Effects of temperature and lunar illumination on cattle activity and distance traveled from water at night by Corriente cattle

Cory G. Oltjen, Colin T. Tobin,
Derek W. Bailey

College of Agricultural, Consumer, and Environmental Sciences

Animal and Range Sciences

NM STATE

BE BOLD. Shape the Future.®

Objectives

- Hypothesis 1: High daytime temperature would increase nighttime activity, distance traveled, and distance from water.

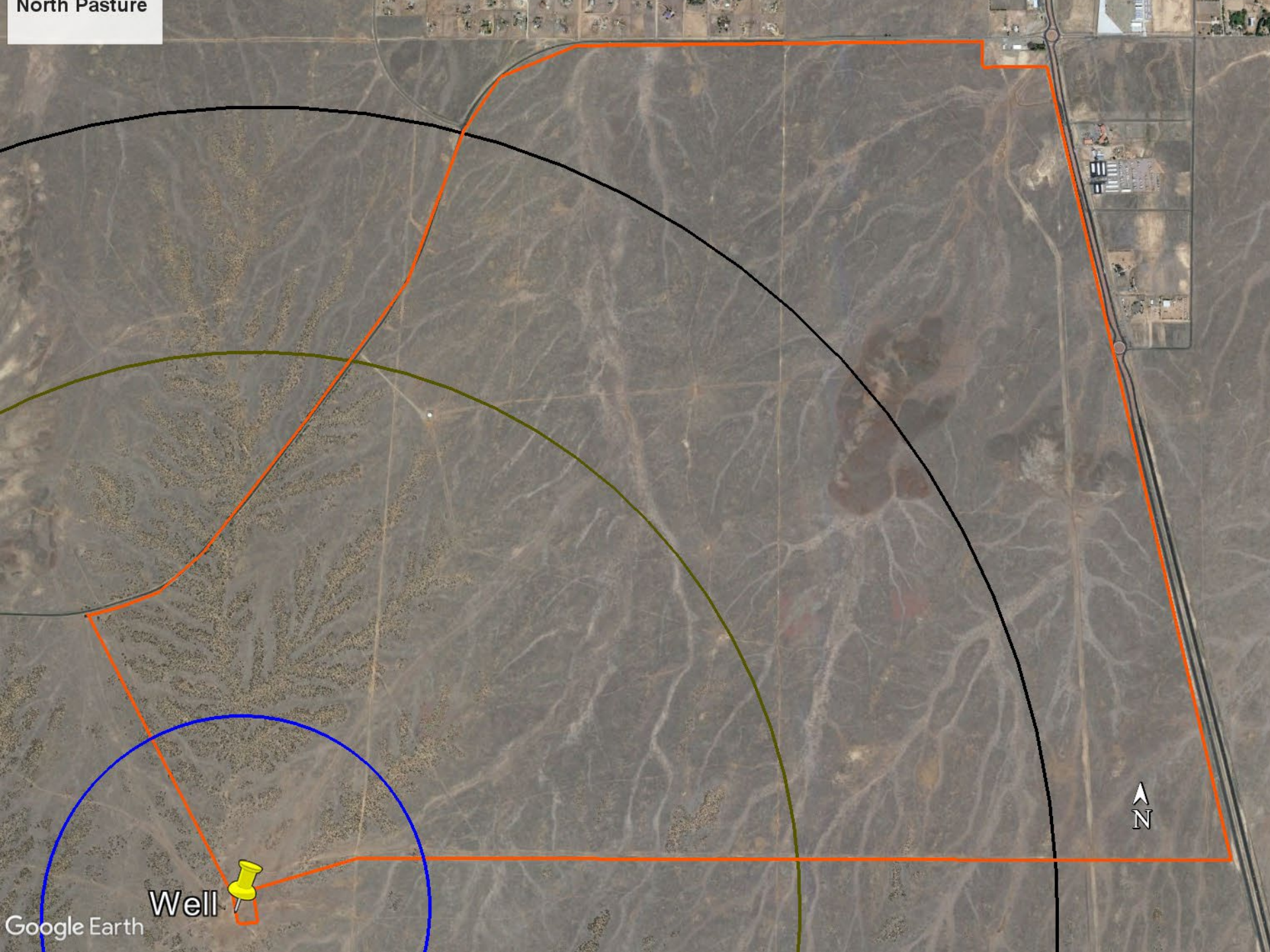
- Hypothesis 2: Temperature and Illumination interact, resulting in an increase in nighttime activity, distance traveled, and distance from water when illumination is greatest.

Cattle Distribution

- Biotic
  - Forage quality
  - Forage quantity
- Abiotic
  - Distance to water
  - Topography
  - Wind direction and speed
  - Temperature
    - Moon illumination
    - Temperature-moon interaction?

Study Location

- Deep Well Ranch
- Working Ranch
- North of Prescott Arizona
- Elevation 1430 to 1660 m


North Pasture
Well
N
Google Earth

Weather and Lunar Data

- Prescot airport weather was collected using Mesowest.
- Temperature was hourly averaged
- Only looked at night hours 10:00pm-3:59am.

- Illumination data was recorded from United States Naval Observatory at midnight

GPS collars

- One herd of ~120 cows
- GPS tracking collars with I-gotU-120 unit
- GPS units took locations every 10 minutes
- Data was cleaned with AnimalTracker App

Data

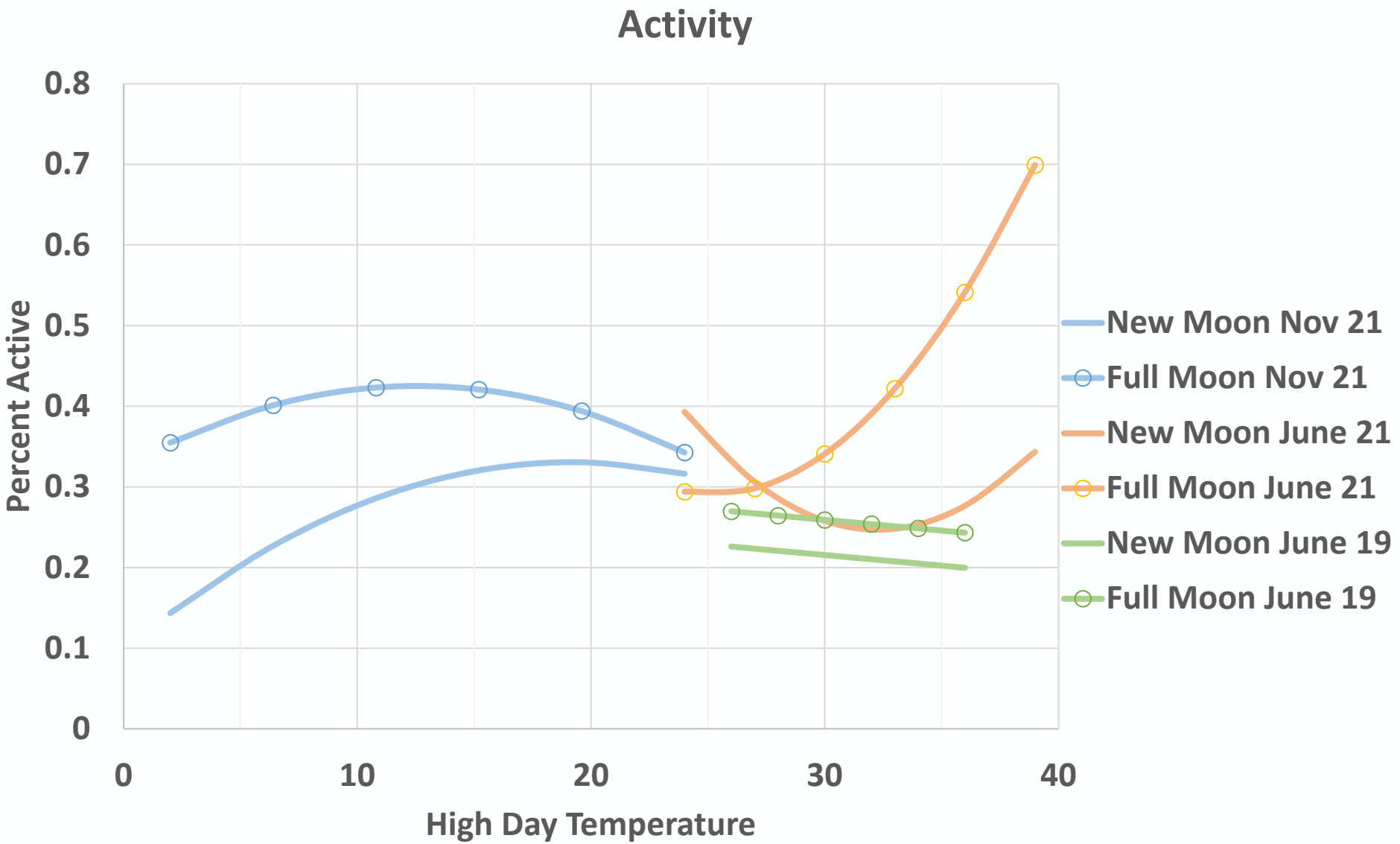
- Time range starting 2019 Jun. 5th, 66 days, 22 animals
- High temperature range 26°C to 36°C

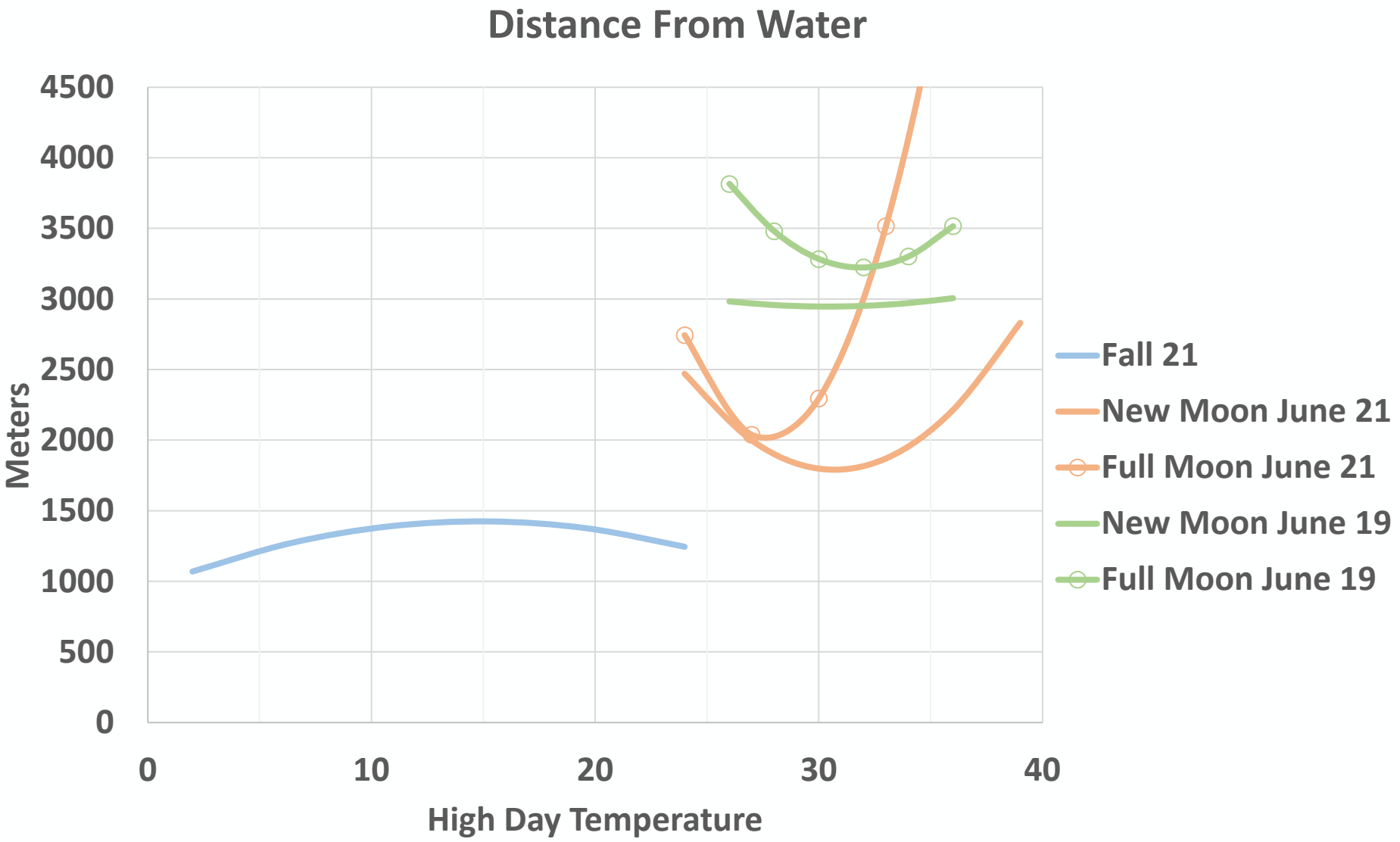
- Time range starting 2021 Jun. 7th, 67 days, 12 animals
- High temperature range 24°C to 39°C

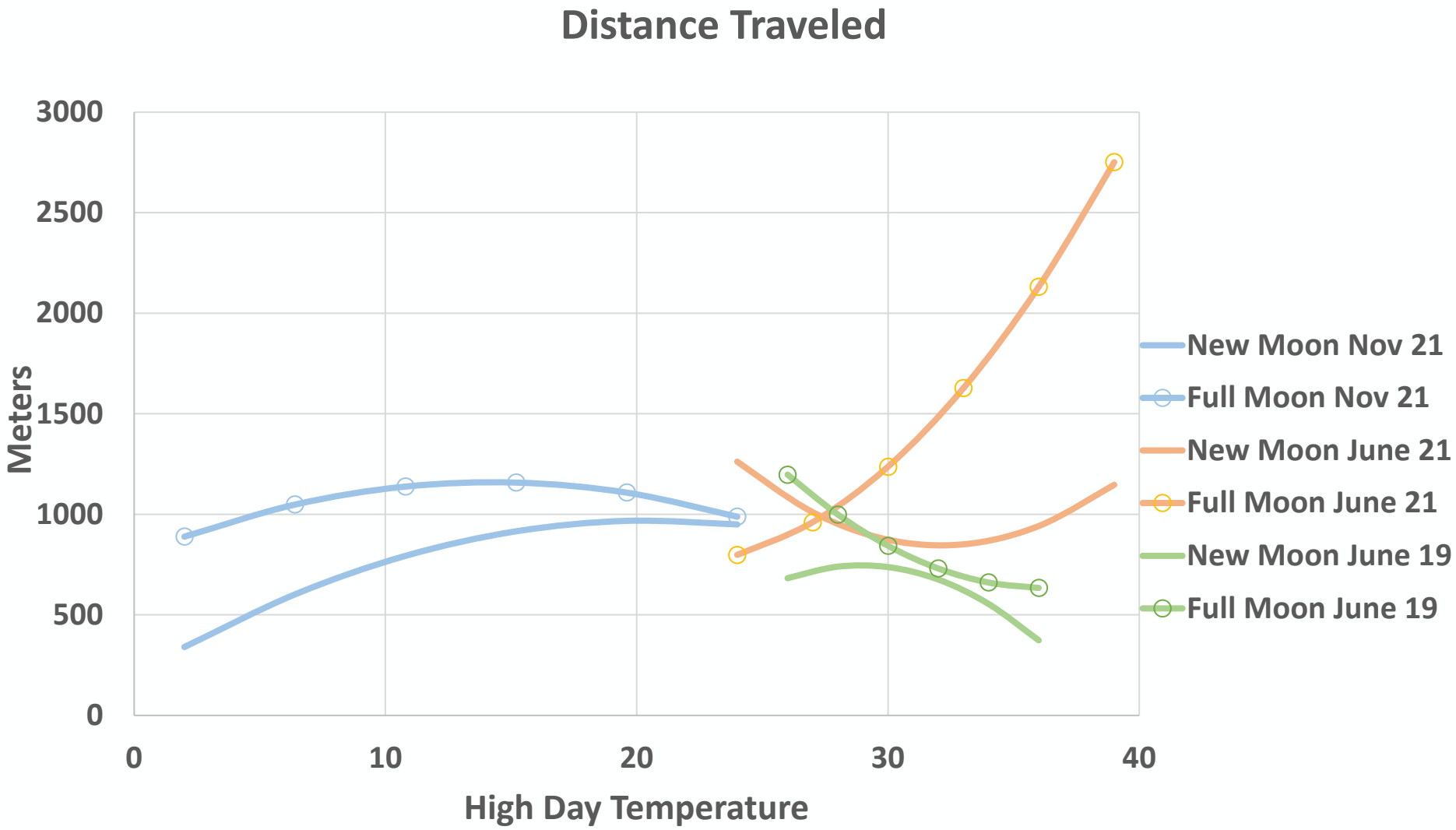
- Time range starting 2021 Nov. 3rd, 92 days, 6 animals
- High Temp range 2°C to 36°C

Nightly Model

- Statistical Model
  - Nightly Distance to water, distance traveled, activity = high day temperature, Illumination, and all squared terms and their interactions
  - Repeated Subject = Individual animal each night
  - Covariance Structure = Autoregressive


Activity
Percent Active
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
High Day Temperature
New Moon Nov 21
Full Moon Nov 21
New Moon June 21
Full Moon June 21
New Moon June 19
Full Moon June 19


Distance From Water
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Meters
0
10
20
30
40
High Day Temperature
Fall 21
New Moon June 21
Full Moon June 21
New Moon June 19
Full Moon June 19


Distance Traveled
3000
2500
2000
1500
1000
500
0
Meters
0
10
20
30
40
High Day Temperature
New Moon Nov 21
Full Moon Nov 21
New Moon June 21
Full Moon June 21
New Moon June 19
Full Moon June 19

Conclusions

- While high day temperature influences nighttime cattle metrics, illumination appears to have a more consistent affect.

  In all cases more illumination increases activity, distance traveled, and distance from water at night.

- Because it is a working ranch sample size and time could be affecting results

Contact Information

Cory Oltjen

College of Agricultural, Consumer, and Environmental Sciences

Range Science

cgoltjen@nmsu.edu

We would like to thank the Harold James Family Trust and Deep Well Ranch for financial and logistical support for this research project.