UNIVERSITY OF ALBERTA

Rangeland Research Institute

Using drones to measure heat stress in cattle

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Unmanned aerial vehicle (UAV) or drone image of variously coloured cattle in a feedlot setting.

The long-term sustainability of livestock production is threatened by climate change. Due to increasing amounts of carbon dioxide in the atmosphere, the earth's climate is warming and precipitation patterns are changing. In 2021, the Canadian prairies experienced record-setting temperatures, in which cattle experienced detrimental environmental conditions, risking heat stress, or even death. Measuring heat stress in cattle, and ultimately identifying and selecting cattle that can tolerate higher temperatures, will be critical to ensuring cattle welfare and productivity are simultaneously maintained into the future.

MSc student, Justin Mufford observes heat stress in cattle using an UAV or drone at the Mattheis Research Ranch.

Photos by: Justin Mufford.

In North America, Black Angus, a breed commonly used in beef production, may be more susceptible to the effects of climate change due to its dark hair coat that absorbs more solar radiation than light-coloured hair. Thus, there is a greater risk of susceptibility to heat stress, and associated reductions in productivity, as well as enhanced morbidity and mortality in these animals, relative to those with lighter colouring. However, observing and assessing cattle responses to heat can be challenging, especially on 'open-range' pasture, where animals may be difficult to locate and monitor.

Observing heat stress in cattle in a ranch setting poses challenges because of the potentially expansive land base. UAV image of cattle grazing at the Mattheis Ranch.

In a study conducted by Justin Mufford, an MSc student at Thompson Rivers University working with John Church (TRU) and in collaboration with Cameron Carlyle (U of A), unmanned aerial vehicles (UAVs) were used to observe cattle in pasture at the Mattheis Research Ranch and in a privately-owned feedlot setting to measure respiration rate, and other behaviours (e.g., time spent standing) to make comparisons among cattle with different coat colours. The UAVs allow remote viewing of multiple animals at the same time through recording of high-resolution video, which can then be analyzed using specialized software in the lab. Environmental data were measured at the same time to generate a heat load index (HLI).

The researchers found that animal respiration rate (a common indicator of 'stress') increased with HLI, and darker coated animals had a larger response in the feedlot, but not in pasture environments. Importantly, temperatures in the pasture did not get as high as those in the feedlot, thereby allowing pasture-based animals to experience less heat stress regardless of their hair colour. Additionally, the likelihood that an animal would be standing increased with HLI in both the feedlot and pasture scenarios. Standing increases the rate of convective heat loss and may be a means to reduce body temperature, in turn reducing the risk of heat stress.

This study demonstrated that consumer grade UAVs are capable of measuring heat stress behavioural responses in cattle and could serve as a new tool to identify and monitor cattle heat stress responses resulting from anticipated future changes in climate and associated weather patterns.

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