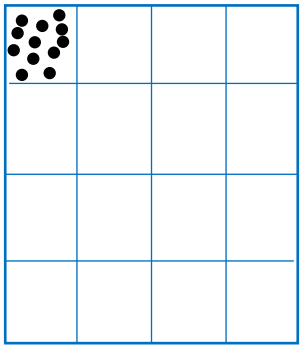
Holistic Planned Grazing™ and the herd effect: an ox's-eye view

Zander Venter
Michael Cramer
Heidi Hawkins

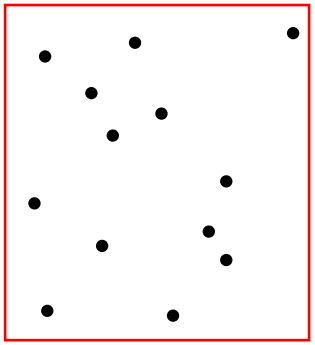
GSSA 2017

BACKGROUND

Holistic Planned Grazing:



Conventional systems:



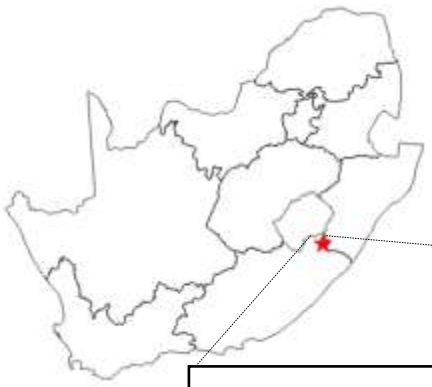
BACKGROUND

“The behaviour of the animals clearly changes at such densities – their hooves break up capped soils and knock down old plants. Though we cannot say for sure why it does, we do know it is related to the large numbers and the limited grazing space....” – Alan Savory 1998

"...the mythical herd effect which supposedly develops when large numbers of animals are grouped together remains a contentious issue....“ – N Tainton 1985

“herd effect”

STUDY SITE



Merino Walk farm,
Cedarville,
Eastern Cape

Overall stocking rate: 0.5 LSU/ha

Grazing densities:

Season-long

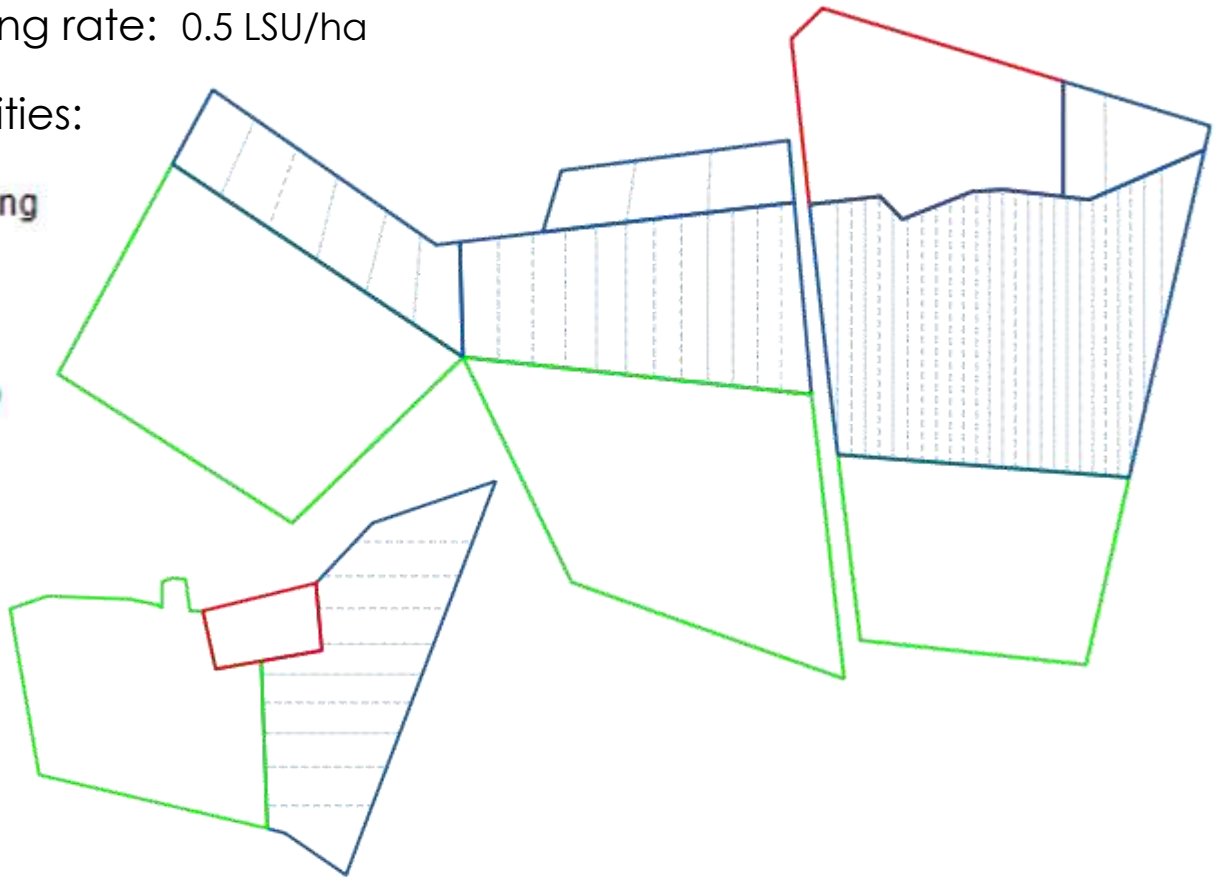
~ 0.75 LSU/ha

Four camp

~ 5 LSU/ha

Holistic

~ 25 LSU/ha



STUDY SITE

Satellite imagery NDVI:

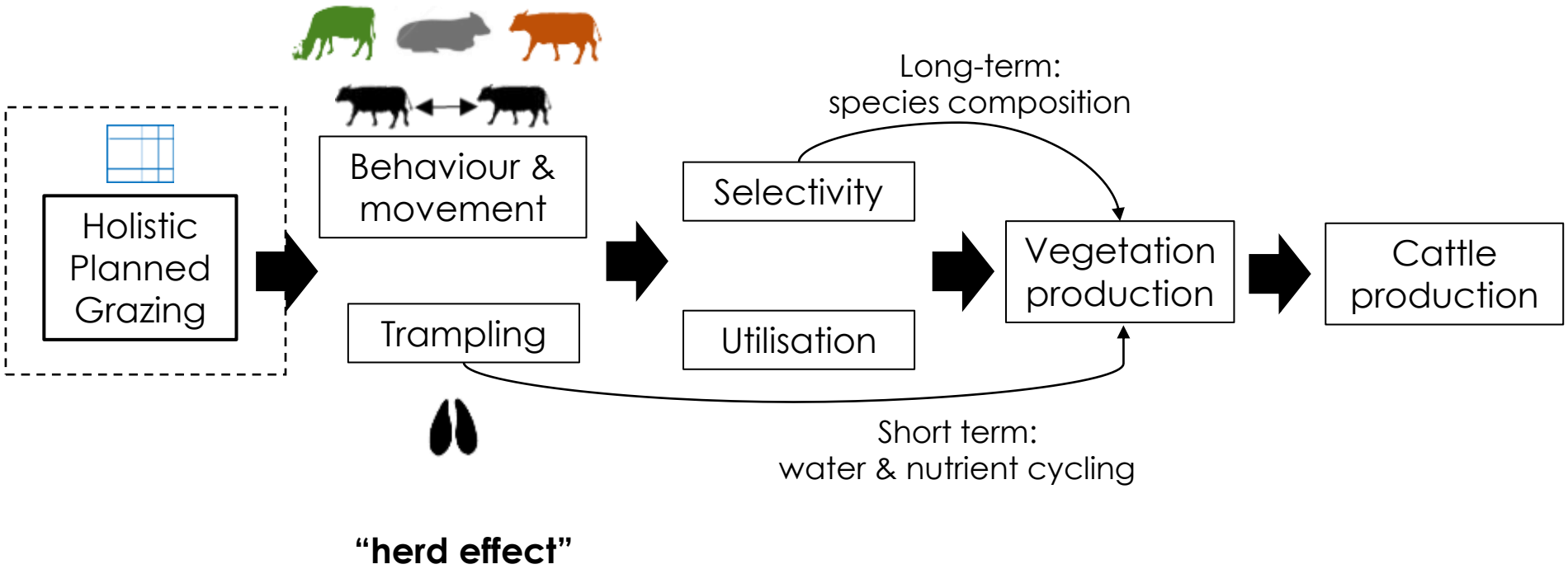
STUDY SITE

Satellite imagery NDVI & cattle GPS points:

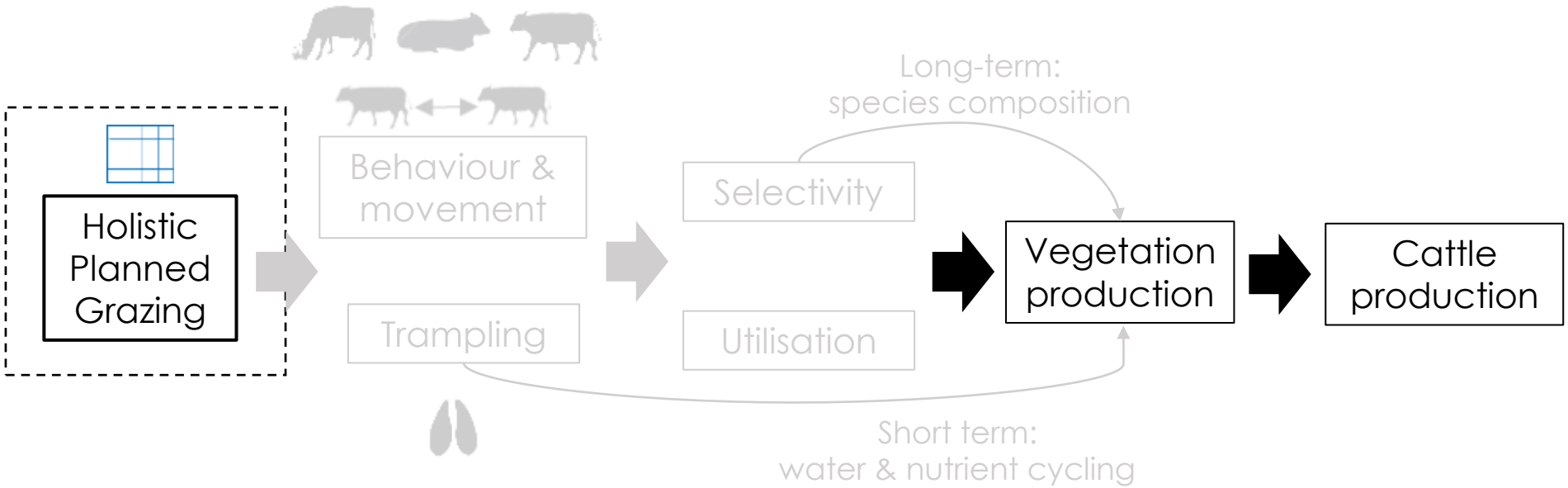
STUDY SITE

On the ground:

Holistic Planned Grazing claims

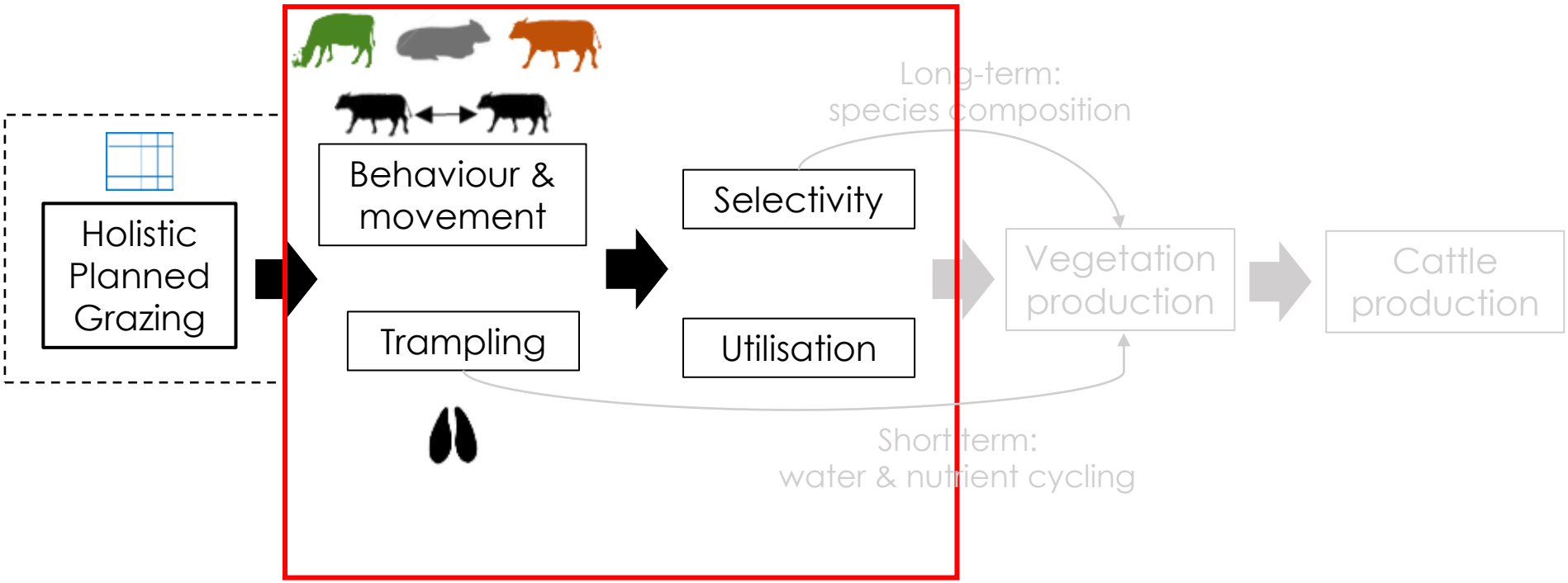


Holistic Planned Grazing claims



- Literature on **vegetation and cattle production**:
  - Increase (e.g. Teague et al. 2011, 2013)
  - No change or decrease (e.g. Hart et al. 1988, McCollum et al. 1999; Tainton et al 2013; Briske et al. 2008, 2014; Hawkins 2017)

HYPOTHESES



- Little to no research on **behavioural mechanisms ("herd effect")**: trampling, animal behaviour, selectivity ?

1. Behaviour & movement

↑ time spent grazing at greater proximity to neighbour

2. Trampling

↑ steps taken and consequent dung trampling

3. Utilisation

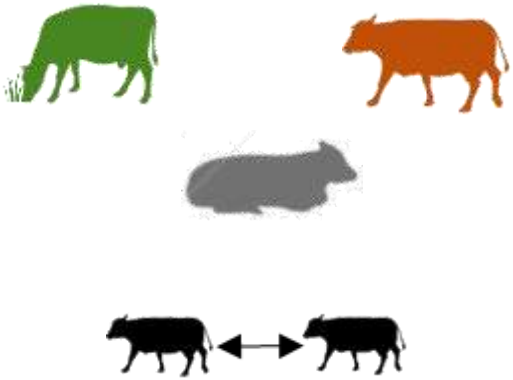
↑ utilisation of standing biomass

4. Selectivity

↓ grazing selectivity at the plant and patch scale

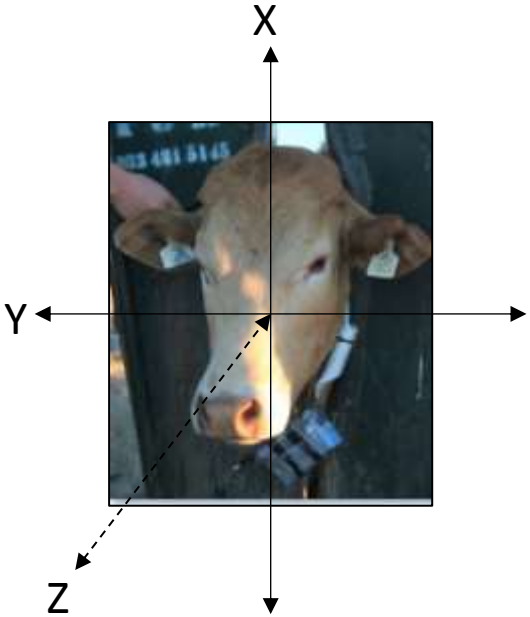
Behavioural measurements

Observations:



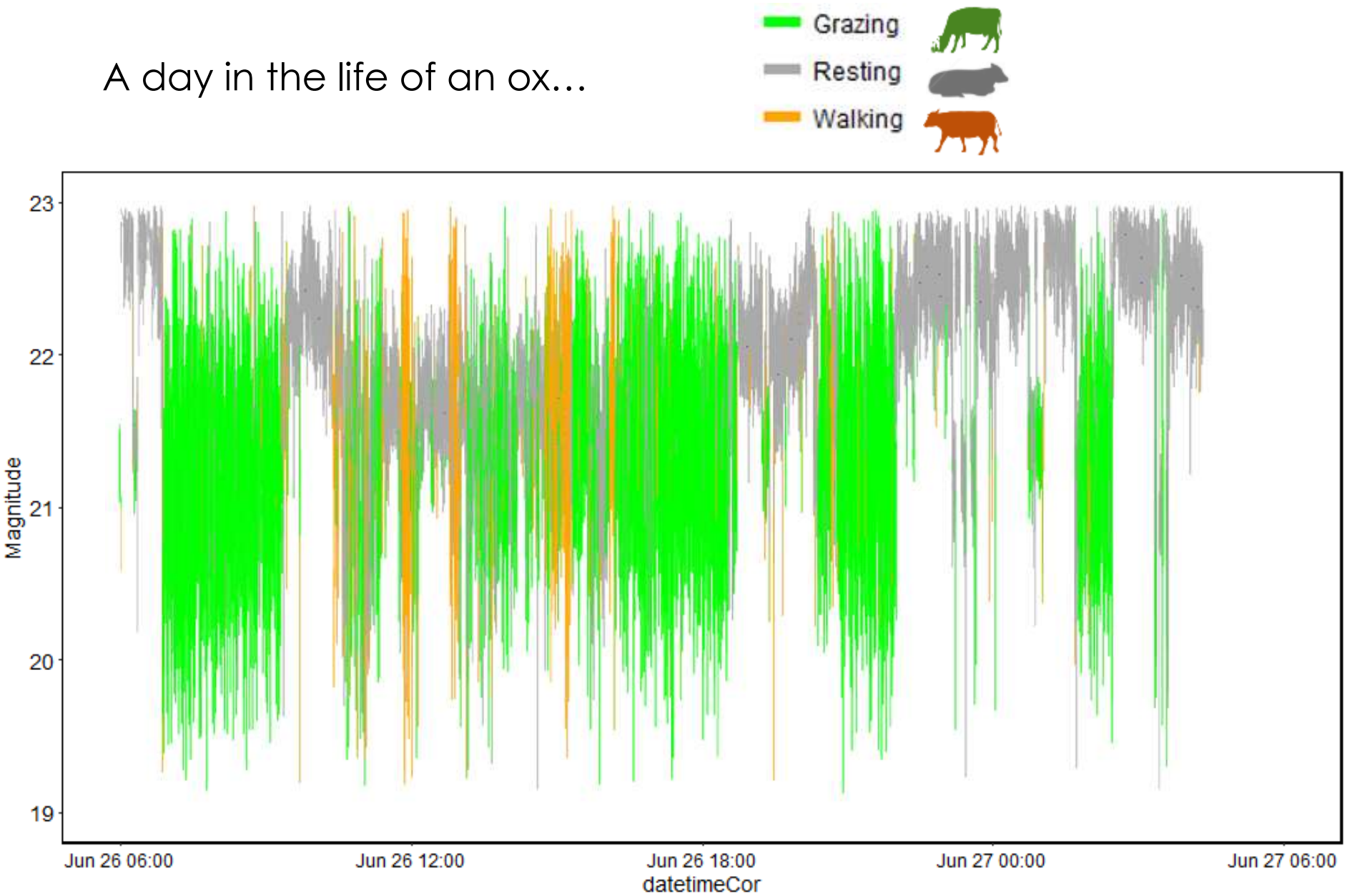
GPS trackers:

Tri-axial accelerometers:



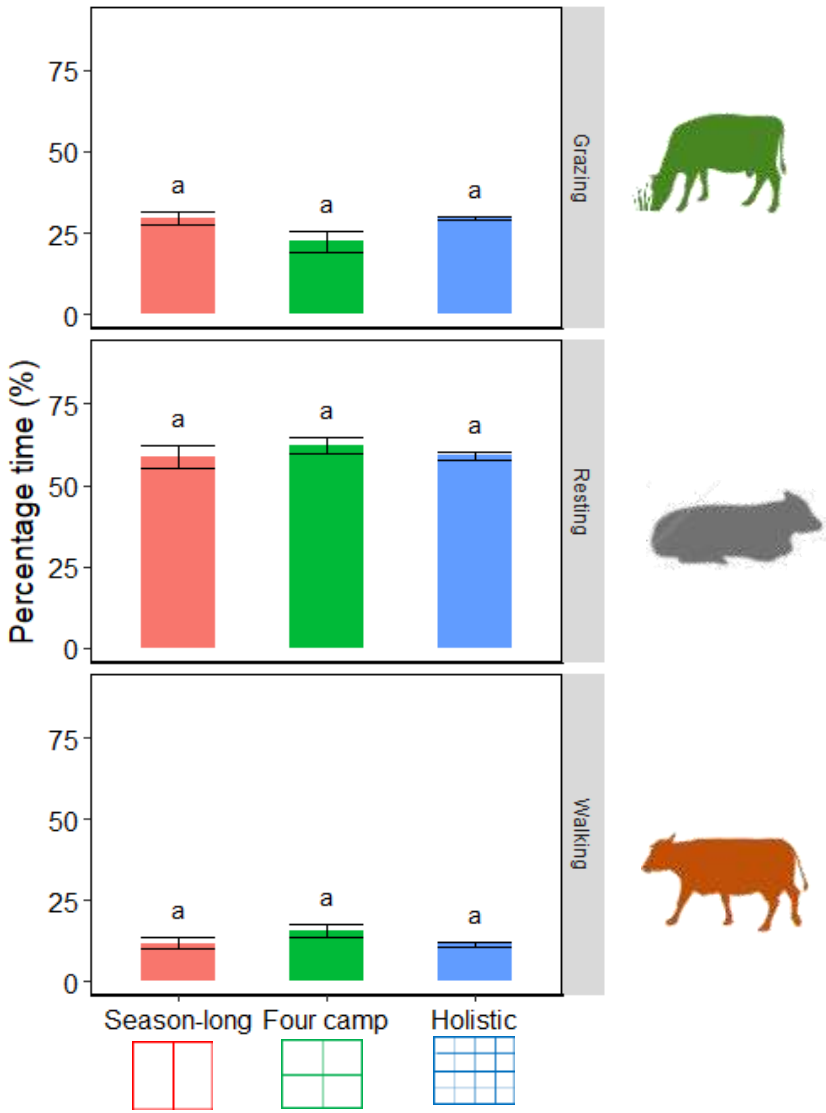
Hypothesis 1: Increased time grazing and proximity

A day in the life of an ox…

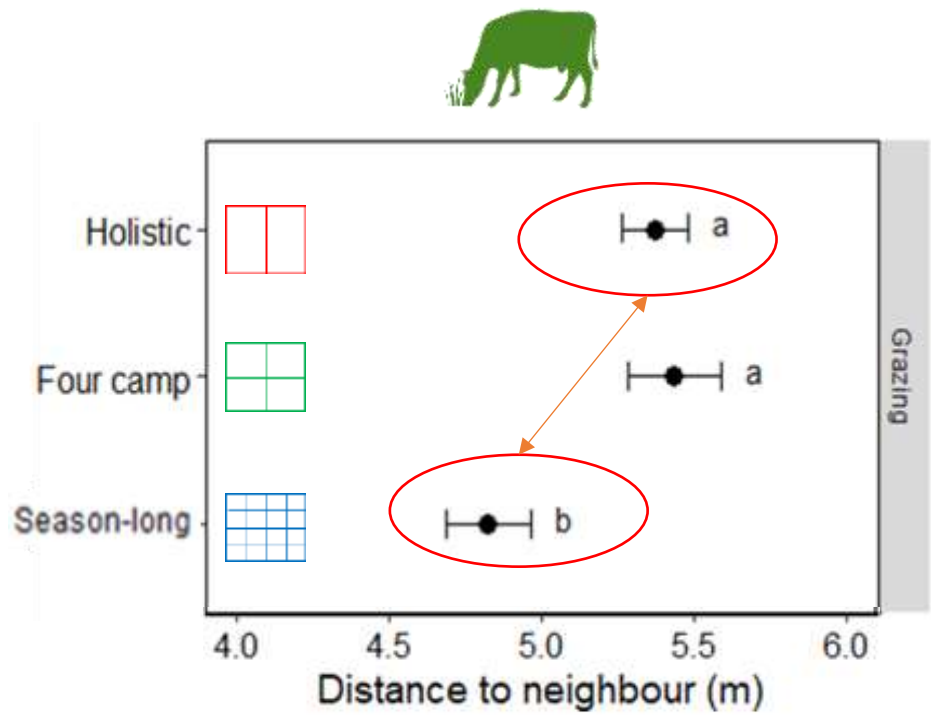


Hypothesis 1: Increased time grazing and proximity

Activity monitor – behaviour



Proximity to neighbour:

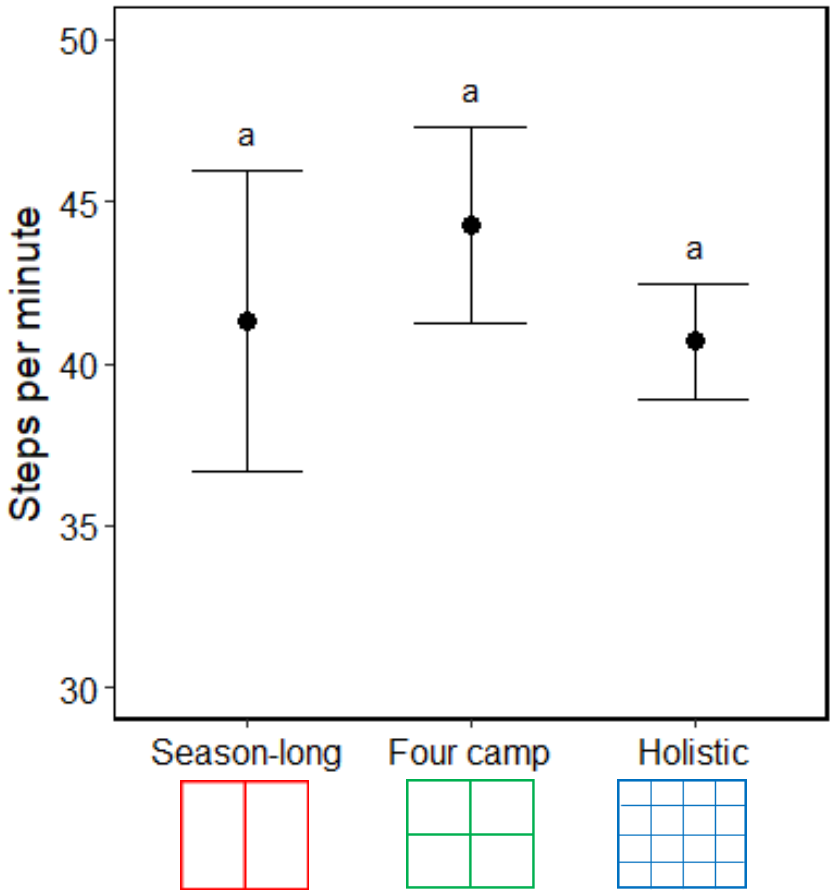


- HPG graze in more dispersed herds than season-long

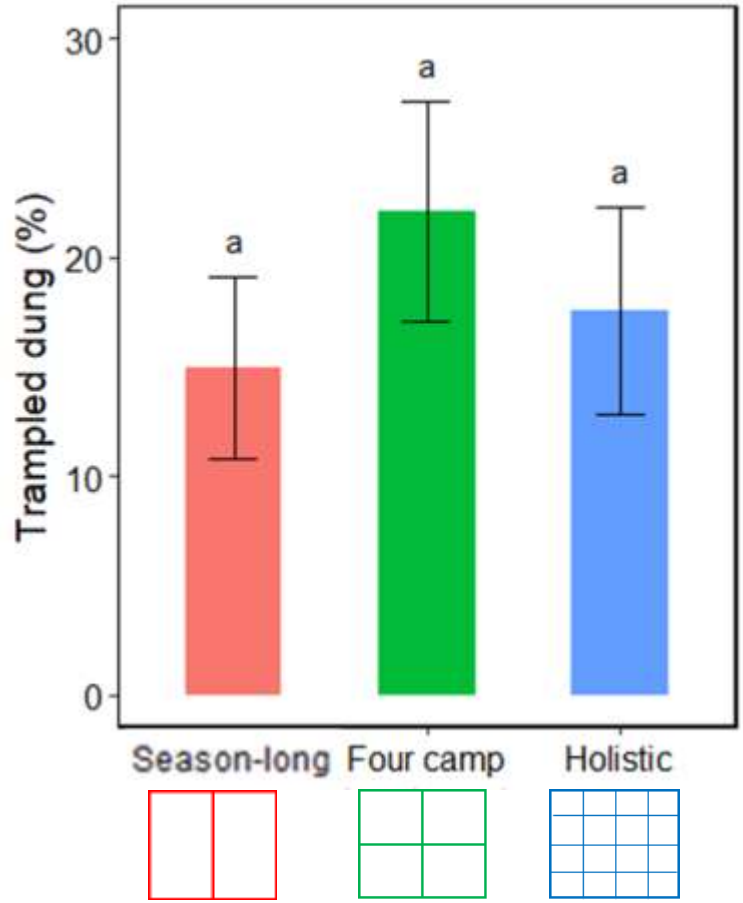
- No difference in time spent grazing

Hypothesis 2: Increased steps taken and dung trampled

Steps per minute:



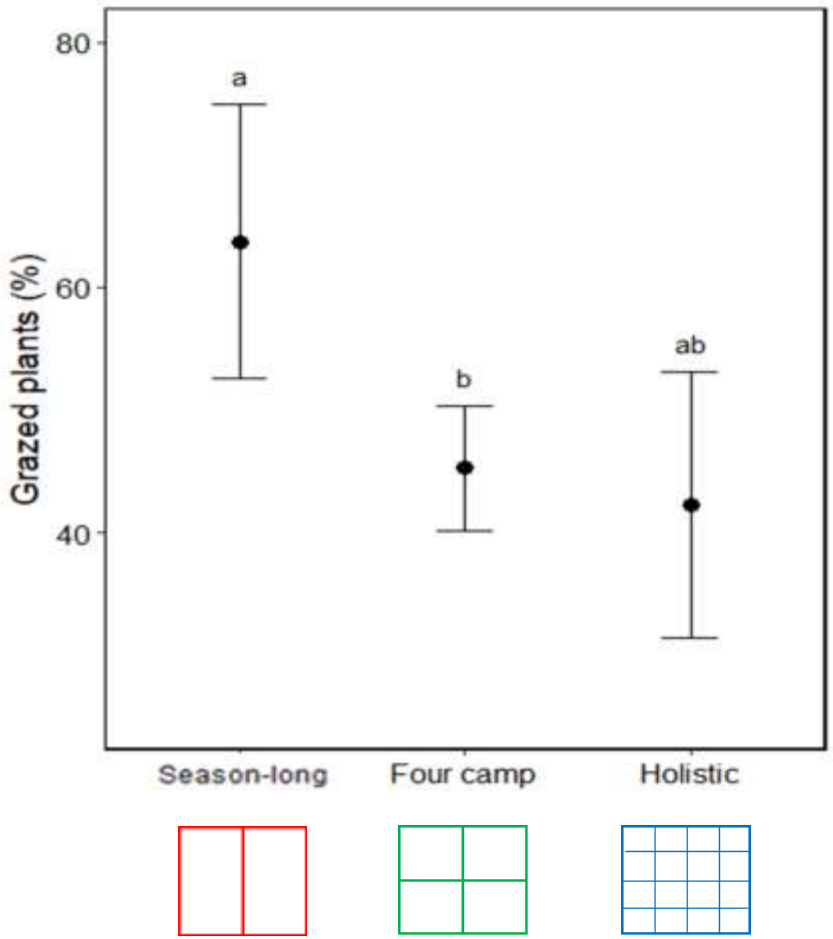
Dung trampling:



- No difference in number of steps taken
- No difference in dung trampling

Hypothesis 3: Increased utilisation of standing biomass

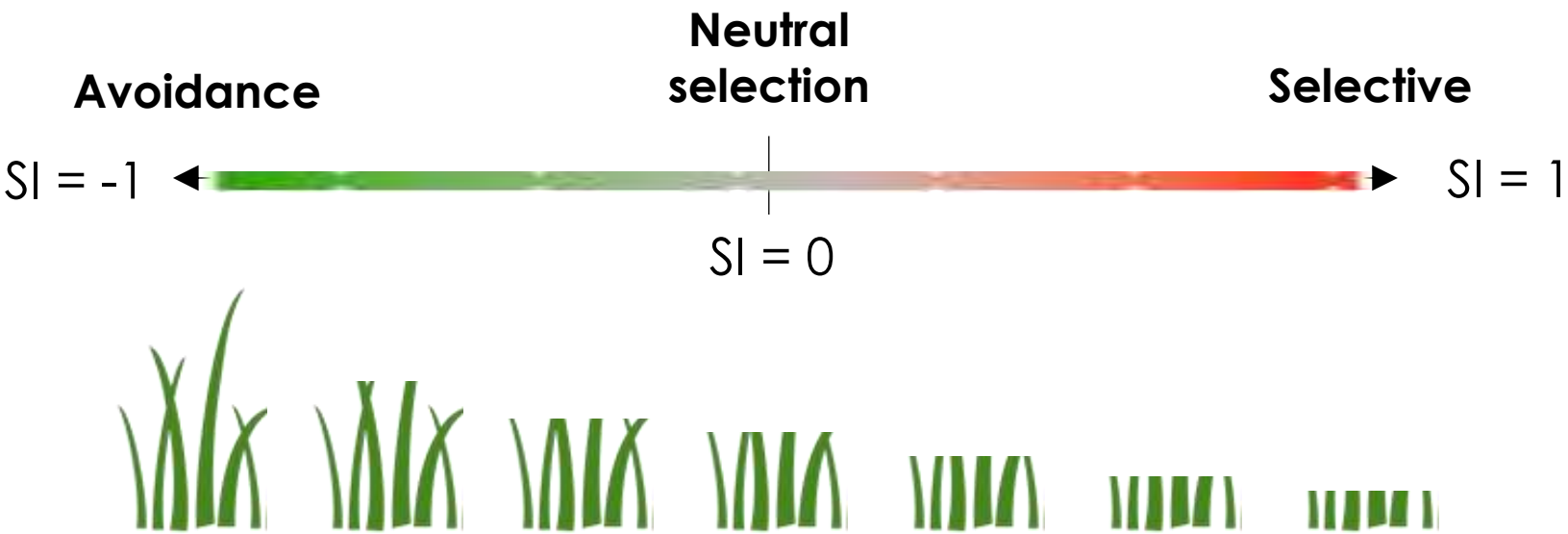
Utilisation: % plants grazed



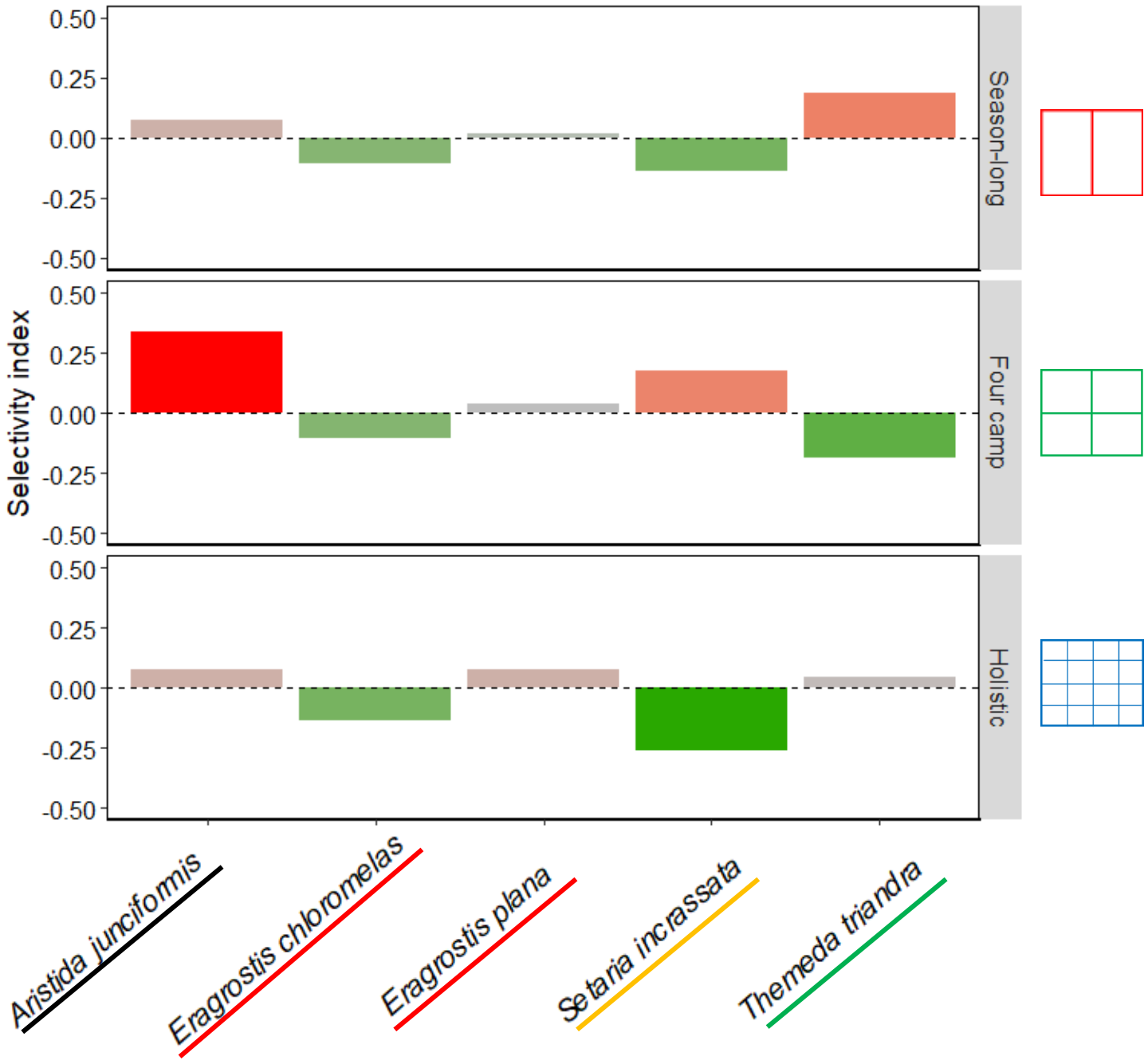
- No difference in utilisation of available forage

Hypothesis 4.1: Decrease selectivity at the plant scale

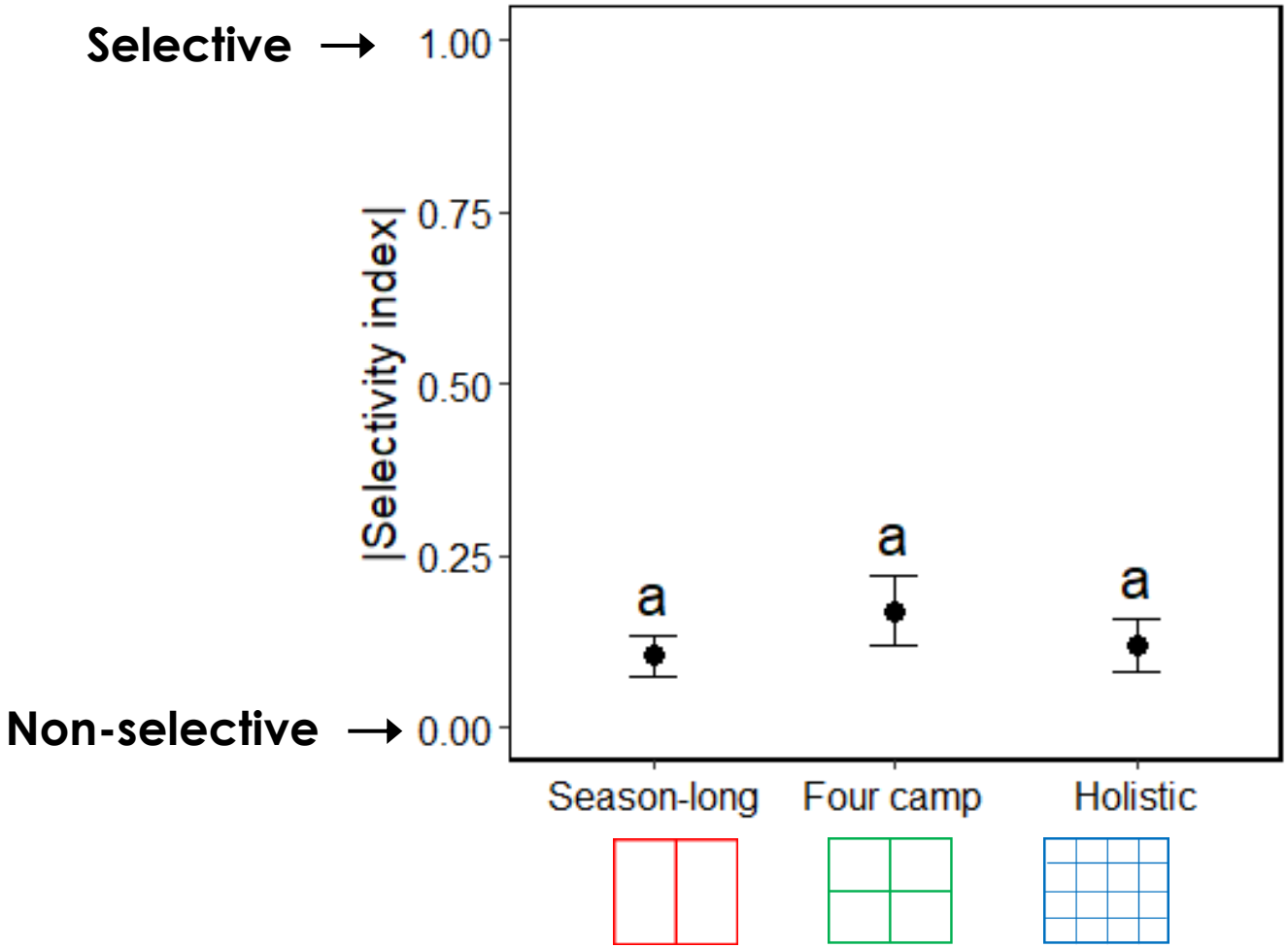
Selectivity index (Ivlev 1964):



Hypothesis 4.1: Decrease selectivity at the plant scale



Hypothesis 4.1: Decrease selectivity at the plant scale



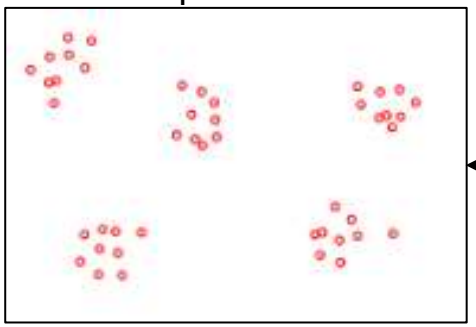
- No difference in selectivity at the plant scale

Hypothesis 4.2: Decrease selectivity at the patch scale

GPS points:

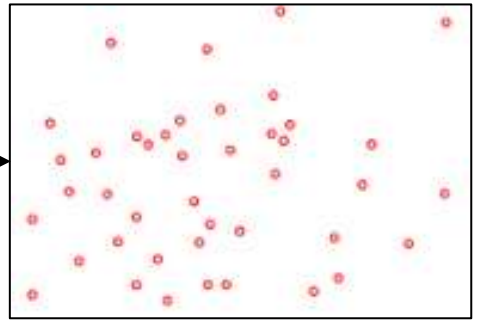
Clark-Evans aggregation index (R) :

Clumped R ≤ 1



More selective

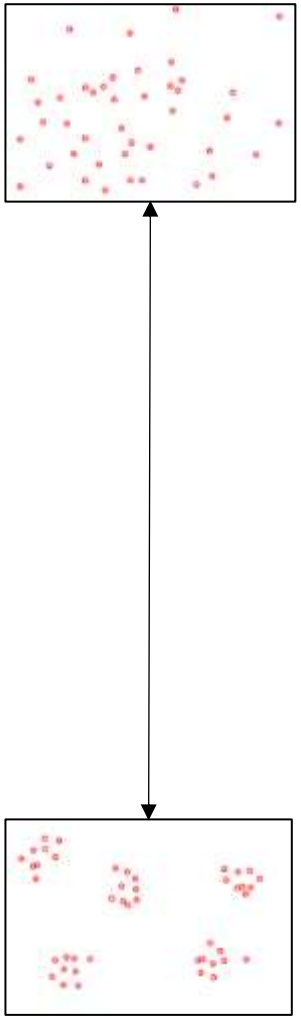
Random R ≥ 1



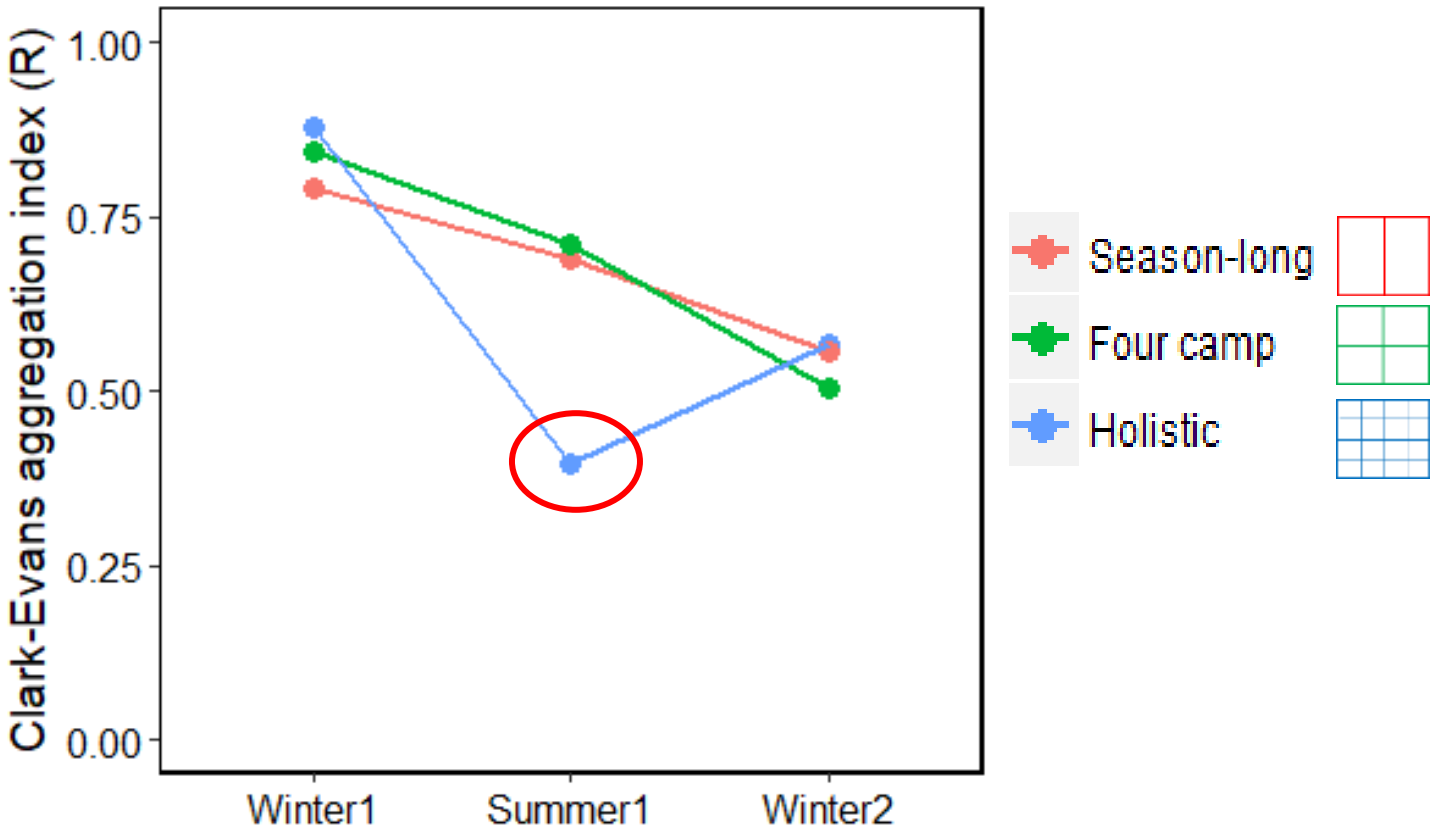
Less selective

Hypothesis 4.2: grazing selectivity at the patch scale

Random R ≥ 1



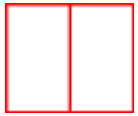
Clumped R ≤ 1



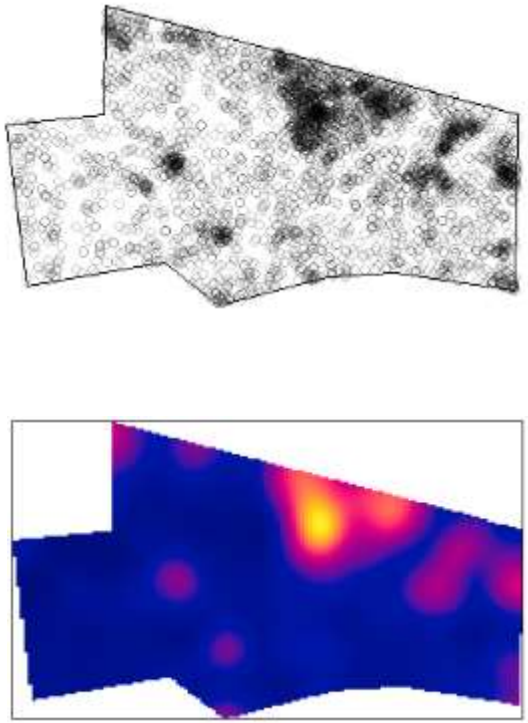
- HPG did not reduce selectivity at the patch scale

Hypothesis 4.2: grazing selectivity at the patch scale

Example: Summer 2017

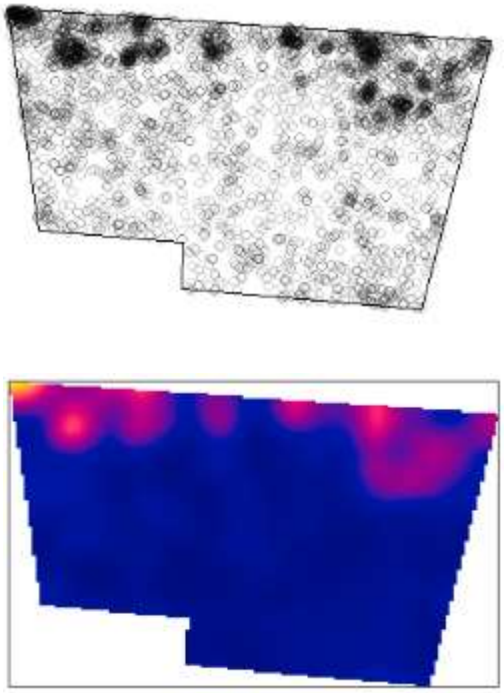


Season-long:

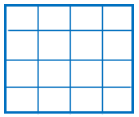


R = 0.689

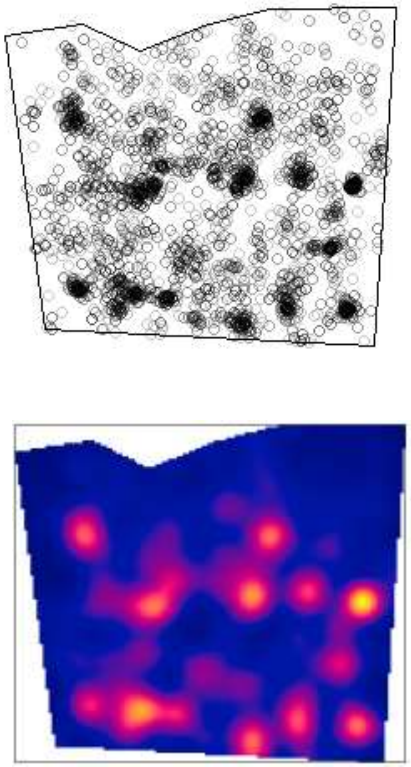
Four camp:



R = 0.711



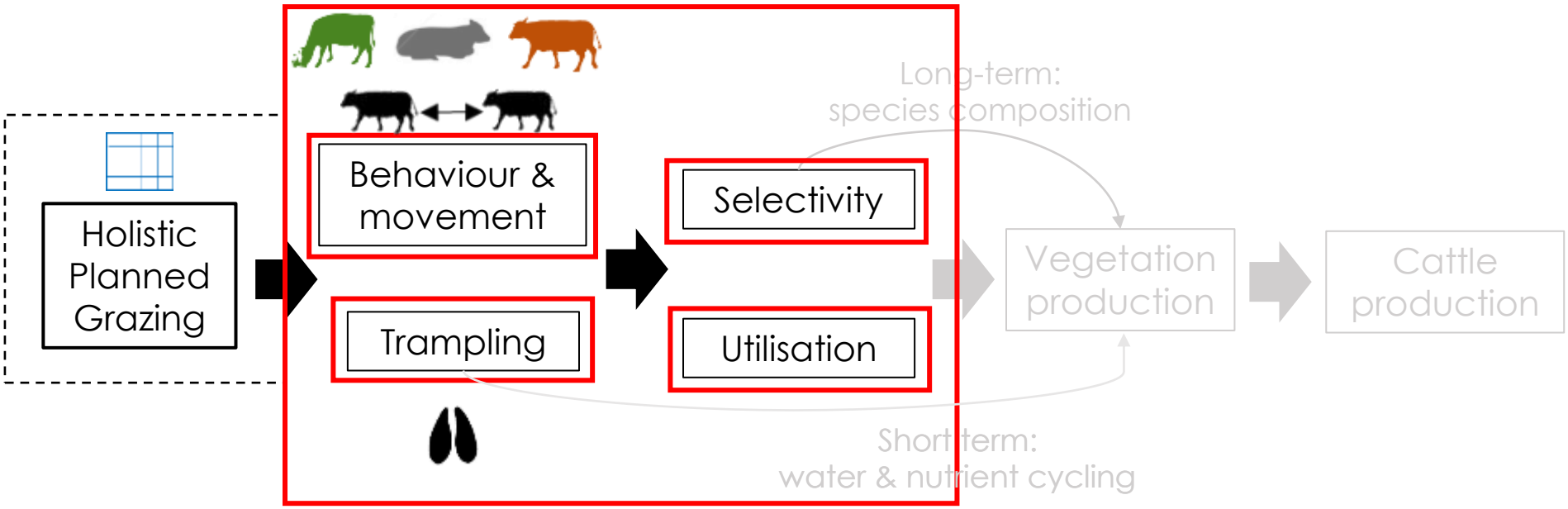
Holistic:



R = 0.395

- HPG did not reduce selectivity at the patch scale

Conclusions



- **No evidence for the "herd effect" as a mechanism**

1

No effect on time spent grazing

Graze in looser herds compared to season-long grazing

2

No effect on number of steps taken

No effect on dung trampling

3

No effect on utilisation of standing biomass

4

No effect on selectivity at the plant and patch scale

Implications

- Advocacy for high-density-grazing approaches to achieve the mythical "herd effect" is questionable

Questions:

Zander Venter | zander.v@hotmail.com |0727381595

Acknowledgements:

UMZIMVUBU CATCHMENT PARTNERSHIP PROGRAMME

GreenMatter

THE OPPENHEIMER MEMORIAL TRUST

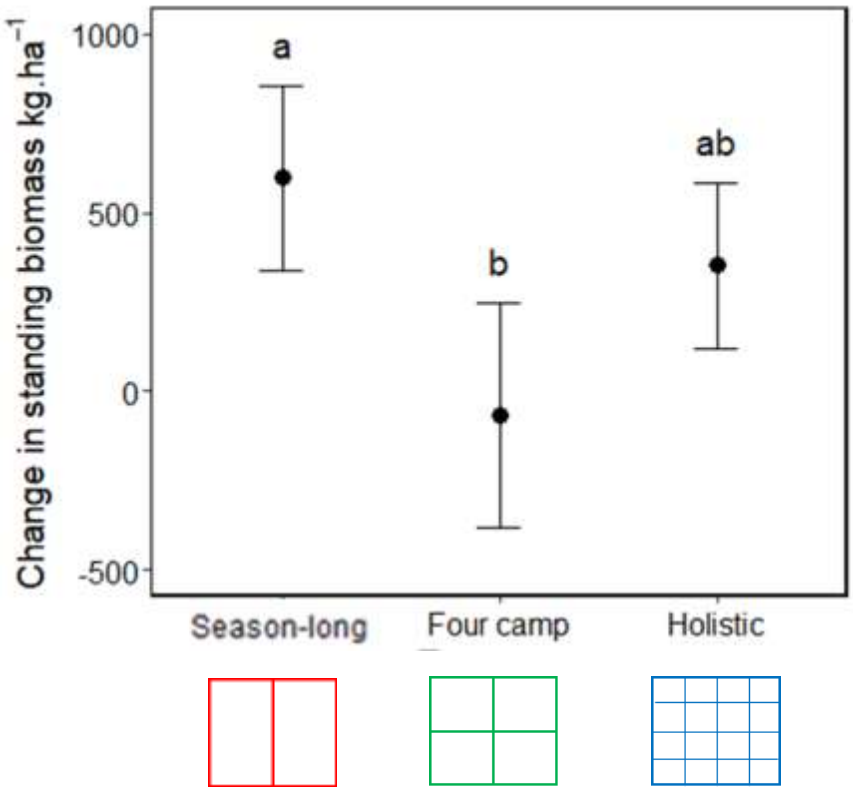
RMRD SA

CAPE WOOLS SA

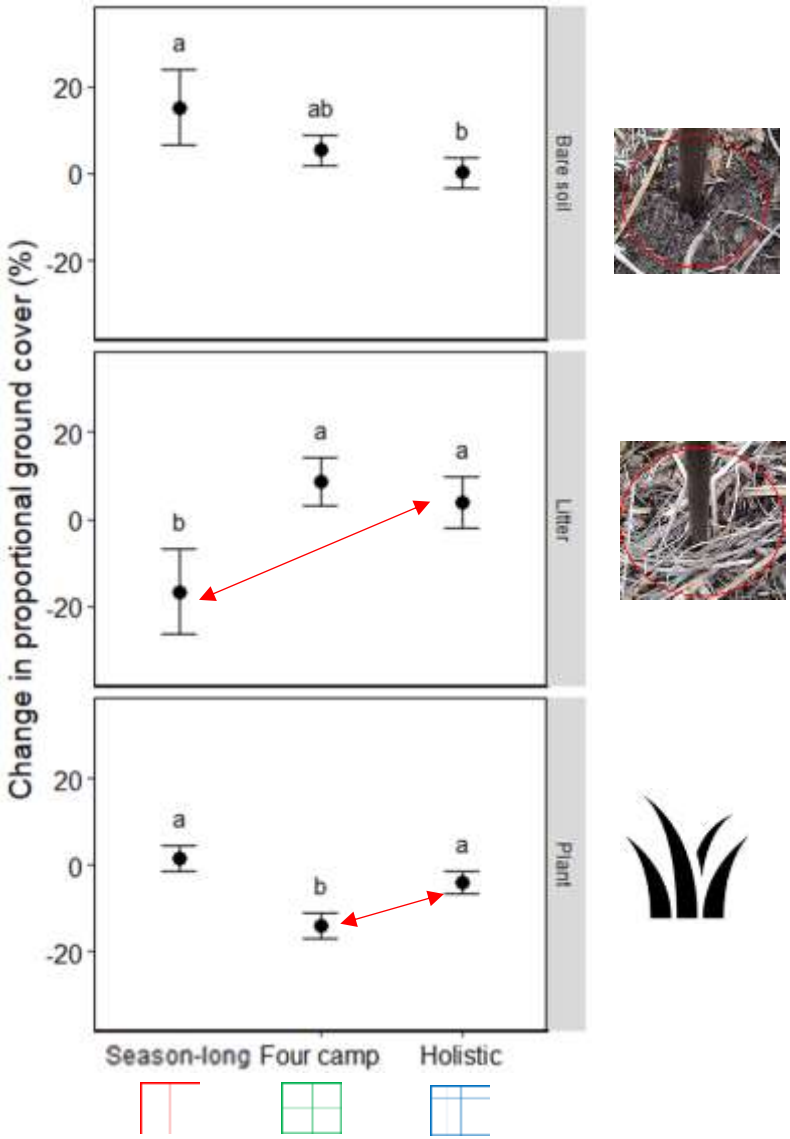
Extra slides…..

Vegetation production

Standing biomass:



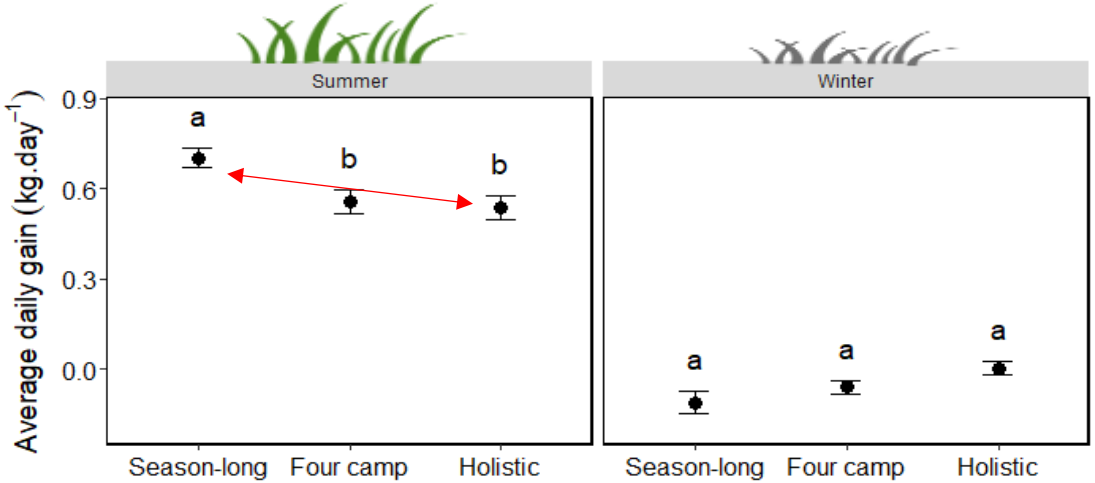
Basal cover:

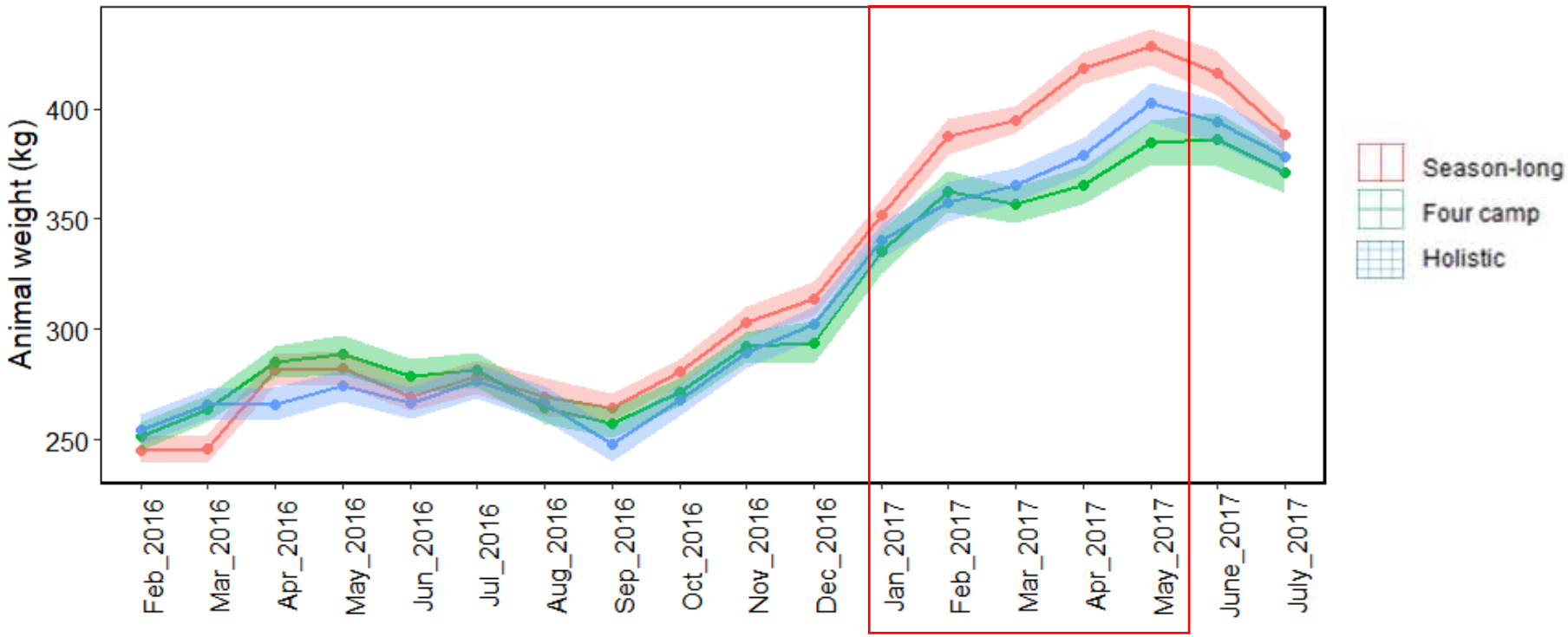


- HPG did not increase biomass
- HPG contributed to increased litter and basal cover

Animal production

Animal weigh gain:





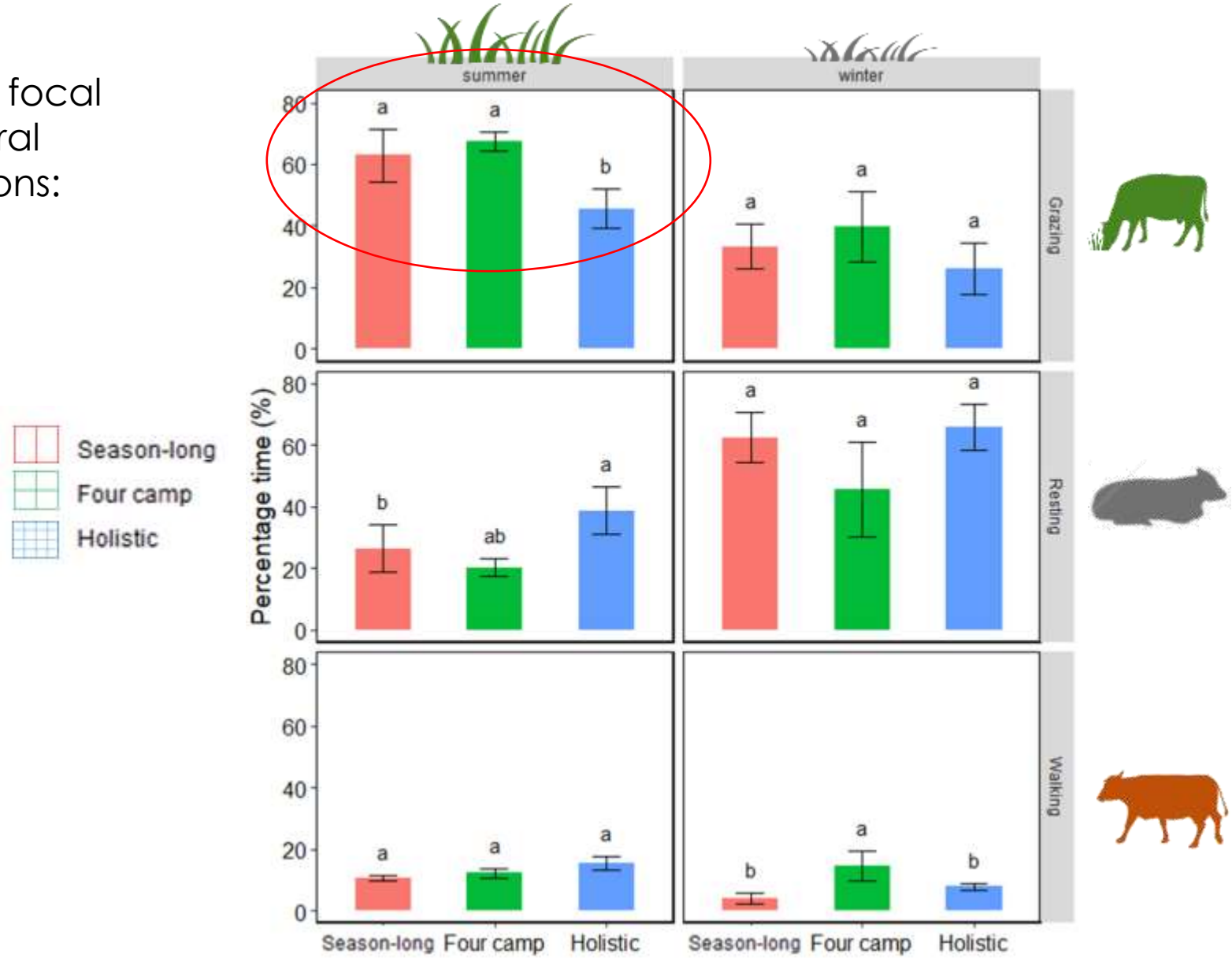
- HPG did not increase animal production

Cattle weight gain across breeds:

```
> Anova(lmm)
Analysis of Deviance Table (Type II Wald chisquare tests)

Response: mean_adg
             Chisq Df Pr(>Chisq)
Treatment   1.6063  2     0.4479
Season    286.6817  1     <2e-16 ***
Breed       1.3197  3     0.7245
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Behavioural observations

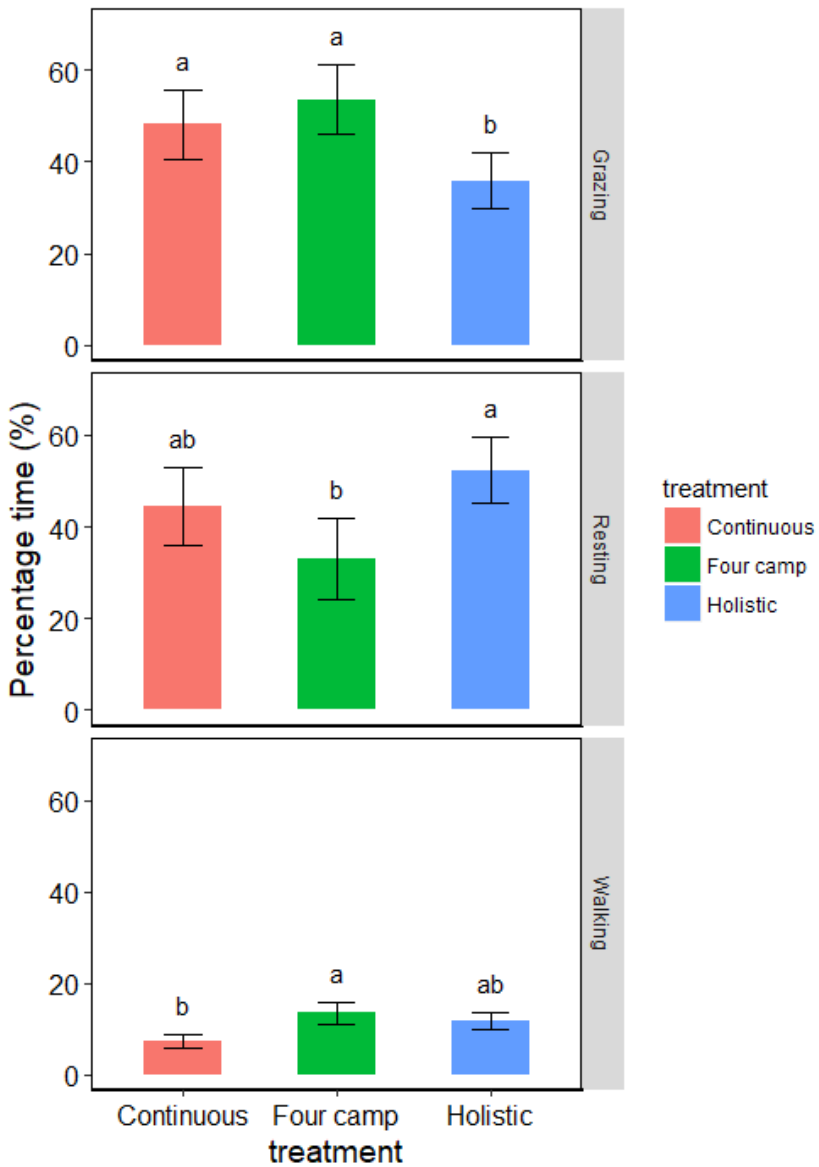
Scan and focal behavioural observations:



- HPG cattle spend less time grazing relative to other systems in summer

Behavioural observations

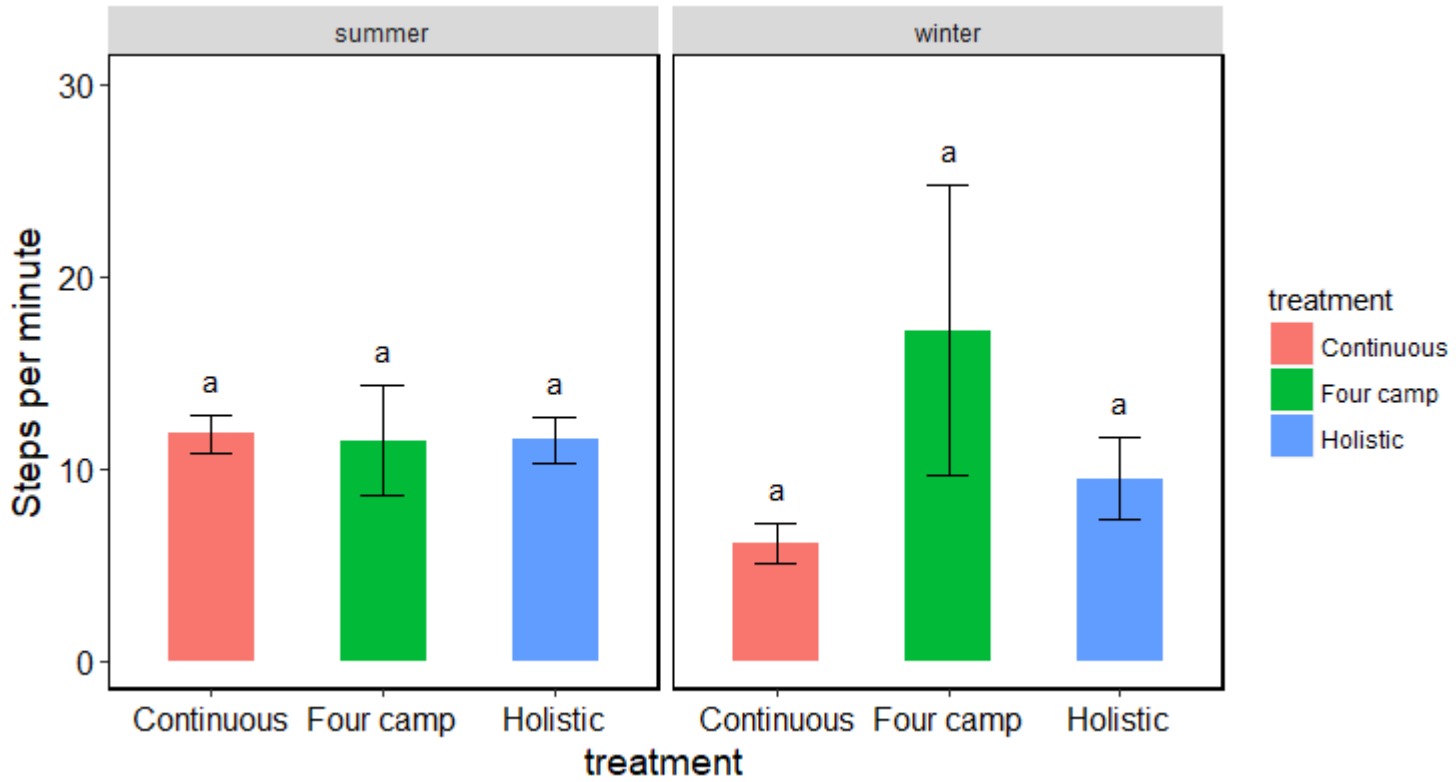
Scan & Focal combined




```
> Anova(pql)
Analysis of Deviance Table (Type II tests)

Response: p_duration
           Chisq Df Pr(>Chisq)
treatment  0.1309  2  0.9366557
season     0.0217  1  0.8829804
behaviour 17.0929  2  0.0001942 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’
>
```

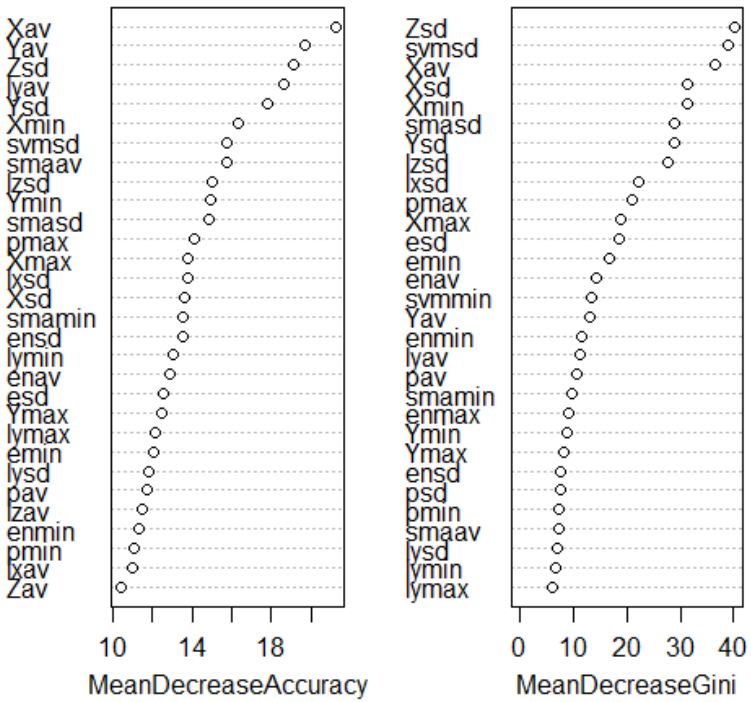
Behavioural observations

Step counts: in between scan samples and focal samples, count the number of steps the focal individual takes over 2 minutes. This is repeated over 8 hrs for 2 days.



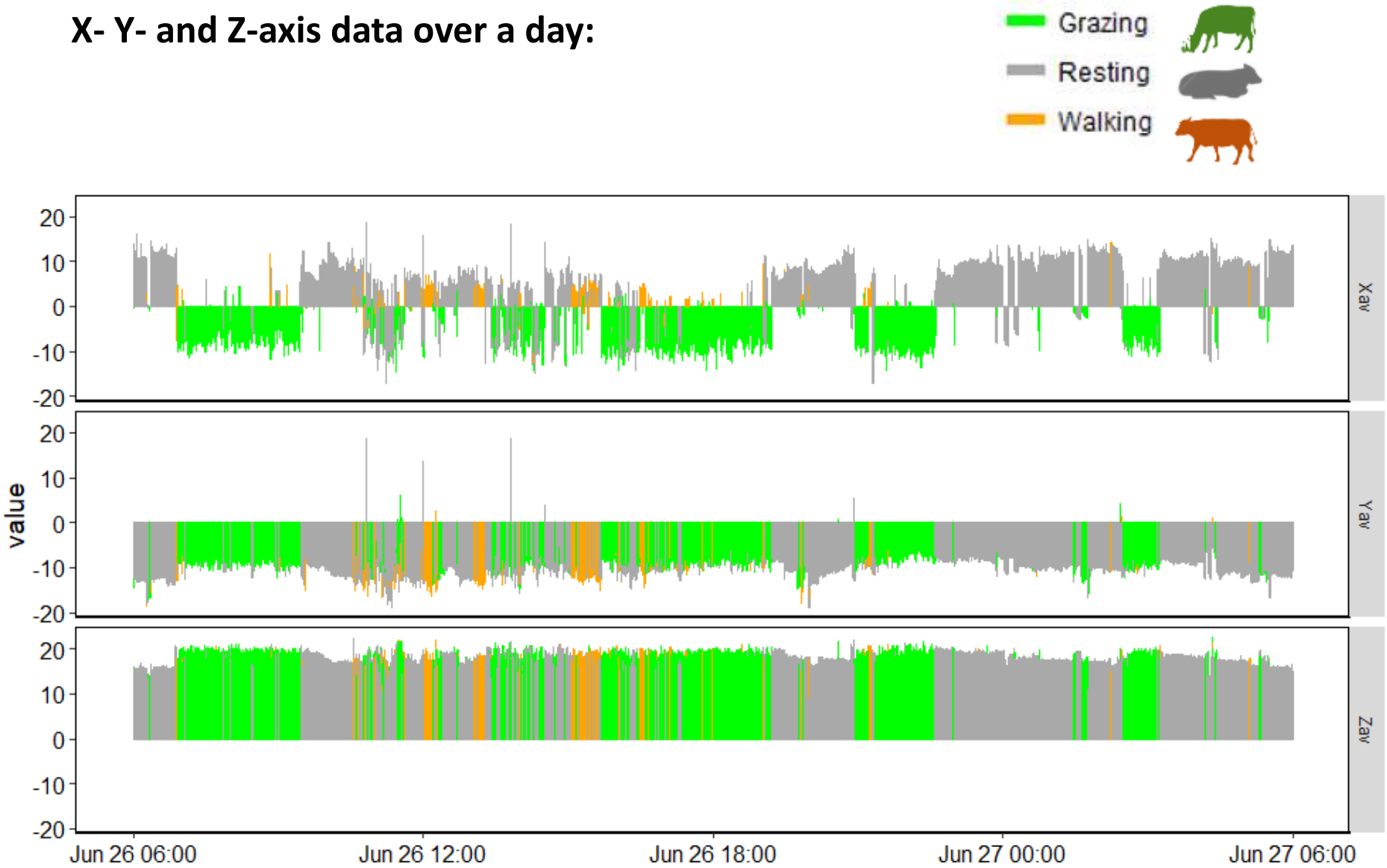
Tri-axial accelerometers and Random Forest model:

Variable importance plot:



Confusion matrix and RF model accuracy:

```
Confusion Matrix and Statistics

          Reference
Prediction Grazing Resting Walking
   Grazing     133       7       3
   Resting       2     201       9
   Walking       1       1      56

Overall Statistics

               Accuracy : 0.9443
                 95% CI : (0.9176, 0.9644)
    No Information Rate : 0.5061
    P-Value [Acc > NIR] : < 2e-16

                  Kappa : 0.9077
 Mcnemar's Test P-Value : 0.01711

Statistics by Class:

                     Class: Grazing Class: Resting Class: Walking
Sensitivity                  0.9779         0.9617         0.8235
Specificity                  0.9639         0.9461         0.9942
Pos Pred Value               0.9301         0.9481         0.9655
Neg Pred Value               0.9889         0.9602         0.9662
Prevalence                   0.3293         0.5061         0.1646
Detection Rate               0.3220         0.4867         0.1356
Detection Prevalence         0.3462         0.5133         0.1404
Balanced Accuracy            0.9709         0.9539         0.9089
```

Activity monitors

X- Y- and Z-axis data over a day: