NATIONAL ARBOVIRUS MONITORING PROGRAM 2022–2023 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 introducing bluetongue, Akabane and bovine ephemeral fever (BEF) viruses.

2. **Bluetongue virus (BTV) early warning** – to detect incursions of exotic strains of BTV and its 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 of endemic bluetongue, Akabane and BEF viruses and their vectors in Australia, 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 within Australia.

Arboviruses monitored by NAMP include bluetongue, Akabane and BEF viruses. Infection with BTV has never adversely affected 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 exporting 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 ruminants are sourced from areas free from transmission of these specified arboviruses. In addition, NAMP data are 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 the producers and collaborators who assisted in gathering the valuable monitoring data underpinning this report. Their assistance is critical in developing and maintaining market access. We would also like to thank Dr Marion Seymour (Deputy Chief Veterinary Officer, Western Australia) and Dr Bruce Hill (Principal Veterinary Officer – Surveillance, Queensland) for their work on the NAMP Technical Committee, 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 insect vectors.

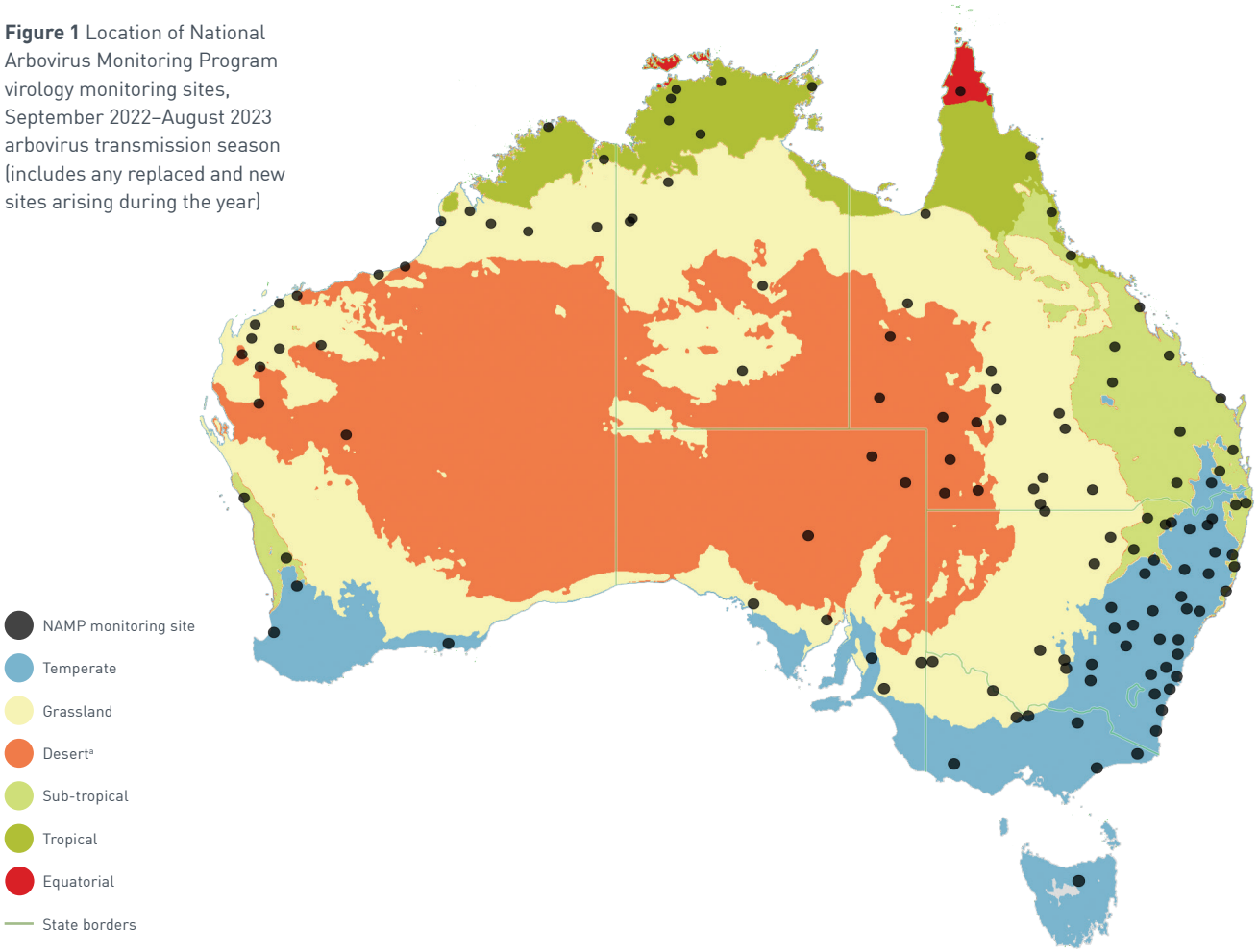
Blood samples from groups of young cattle that have not previously been exposed to arbovirus infection are tested at regular intervals for evidence of new infection with bluetongue, Akabane and BEF viruses. The program seeks to align blood sampling frequency to the probability of arbovirus transmission (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 determine arbovirus distribution – sites are located along the border between areas where infection is expected and not expected, and 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 – all blood samples collected at this location are subjected to virus isolation. NAMP surveillance data relating to early warning of bluetongue infection are supplemented by targeted surveillance activities conducted by the Northern Australia Quarantine Strategy (NAQS) in remote coastal regions of northern Australia (the Northern Territory, and northern Queensland and Western Australia).

Figure 1 Location of National Arbovirus Monitoring Program virology monitoring sites, September 2022–August 2023 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. 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 include *C. actoni*, *C. dumdumi*, *C. fulvus* and *C. wadai*, but these are less widely distributed than *C. brevitarsis*.

The main vector for BEF virus in Australia is generally considered to be the mosquito *Culex annulirostris*. *C. annulirostris* has different ecological thresholds from *C. 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.

Australian research since the mid-1970s has provided a detailed understanding of the epidemiology of BTV strains in Australia and their *Culicoides* species biting-midge vectors. These vectors enter northern Australia during significant weather events, occasionally resulting in new BTV serotypes in northern Australia.

Many regions in Australia do not support the specific *Culicoides* vectors that can transmit BTV and Akabane virus and therefore remain free from viral transmission. Climatic conditions have a significant effect on vector distribution, which accounts for variations in the boundary between areas where viral transmission occurs and areas free of transmission.

MONITORING RESULTS FOR 2022–2023

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 2022–2023 arbovirus transmission season (September 2022 to August 2023). 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 2022 – August 2023

Jurisdiction	Sentinel herds	Serosurvey sites	Insect traps
New South Wales	42	1	34
Northern Territory	8	3	14
Queensland	21	11	21
South Australia	8	0	4
Tasmania	1	0	1
Victoria	8	0	6
Western Australia	17	7	16
TOTAL	**105**	**22**	**96**

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.

Transmission of BTV is endemic in northern and northeastern Australia (New South Wales, the 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 2022–2023 season; serotypes detected during the period were BTV-1, 5, 12, 15, 16 and 21. Serological reactivity to BTV-3 and 23 was also observed, but was considered to be the result of cross-reactions; these serotypes were not confirmed by sequencing.

In the **Northern Territory**, the dry season day and night temperatures were well above the long-term average across the Top End and close to average in southern areas. Below-average temperatures and above-average rainfall resulted in the coolest wet season since 2011–2012 and the wettest season since 2010–2011.

Transmission of BTV was detected at all sites within the Northern Territory's Bluetongue Zone. In the 2022-23 season, BTV-1, BTV-12 and BTV-16 were detected. Transmission was not detected in the BTV transmission–free zone.

The number of key vector species detected in the Northern Territory was significantly lower than previous years. The exotic species *C. nudipalpis* was again detected at northern sites (Cobourg Peninsula); it is closely related to *C. imicola*, a vector of BTV in Africa, and therefore may possess the capacity to act as a competent vector of BTV in Australia. Survey work is ongoing to investigate

1 namp.animalhealthaustralia.com.au

its potential establishment. No key *Culicoides* species vectors were recorded in the Northern Territory's BTV transmission-free zone.

In **Western Australia**, warm and wet conditions largely prevailed in the north during spring and summer 2022–2023, including heavy rainfall and regional flooding driven by cyclone activity. However, the South West Land Division, and parts of the southeast, recorded below-average rainfall over summer.

Transmission of BTV in Western Australia was only detected in the eastern Kimberley region, well inside the Bluetongue Zone. Although BTV-16 was predominant, BTV-1 was also detected. Exposure to BTV-1, 5, 16 and 21 was detected at Kalumburu.

In Western Australia, *Culicoides brevitarsis* was the predominant vector collected from sites in the Kimberley, with very low numbers of *C. actoni* also collected. Low numbers of *C. brevitarsis* were collected at a site south of Broome, outside the BTV transmission zone. Collecting competent vectors from this site is relatively common, and consistent with previous years.

In **Queensland**, spring and summer rainfall was above average across the northern and western districts of the state, with below-average rainfall in the southeast and southern inland districts. Temperatures were cooler than average in the south of the state but warmer in the north through spring, followed by warmer temperatures in the southwest and Cape York Peninsula through summer, and cooler temperatures than average across the rest of the state. In autumn 2023, overall rainfall was below average for the state; however, record-breaking high rainfall occurred in the northwest, which led to widespread flooding in the Gulf Country, central west and southwest.

Transmission of BTV was widespread in the coastal areas of Queensland as far south as Bundaberg throughout the year, and occasionally in the southern inland areas during summer. No detections occurred in the northern and central inland areas. The predominant strain was BTV-16, although BTV-1, 15 and 21 were also detected. Serological reactivity to BTV-3 and 23 was likely caused by cross-reactions from prior exposure to BTV-16. The southern areas were the most affected by flood, which delayed access for sampling.

The distribution of vector species in Queensland was comparable to previous years, being predominantly in the far north and eastern coastal regions. *C. brevitarsis* was the most abundant vector species across the state, followed by *C. wadai* (along the east coast), *C. actoni* (in Cooktown and Mackay – further south than usual, although not unprecedented) and *C. fulvus* (Cooktown). Low numbers of *C. brevitarsis* were retrieved from inland traps.

In **New South Wales**, rainfall for 2022–2023 was generally above average to very much above average, particularly in July – November 2022. From December 2022, rainfall tended to be average or lower, although some regions continued to receive above-average rainfall. Maximum temperatures were generally below average or cooler across the whole state from September to December 2022, shifting to above average in February, March and June 2023. Freezing overnight temperatures were recorded from the Northern to Southern Tablelands starting from May 2023.

Transmission of BTV in New South Wales extended across the North Coast, Hunter, Greater Sydney, Northern Tablelands and North West Slopes regions to Brewarrina in the Western region. The predominant serotype, BTV-16, was found at all except two sites. Also detected were BTV-1 and 21. The incidence of seroconversions was high in all herds, except those at the margins of the transmission zone, where it was moderate to low. There was no evidence of transmission on the coastal plain south of Camden, nor for a repeat year at Mudgee.

Culicoides brevitarsis is the principal BTV vector in New South Wales, comprising 57% of the total trap catch for the second year in a row. A single specimen was caught south of the Sydney basin, representing the only collection of *C. brevitarsis* outside the current BTV transmission zone within New South Wales. *C. wadai* was largely absent for 2022–2023, except at the Casino site.

In **Victoria**, winter rainfall was generally close to average, followed by a dry July and a wet August. Maximum and

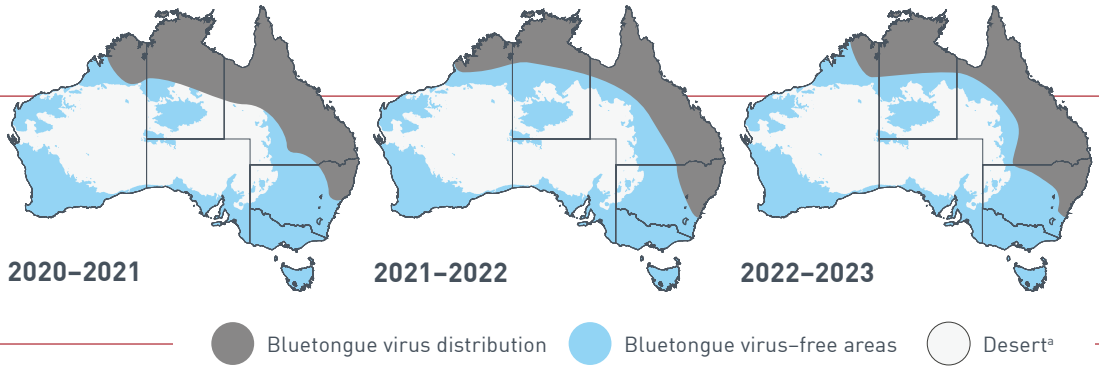


Figure 2 Distribution of BTV virus in Australia, Sep 2020 – Aug 2023

a Köppen climate classification

minimum temperatures were above average across much of the state. Spring rainfall was the highest on record, with below-average maximum temperatures but above-average minimum temperatures. Summer rainfall was below average. Autumn rainfall was close to average for the state, though higher in some regions, with below-average maximum temperatures in the state's west and northeast and close to average temperatures elsewhere. Minimum temperatures were above average across the South West, Central and Gippsland districts.

In **South Australia**, autumn rainfall tended to be above average in the state's northwestern and southeastern districts, but was below average in parts of the North East Pastoral district. For South Australia as a whole, autumn rainfall was below average. The state's mean maximum temperature was above average, while the mean minimum was below average.

In **Tasmania**, a relatively dry winter was followed by spring rainfall very much above average across the north and much of the east coast. In contrast, rainfall was below average for the southwest of the state. Day and night temperatures were generally close to or slightly warmer than average. Autumn rainfall totals were below average for some regions (South East, Upper Derwent Valley, Central Plateau, Western and North West Coast) and close to average elsewhere. Both mean maximum and mean minimum temperatures were close to average across the state.

No *Culicoides* species known to be capable BTV vectors were detected in Victoria, South Australia or Tasmania, consistent with the serological evidence of virus absence. Detected species were consistent with previous years.

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 the **Northern Territory**, there was no evidence of Akabane virus transmission outside the northern endemic region (note that no surveillance sampling was conducted in the known endemic region).

In **Western Australia**, transmission of Akabane virus was detected in animals in the Kimberly (as for previous years) and in a single animal in coastal Pilbara.

In **Queensland**, Akabane virus transmission was detected in all regions across the state, though not at all sites.

In **New South Wales**, low to moderate levels of Akabane virus transmission were detected in animals at most sites from the North Coast south to the Southern Highlands region, extending into the Hunter Valley to Scone, the Northern Tablelands, and the North West Slopes. No cases of Akabane disease were confirmed.

In Victoria, South Australia and Tasmania, no Akabane virus transmission was detected.

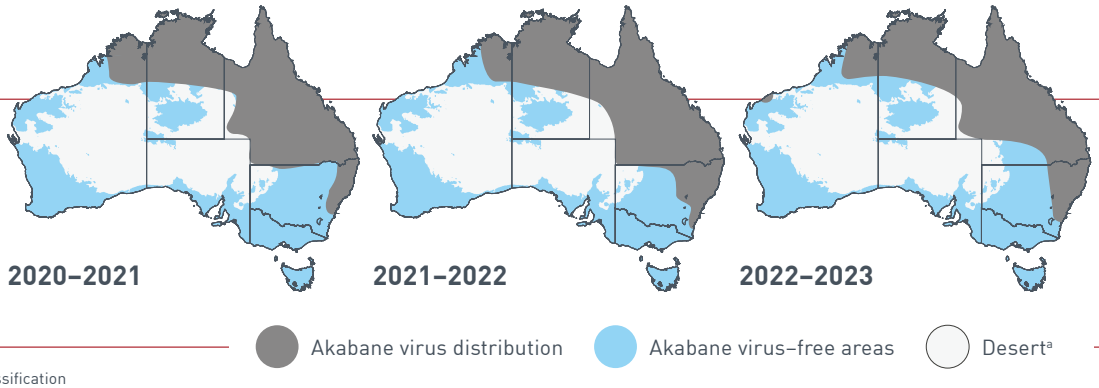


Figure 3 Distribution of Akabane virus in Australia, Sep 2020 – Aug 2023

a Köppen climate classification

BOVINE EPHEMERAL FEVER VIRUS DISTRIBUTION

The BEF virus is endemic in northern Australia, where disease can occur in both the dry and wet seasons (spring, summer or autumn). Significant rainfall and flooding events throughout much of southeast Australia facilitated BEF transmission in the 2022–2023 season (Figure 4). Cold winters limit occurrence of the virus by restricting the distribution of its mosquito vector.

In the **Northern Territory**, transmission of BEF was detected in animals at most sites, beginning in October at Beatrice Hill and Katherine, and from December elsewhere.

In **Western Australia**, BEF transmission was detected in animals in the Kimberley, Pilbara and Murchison. No clinical signs were reported for any of the animals involved.

In **Queensland**, transmission of BEF was detected in animals at most sites across the state, consistent with previous years. Additionally, clinical BEF was diagnosed on 57 occasions across the state.

In **New South Wales**, seroconversion to BEF was detected in animals across the North West Slopes region and northern parts of the Western region. Additionally, cases were confirmed on the Far North Coast, across the Northern Tablelands, and in the Hunter Valley and Sydney Basin.

In Victoria, South Australia and Tasmania, no evidence of BEF transmission was detected.

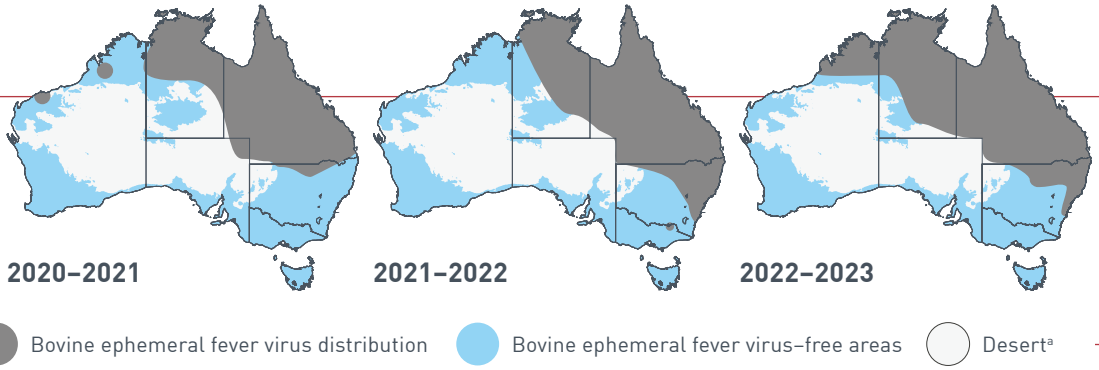


Figure 4 Distribution of BEF virus in Australia, Sep 2020 – Aug 2023

a Köppen climate classification

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ISSN 1836-5418