEF transmission in the 2021–2022 season (Figure 4). The occurrence of the virus is limited by the effects of cold winters, which restrict the distribution of its mosquito vector.

In **Western Australia**, BEF was detected at one sentinel site in the Kimberley, with no observations of clinical disease in cattle this season. In the **Northern Territory**, BEF virus activity was first detected in the north at Beatrice Hill, and was subsequently widespread across the north, with most animals in northern herds seroconverting. One animal in a herd to the north of Alice Springs seroconverted in May.

Sampling from NAMP sentinel and serosurvey herds in **Queensland** showed that BEF continued to be widely distributed across the state, extending to the far southeast and southwest. Clinical disease was confirmed by testing at Biosecurity Sciences Laboratory on 54 occasions, predominantly from shires within the southeast of the state.

In **New South Wales**, BEF virus monitoring was undertaken at selected NAMP sites on the south coast and in inland regions. Seroconversions were detected at

Gravesend, Walgett, Camden and Mudgee. Diagnostic testing at the state veterinary laboratory confirmed clinical cases on the north coast from November, extending south to the Nowra region by March. Cases were reported throughout the Hunter Valley region and near Pilliga in the North West region and Coonamble in the Central West region.

In **Victoria**, clinical disease was detected near Wodonga in northeast Victoria in March 2022. In the NAMP sentinel herds in Victoria, no seroconversions were detected and no clinical disease reported.

BEF virus and clinical disease were not detected in South Australia or Tasmania.

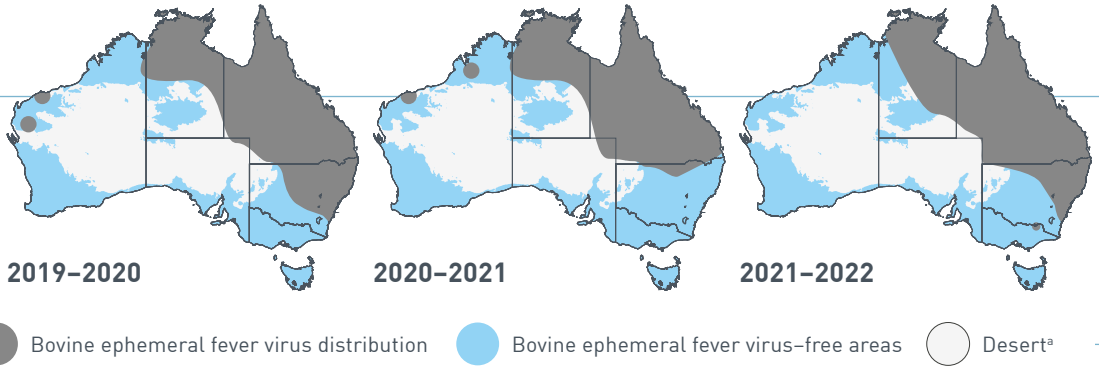


Figure 4 Distribution of bovine ephemeral fever virus in Australia, 2019–2022

a Köppen climate classification

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