

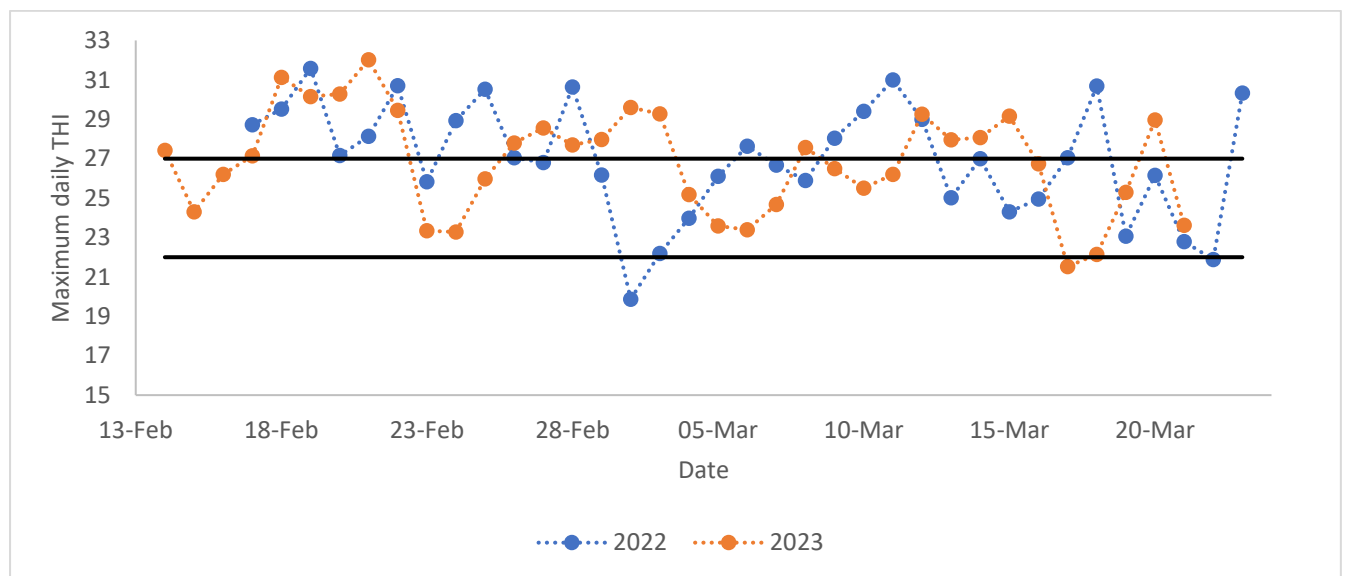
## Microclimate data at heat stress sites

The aim of this experiment is to quantify the effect of heat events on sheep reproduction, thermoregulatory capacity, behaviour and wellbeing through long-term data collection. Data were collected from three research sites for this experiment during 2022 and five research sites during 2023. There is one site (Ridgefield) that utilises three paddocks at each joining that offer either no shade, medium shade, or high shade. The remaining sites are commercial farms where only one paddock is monitored across three years. In addition to the collection of microclimate and reproductive data, the ewes have intra ruminal temperature loggers that will be collected after three years of joining.

### *Climatic conditions*

The THI for UWA Ridgefield Farm over the joining periods in 2022 and 2023 are shown in Figure 1, indicating that just over half of the days during joining exceeded a THI of 27. In both years there was a general trend for THI to decrease from the start to the end of joining, and in both years there was a noticeable decrease in THI around the middle of joining (late February to early March) although that dip was less substantial in 2023 than it was in 2022. Nevertheless, there were days with THI > 27 across the joining period, even after mid-March. Just over half of the days during the joining period had a THI of >27 at Ridgefield in both 2022 and 2023.

In 2022, eighteen of the 35 days of joining (51%) exceeded a THI of 27, while 2023 had one more day with THI above 27 (19 of 35 days = 54%) during the joining period. The average daily maximum THI across the joining period was  $27.0 \pm 2.9$  in 2022, and  $26.9 \pm 2.6$  in 2023.

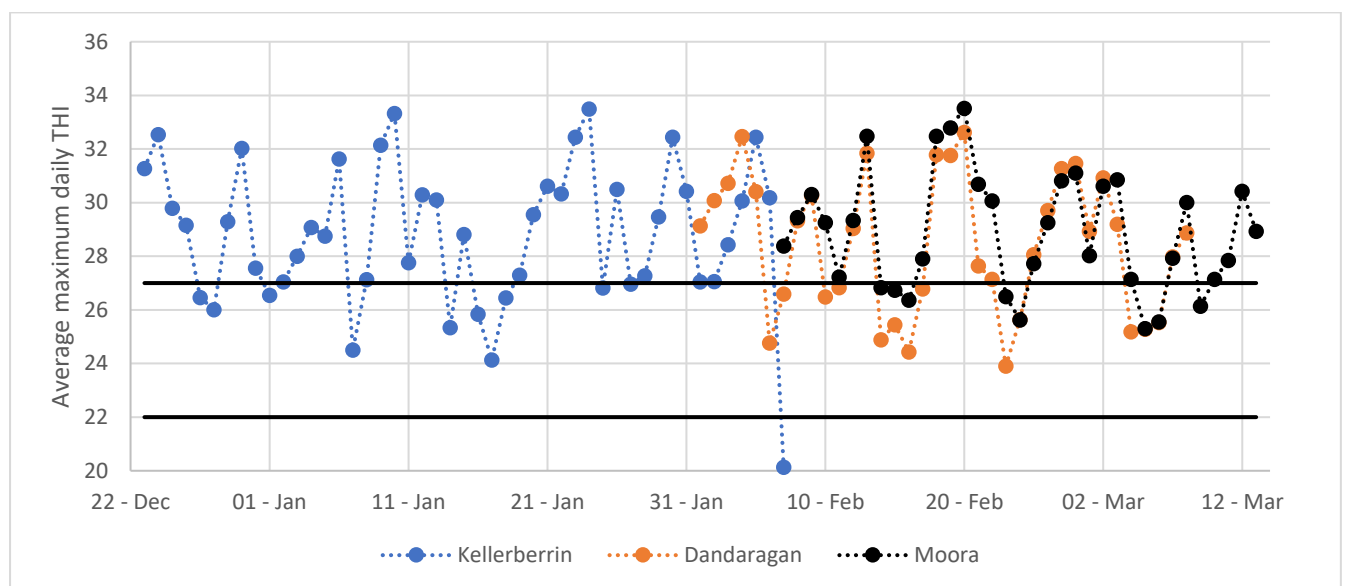


**Figure 1: The daily maximum temperature-humidity index (THI) calculated as the average of all of the weather stations at the UWA Ridgefield farm in Western Australia during 2022 and 2023. There was generally less than 1°C THI variation between the highest and lowest stations on any day. A day with a THI value above 27 was defined as a day of heat stress, between 22 and 27 was defined as moderate heat stress, and < 22 was considered an absence of heat stress.**

In 2023 the commercial farms had more days where the THI was greater than 27 during joining than did Ridgefield. The weather stations have not yet been recovered from Lower Murchison. For the other farms, Kellerberrin had 77% of days with maximum THI >27, Dandaragan had 64% of days with maximum THI >27, and Moora had 77% of days with maximum THI >27 (Figure 2).

At Kellerberrin the probes that measured humidity on two of the stations (WS09 and WS23) malfunctioned, and those probes recorded 99% RH for the entire deployment. The dry-bulb sensors on those stations recorded data very similar to the other two stations that were deployed on the property (WS12 and WS24). Because the humidity is required to calculate the THI, the THI for Kellerberrin was calculated as the average of WS12 and WS24.

At Dandaragan, one of the weather stations (WS32) missed a log at 14:30h on 23 – Feb, and so the data from 14:00 and 15:00 were interpolated to replace the missing data. The impact on the mean daily summaries was small.



**Figure 2.** Average daily maximum daily THI from the weather stations deployed on each of the commercial farms for their respective joining periods.

### Wind speed

As might be expected, the average daily wind speed varied quite a bit between the protected and exposed sites in each paddock at Ridgefield (Figure 3). In the protected areas, the daily average wind speed was generally lower than 5 m/s, but in the exposed sites it was 10-20 m/s. A similar pattern emerged on the commercial farms. In general, the average wind speed was higher at Kellerberrin during joining than it was on the other commercial farms and Ridgefield. We will use GPS data from the sheep to investigate whether the utilisation of the paddocks by the sheep was influenced by the available wind on days of different THI.

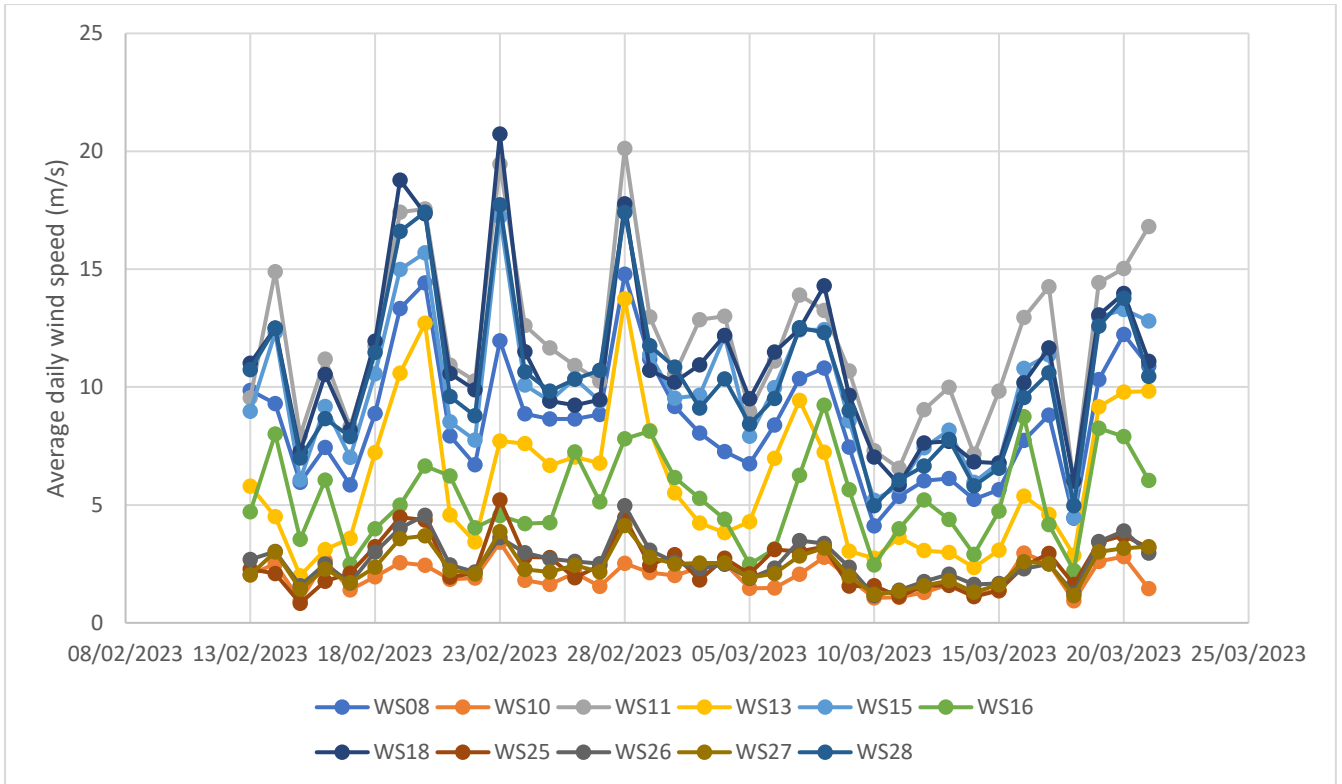


Figure 3a: Average daily wind speed from each weather station deployed in each paddock at the UWA Ridgefield farm in Western Australia during mating in 2023.

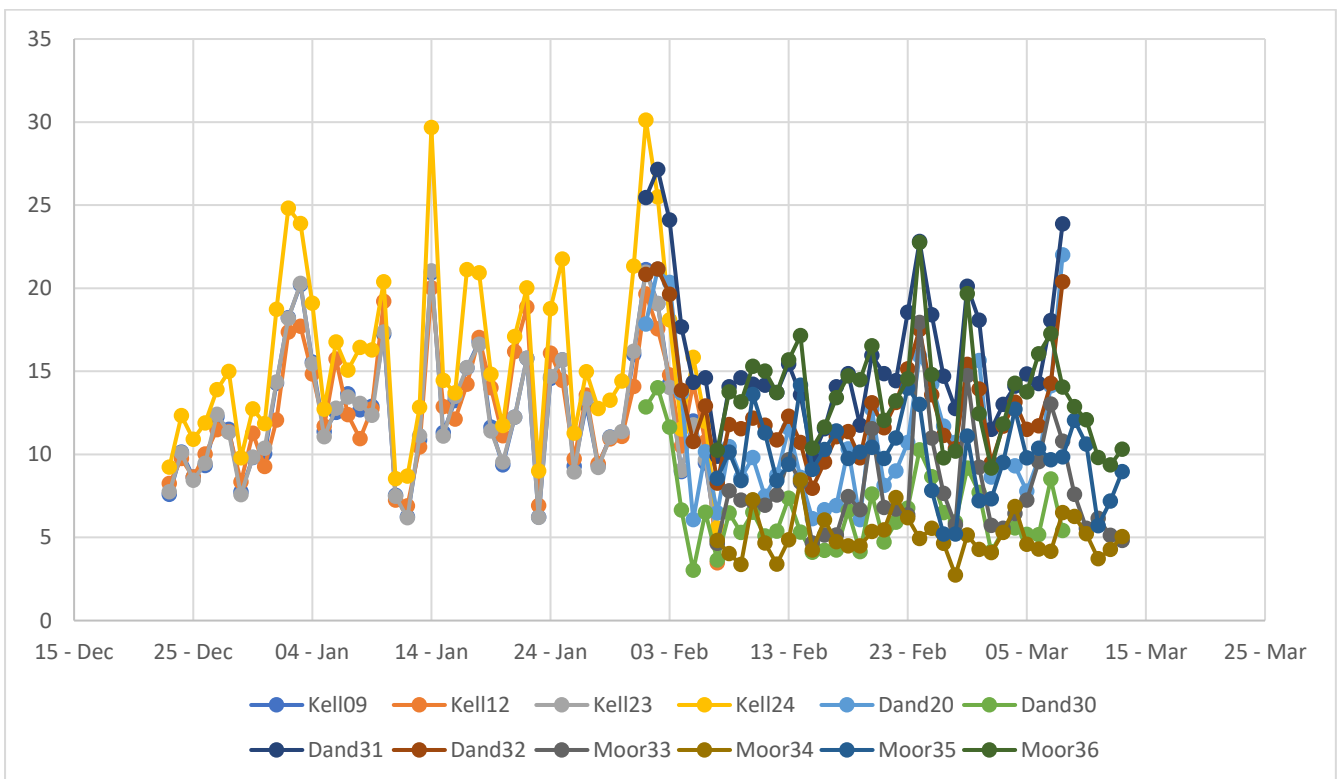
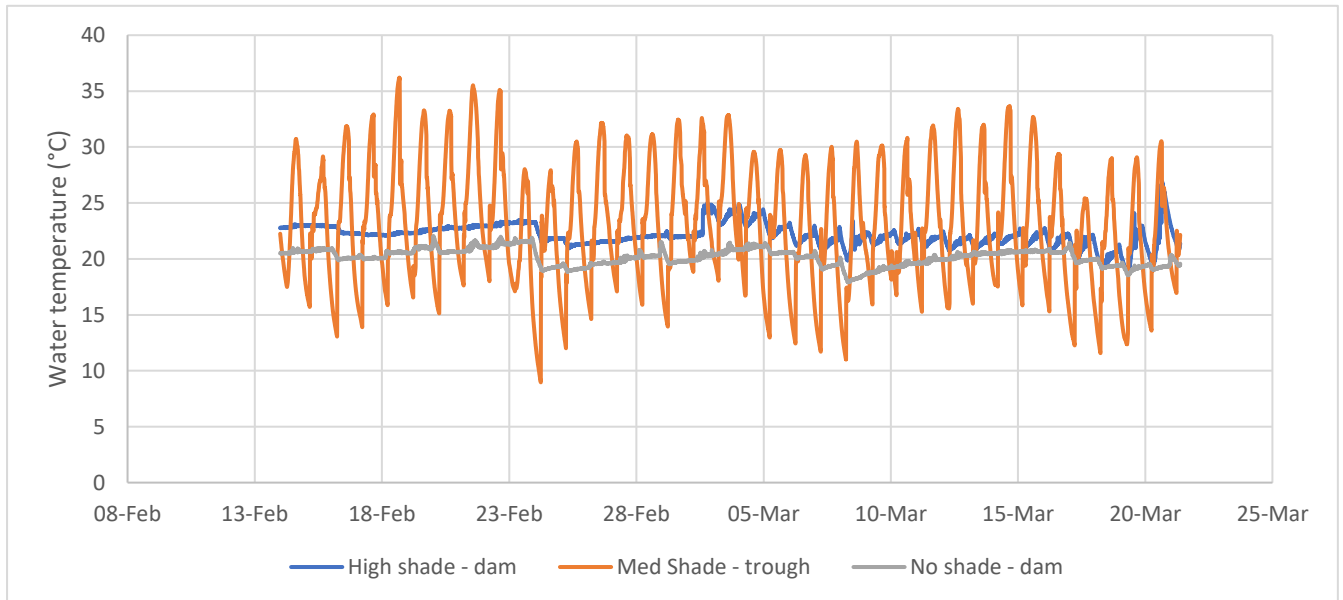


Figure 3b: Average maximum daily wind speed from each weather stations deployed on each of the commercial farms for their respective joining periods.

### Water temperature of the water points at Ridgefield

The water temperature was almost constant in the large dams in the “High shade” and “No shade” paddocks, but presented a diurnal cycle in the water trough in the “Medium shade” paddock (Figure 4). In all locations, except the high shade paddock at Ridgefield, no shade was available around the dam or the water troughs. The decrease in water temperature observed on March 03 in both the dam and the trough was due to a relatively low ambient temperature on the previous day.



**Figure 4:** Temperature of the water that was available to the sheep in each of the three treatments.