# Continuous observations of CO<sub>2</sub>, H<sub>2</sub>O and CH<sub>4</sub> exchange in an East-African rangeland

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D762 | EGU2020-12657

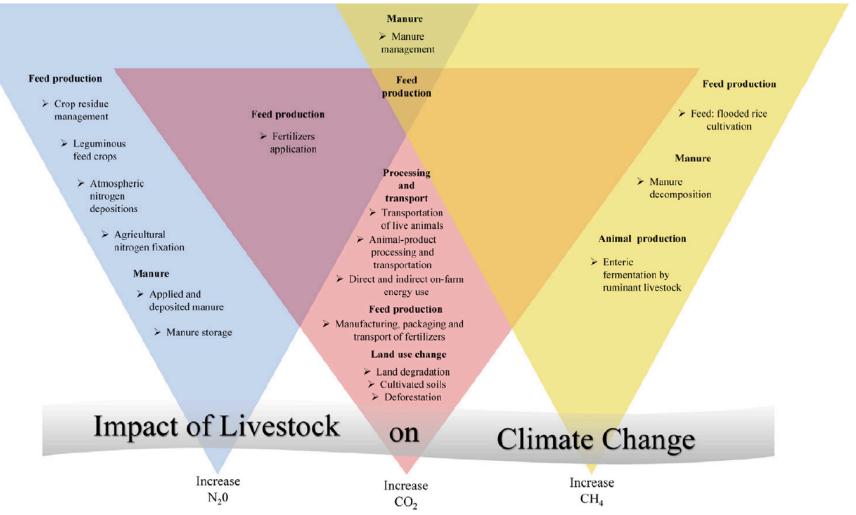


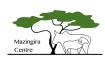






# Livestock Systems -> Climate Change





# Climate Change -> Livestock Systems

Increase of Temperature

#### Impact of Climate Change on Livestock Water Increase water consumption 2 to 3 times **Forage** Decrease nutrient availability Increase herbage growth on C4 species (30-35 °C) Increase Precipitation Decreases feed intake and efficiency of feed of CO2 conversion (mostly livestock that are fed large variation amounts of high-quality feeds) Production Forage Forage > High producing dairy cows decrease milk production Changes in Long dry Meat production in ruminants decreases because of a reduction in body size, herbage growth seasons carcass weight, and fat thickness (more effect on decrease: C3 species) Reproduction -Forage quality -Forage growth Decreases reproduction of cows, pigs and poultry of both sexes Decreases forage Diseases Forage -Biodiversity quality (more effect Reduce reproduction efficiency on hens and consequently egg > Increases: > Affect on C3 species) > Floods change: -Pathogens composition Health -Form & structure - Parasites > Positive effects on of pasture by: ➤ May induce high mortality in grazing cattle of roots -Disease spreading plants: -Shifting of seasonal pattern -Leaf growth rate -Disease transmission > New diseases may effect livestock immunity Partial stomata closure -Changing optimal growth rate -New diseases -Reduce transpiration Prolonged high temperature may affect -Changing availability of water -Outbreak of severe disease livestock health (e.g. Protein and lipid -Improve water-use -Spreading of vector-born efficiency metabolism, liver functionality) diseases



# Research question and approach

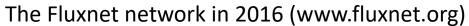


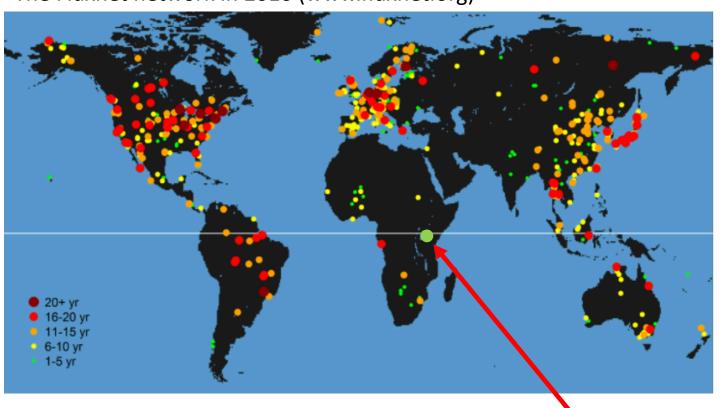
- Kapiti Research Station as a benchmark compared to many other (often) degraded) rangelands
- Ecosystem scale measurements of CO<sub>2</sub>, CH<sub>4</sub> to also include fauna and link to remote sensing/satellite products

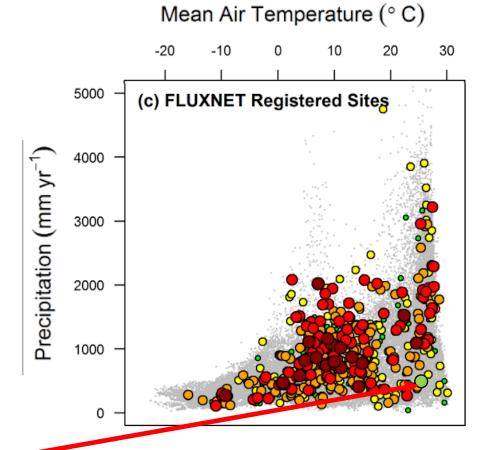




# Kapiti Research Station Flux site (hopefully soon to be in Fluxnet)





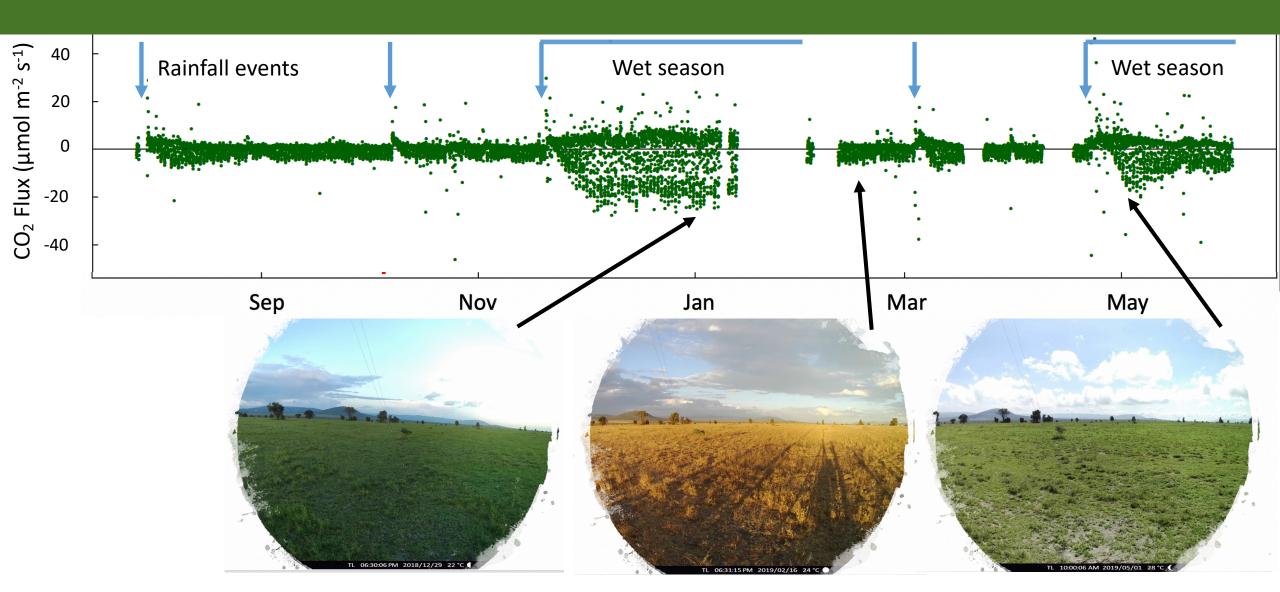


Climatic regions covered by fluxtowers

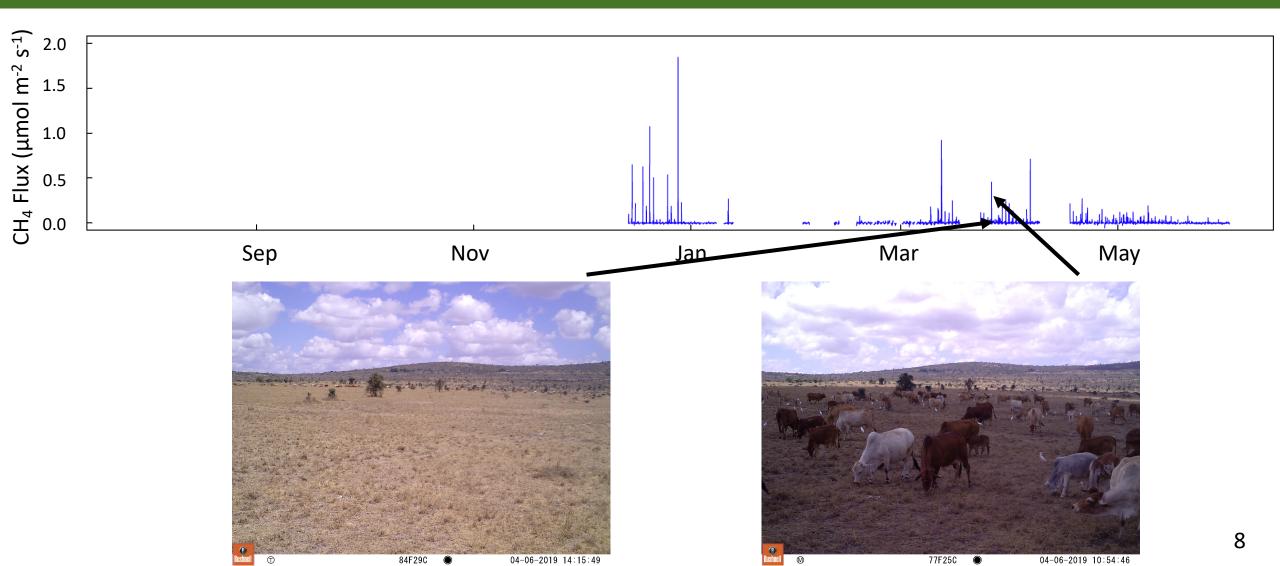


Kapiti Research Station (not yet registered)

# Effects of moisture on vegetation -> CO<sub>2</sub>



# Methane emissions depend on livestock presence



# Best guess "carbon budget" of the site

Average net CO<sub>2</sub>-C exchange: -0.5 g C m<sup>-2</sup> d<sup>-1</sup>

CO<sub>2</sub>-C Accumulation over 365 days: -182.5 g C m<sup>-2</sup>

Average net CH<sub>4</sub>-C exchange: 0.005 g C m<sup>-2</sup> d<sup>-1</sup> (this does account for livestock emissions at night when in enclosures – thus underestimated!)

CH<sub>4</sub>-C Accumulation over 365 days: 1.85 g C m<sup>-2</sup>

Global Warming Potential (CO<sub>2</sub>-eq.):

 $-139 \text{ g CO}_{2}\text{-C eq. m}^{-2} \text{ yr}^{-1}$ 



#### Next steps...

# delay in analysis due to COVID-19 and urgent contingency planning

- Data analysis for >1.5 years
- How to extrapolate CH<sub>4</sub> emissions from livestock to whole day and account for exclosures?
- Link to remote sensing products (wildlife & phenocameras)
- Assess the effects of irregular seasonality
- -> the site is currently not accessible

