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Climate Induced Catastrophic Shifts in Pastoralism Systems Managed Under the Maximum Sustainable Yield Model

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The effects of the foreseen change in precipitation and temperature on dynamic grazing systems that are managed under the hypothesis of the Maximum Sustainable Yield (MSY) are assessed. The grazing system model is based on the standard Gordon Schaefer approach that relates the rate of above ground vegetation production under biomass density saturation limitations to consumption by herbivores.
The model is modified using principles from water balance hydrology relating potential to actual plant evapotraspiration. The new model introduces vegetation grown limitations due to climatic aridity. The much criticized but still applied MSY hypothesis assumes the optimum herbivore density for maximum biomass removal, thus producing a low ecological stability system that is prone to catastrophic shifts. The developed model shows that as climate changes towards a warmer and dryer future, especially in arid environments where water is a limited resource, the probability of a mismanaged grazing system to collapse increases.