

## Future Heat Stress Projections and their Effects on US Livestock

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Future climate change may result in variations in heat stress experienced by livestock, which will consequently impact agricultural health, well-being, and yield. In this study, we estimated future yield changes for livestock due to heat stress in the United States under the high greenhouse gas emissions scenario, representative concentration pathway (RCP) 8.5. This research applied the Community Land Model version 4.5 (CLM4.5), a component of the Community Earth System Model (CESM) that has been developed by the National Center for Atmospheric Research (NCAR). To use CLM 4.5 we added a special additional module, the HumanIndexMod, to compute heat stress metrics such as Temperature Humidity Index for Comfort (THIC) as well as wet bulb temperature. We conducted retrospective simulations driven by reanalysis of past observed climate data, and future climate scenarios driven by an ensemble of future climate model projections.

Using output from these simulations with the HumanIndexMod, we utilized the agricultural livestock model of St. Pierre et al. (2003). THIC, swamp cooler efficiency, and wet bulb temperature are all projected to increase by the end of the century across the U.S. (2071-2100). An increase in THIC results in a negative effect on animals, inhibiting their performance and output. We found that heat stress caused by temperature and humidity increases as embodied by THIC and the variables that rely upon it, is predicted to decrease overall production yield for dairy cattle, finishing hogs, poultry and various livestock, as a result of heat stress and other major climatic factors.

Specifically, we calculated the differences for dry matter intake loss and milk loss for the Dairy Cow Model as well as other yield related variables to ascertain the impact of climate change on agriculture. In the future there will potentially be substantial reductions from current levels, for dry matter intake loss and milk loss. The Growth Finished Hog and Poultry models also showed changes between future and current levels for various yields.

### References

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