Discussion points for today

- Covariate discussion
    - Defining available crop
    - Defining a ''crop-user''
    - Defining a crop season

- Quantitative cross-population comparison suggestions

Overall questions

1. Do pigs that use crops use non-crop resources differently than pigs that don't use crops?
2. Is there evidence that pigs use crops in different ways?
    - e.g. Do pigs move differently once they are in crops and how?

Pig data and covariates

Processed pig data

- 227 pigs, 12 studies

Covariate data

- Dist-to-nearest perennial water
- Tree cover density
- Elevation
- Human development index
- **Distance-to-nearest crop**

- NDVI/EVI
- Masting tree density
- Temperature
- Precipitation
- Snow depth

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How do you define available crop? Distance to nearest crop that has been used previously?

What we are doing is...

1. Estimating resource utilization functions for each pig using GPS movement data
2. Comparing resource utilization between crop and non-crop using pigs

Predicting resource utilization

Covariates + movement model → prediction of resource utilization

1. *Location-based covariates*: How long a pig remains in a cell as a function of resource
2. *Directional covariates*: The direction in which a pig moves from that cell as a function of the resource gradient
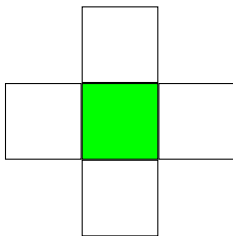
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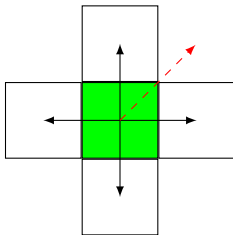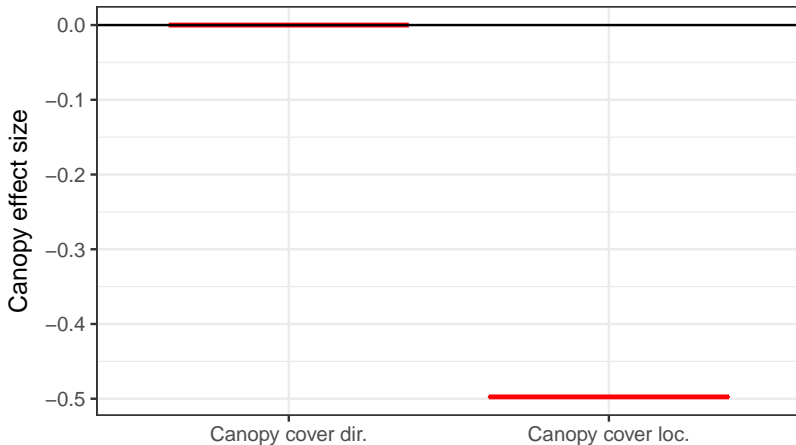
An example from Tejon
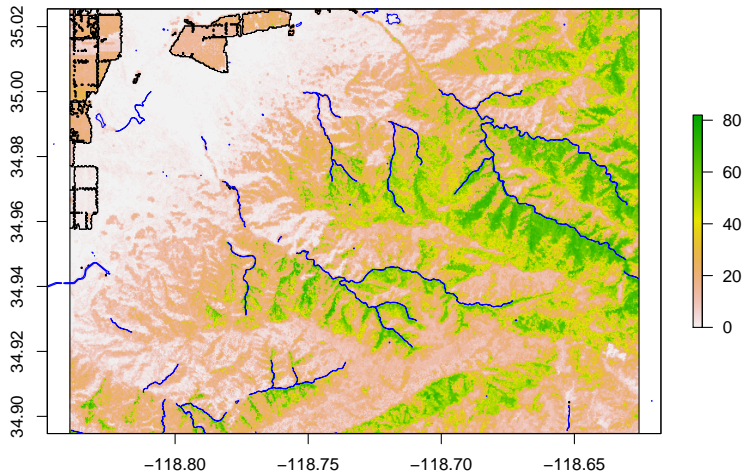
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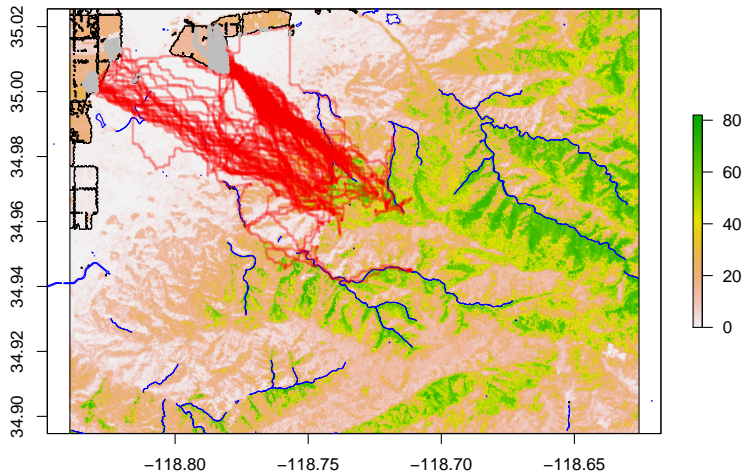
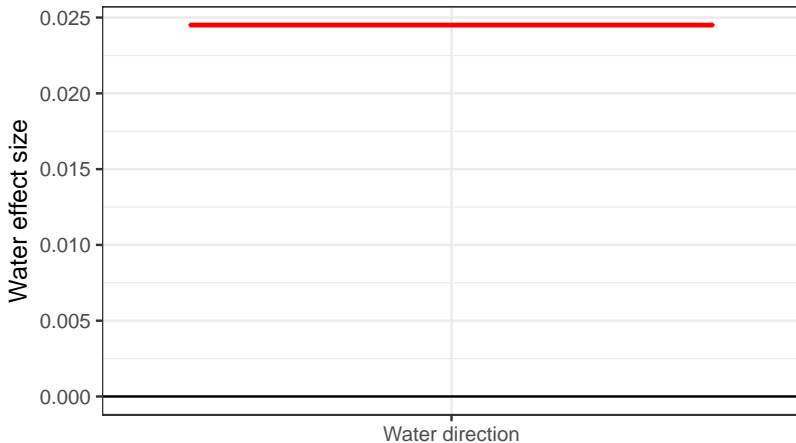# Predicted time-invariant resource utilization

Assume resource use is constant across day and season (obviously false, but an illustrative place to start)

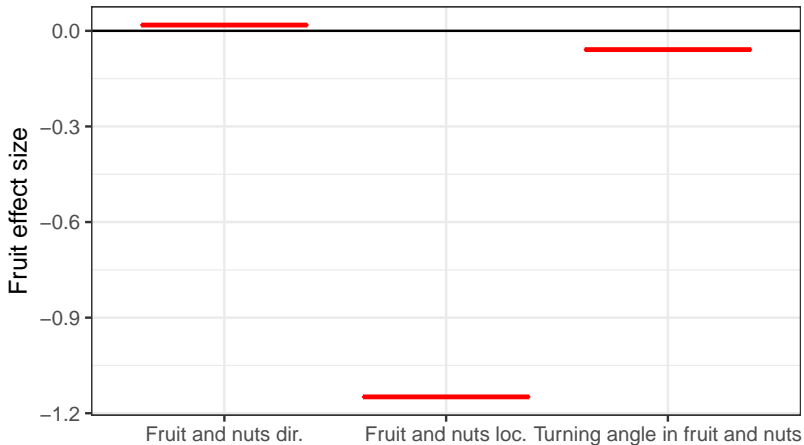Predicted time-invariant resource utilization

M302 moves significantly slower in increased canopy cover

Predicted time-invariant resource utilization

M302 moves toward water

Predicted time-invariant resource utilization

M302 moves slower in crops, turns more, but only weakly moves
toward crops...not accounting for daily patterns of resource use.

Predicted time-variant resource utilization
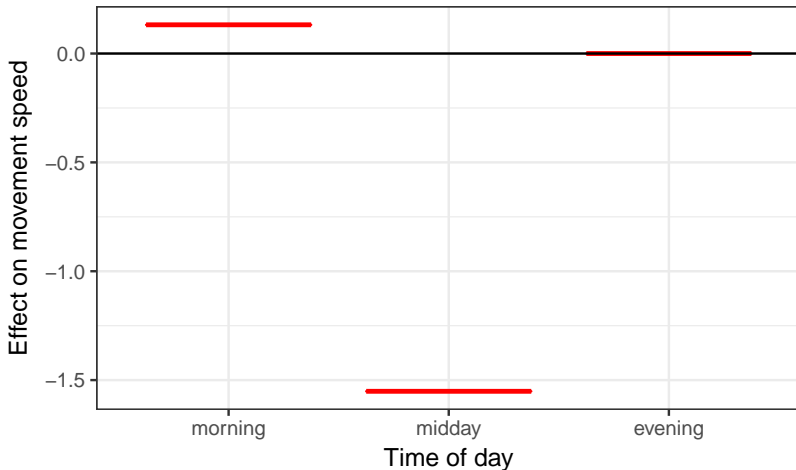
Allow the use of particular resource to vary with the time of day and season

Time of day

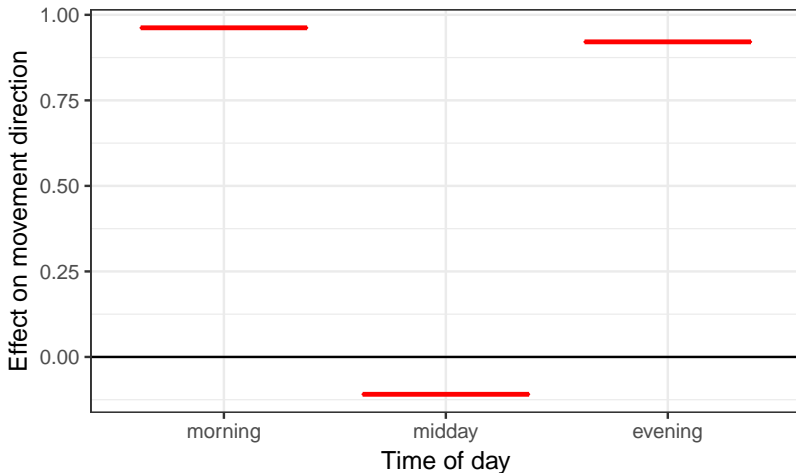- Morning: 1:00-8:00
- Midday: 9:00-16:00
- Evening: 17:00-0:00

Season

- Spring: March, April, May
- Summer: June, July, August
- Fall: September, October, November
- Winter: December, January, February

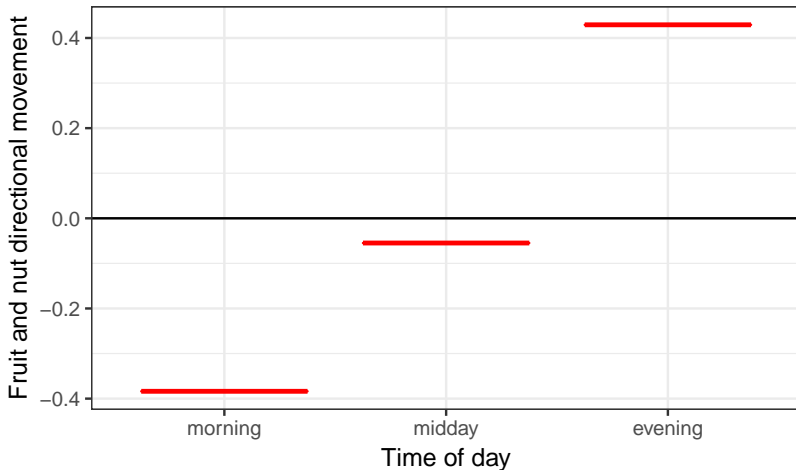Predicted time-variant resource utilization

M302 moves slower during midday than the evening or morning

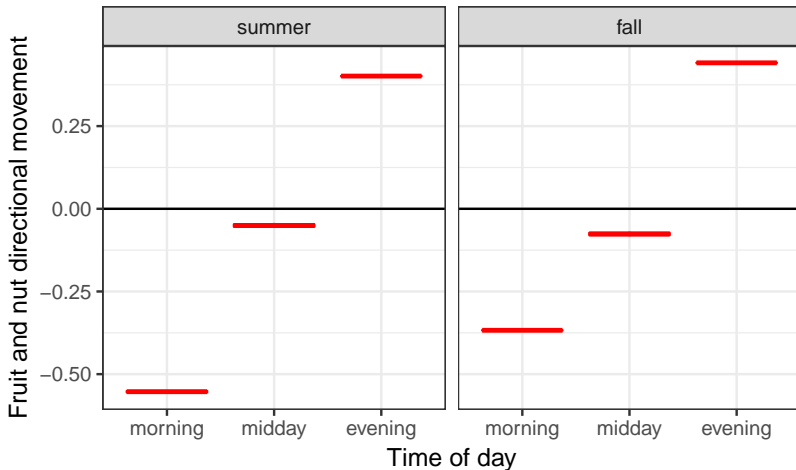## Predicted time-variant resource utilization

M302 shows more directional movement in the evening and the morning
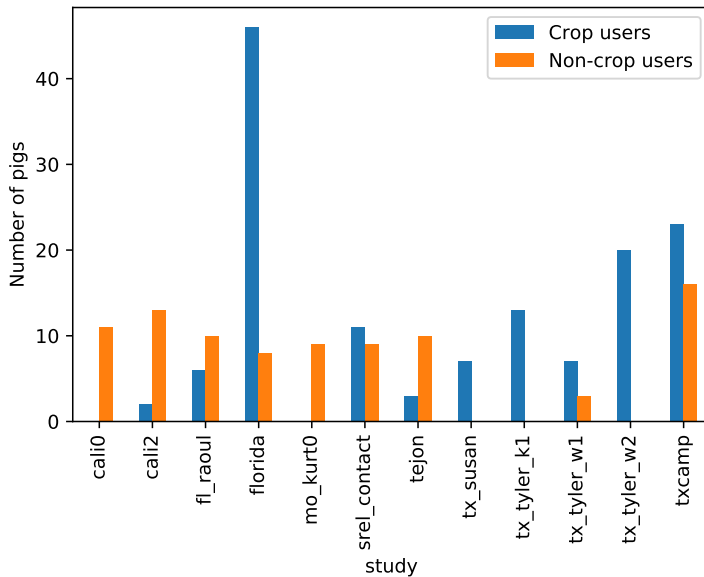
Predicted time-variant resource utilization

M302 moves toward fruit and nuts in the evening and away in the morning
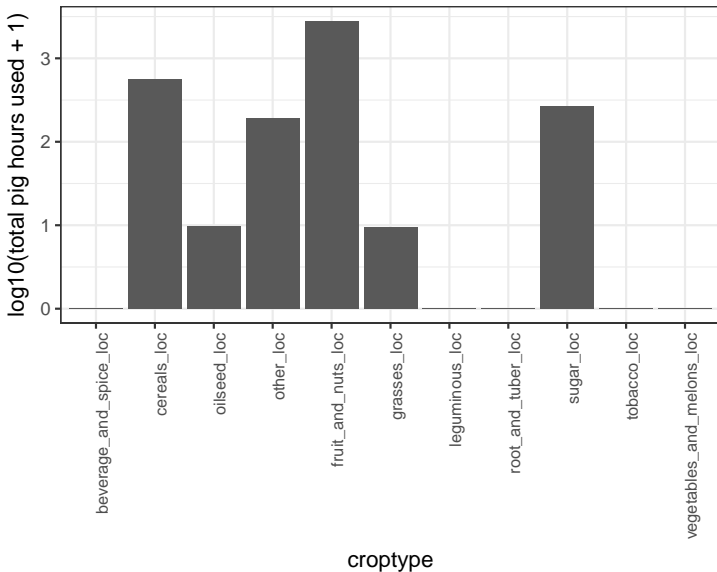
Predicted time-variant resource utilization

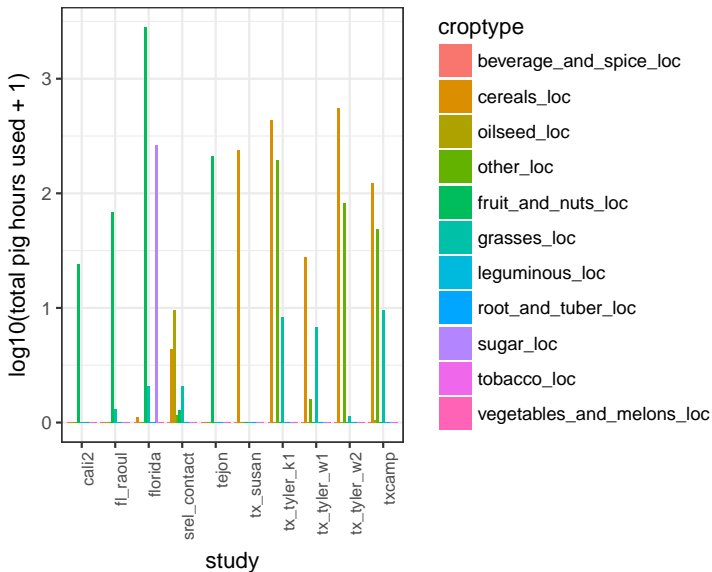Consistent affect of fruit and nuts in the fall and summer

Resource-use and crop-use across studies

Resource-use and crop-use across studies

Resource-use and crop-use across studies

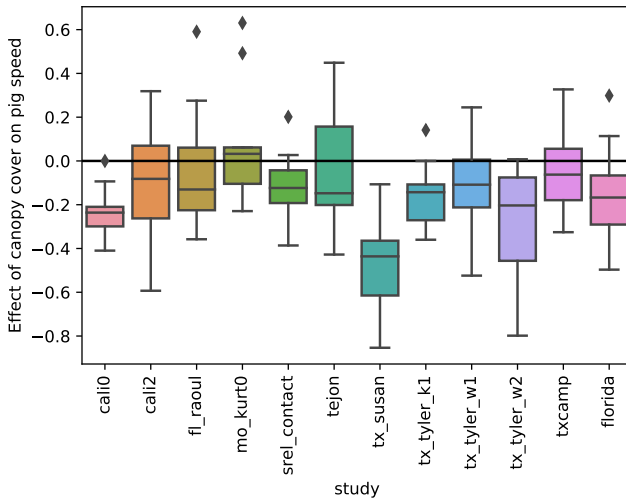Does the use of non-crop resources distinguish between movement patterns of crop-using and non-crop-using pigs?

Does the use of non-crop resources distinguish between movement patterns of crop-using and non-crop-using pigs?
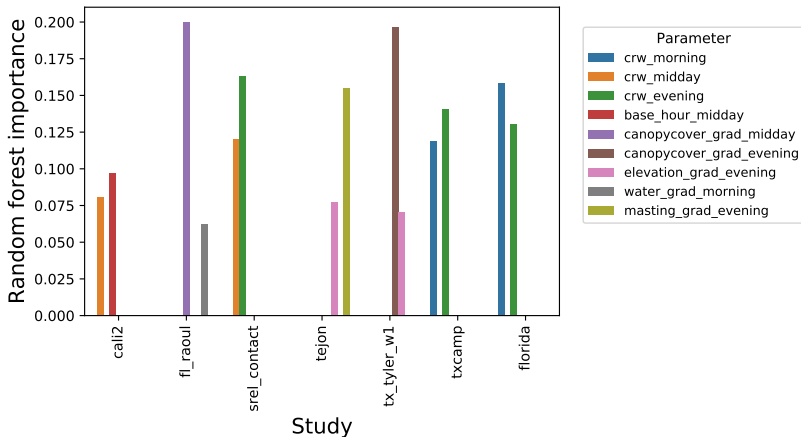
Yes, but in different ways across studies.

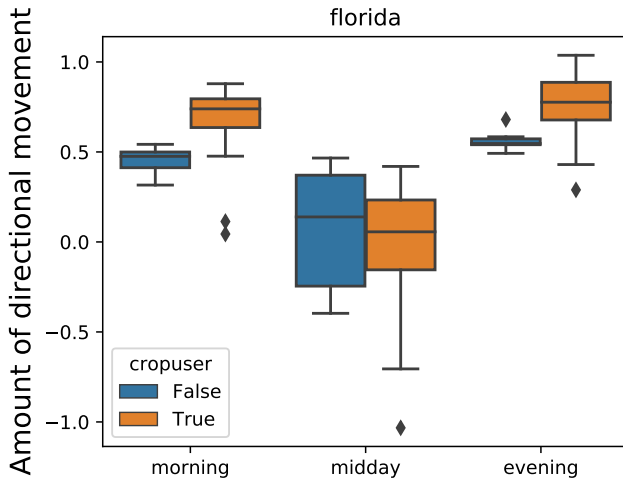# Question 1: Crop-users vs. non crop-users

One of the few consistent effects across pigs and studies
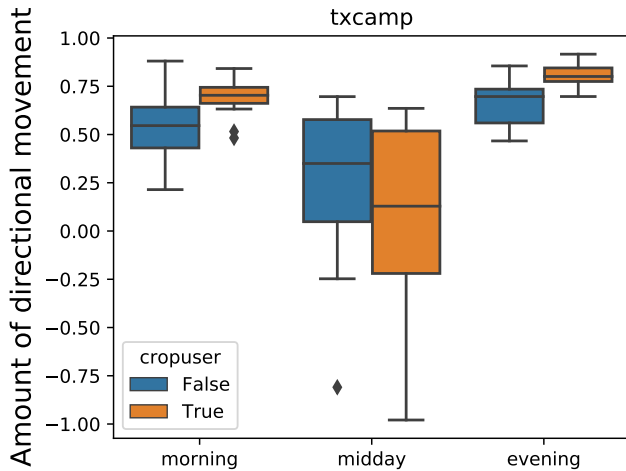
Question 1: Crop-users vs. non crop-users

After accounting for crop use, general turning angle and movement speed distinguishes crop-users from non crop-users *in some studies*

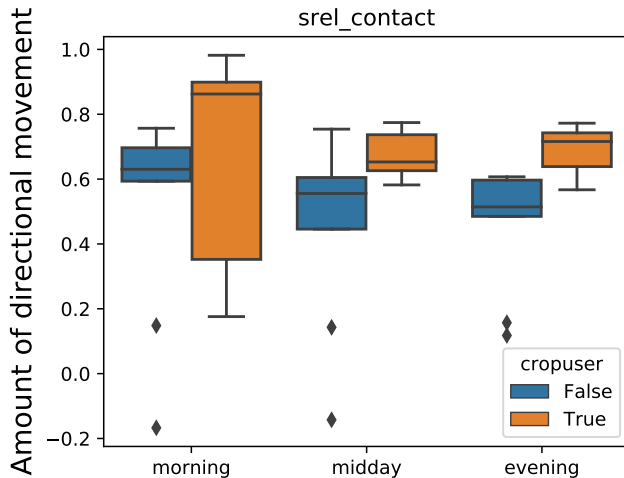# Question 1: Crop-users vs. non crop-users

florida

Increased directional movement in florida crop users in morning and evening

Question 1: Crop-users vs. non crop-users

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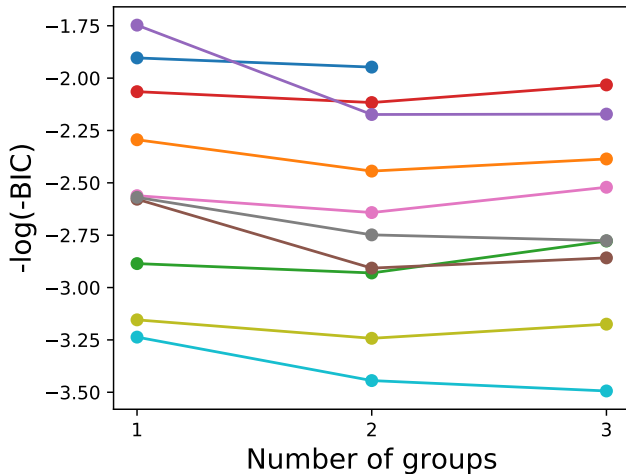
Question 2: Grouping crop users

Do pigs use crops in different ways? If so, how?

Question 2: Grouping crop users
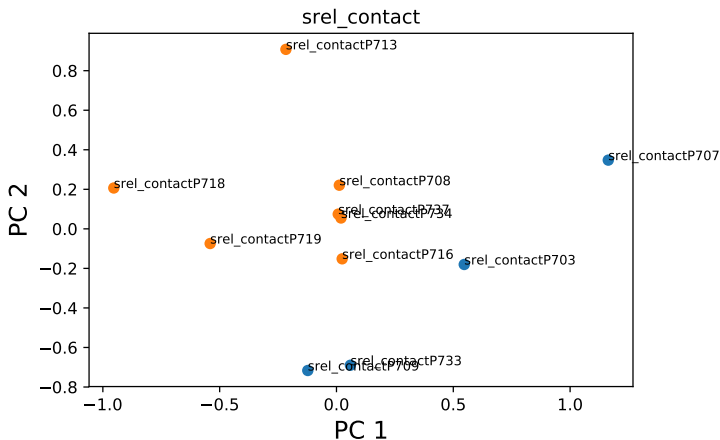
Do pigs use crops in different ways? If so, how?

Use a cluster analysis to identify whether there is evidence that pigs differ in the way in which they use crops
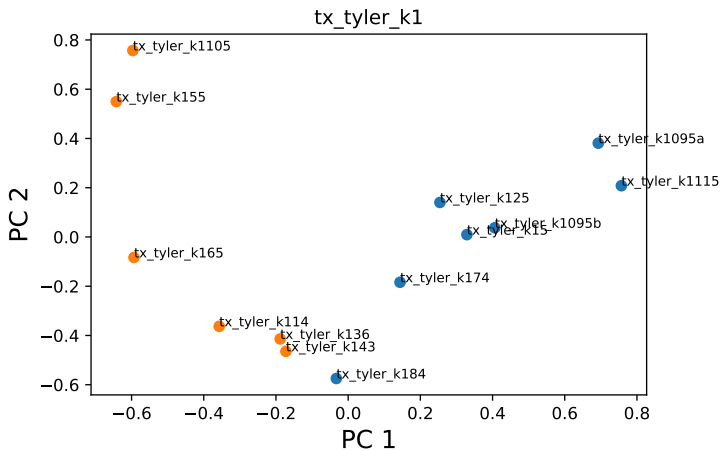
Question 2: Grouping crop users

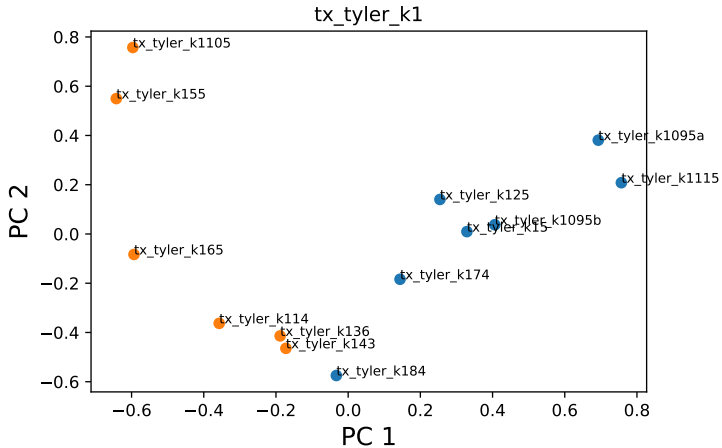Every study suggests that crop users can be broken into at least 2 groups

Question 2: Grouping crop users
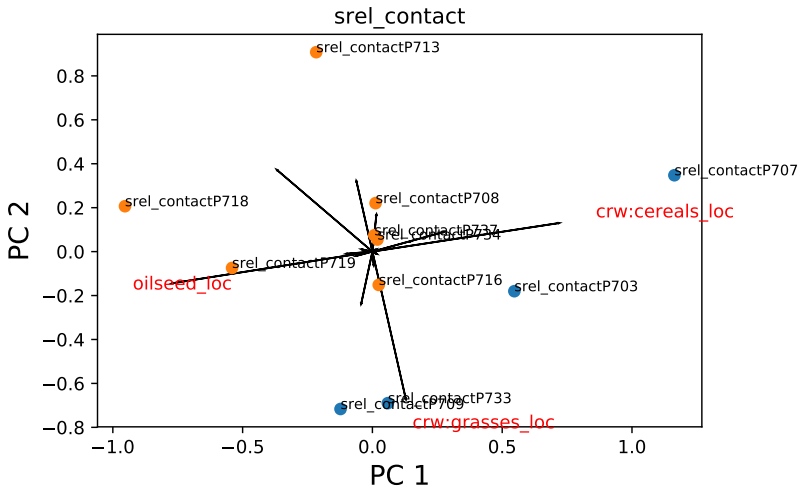

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Question 2: Grouping crop users

tx_tyler_k1
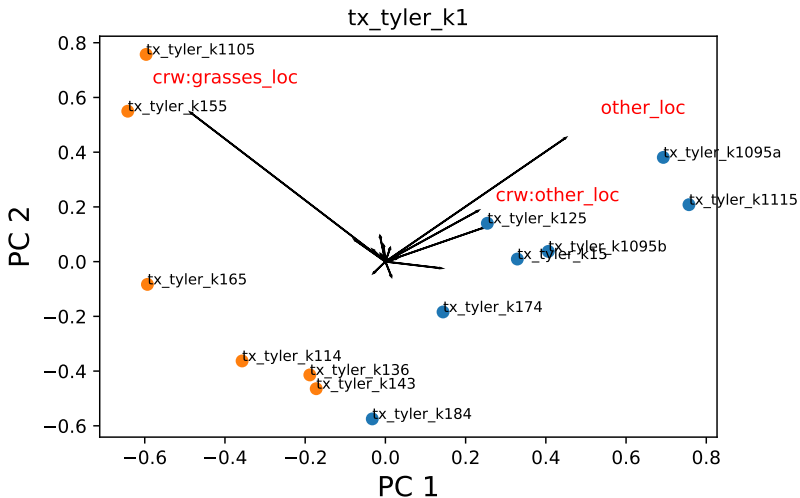
Question 2: Grouping crop users

tx_tyler_k1

Movement patterns within crops describe the primary variation in these groupings

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Question 2: Grouping crop users

- Differences in seasons and crop type make this challenging
  - Suggestions?
- Can still see some interesting patterns with qualitative comparisons