

Ibex in a changing climate: the response of a large ungulate to severe weather conditions

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INTRODUCTION




Extreme weather events, such as summer heatwaves and strong rainfalls, will become more common due to climate change



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 Several studies showed behavioural response of mammals to severe weather conditions (Anderwald et al. 2024, Brivio et al. 2024, Stiegler et al. 2023, Van Beest et al. 2012, Conradt et al. 2000)



- 🐐 The Alpine ibex (*Capra ibex*) is highly sensitive to heat stress (Aublet et al. 2009, Semenzato et al. 2021)
- 🐐 Variability in weather and climate may severely influence survival and reproduction (Jacobson et al., 2004, Pettorelli et al., 2007)
- 🐐 Given this sensitivity, we expect ibex to adapt by altering their habitat use



- 🐐 Understanding their behavioural choices helps predict their long-term survival and adaptability in the face of climate change.





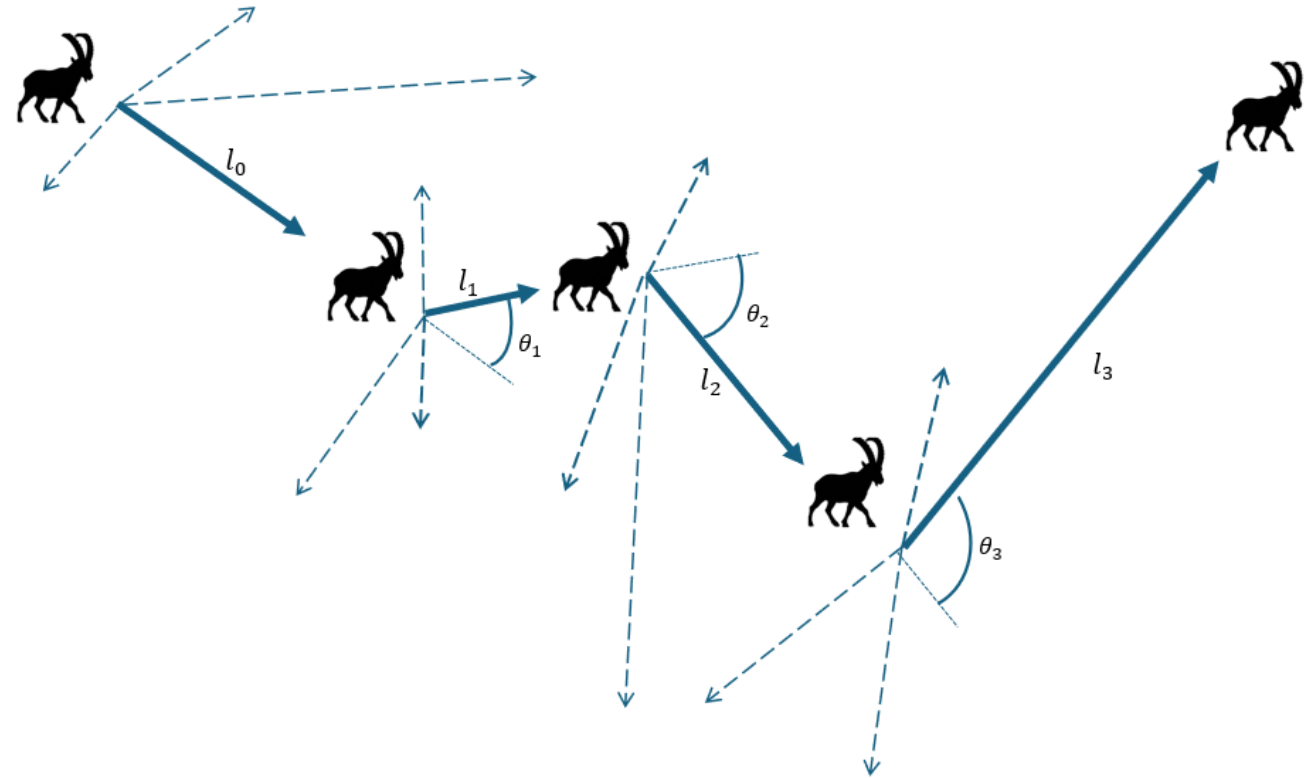
How do Alpine ibex use their habitat during the warmest days?



Do Alpine ibex respond to strong rainfalls?

METHODS

- 🐐 Integrated Step Selection Analysis (iSSA) to investigate summer habitat selection
- 🐐 It models the likelihood of an animal choosing a particular location based on both environmental factors and the movement characteristics



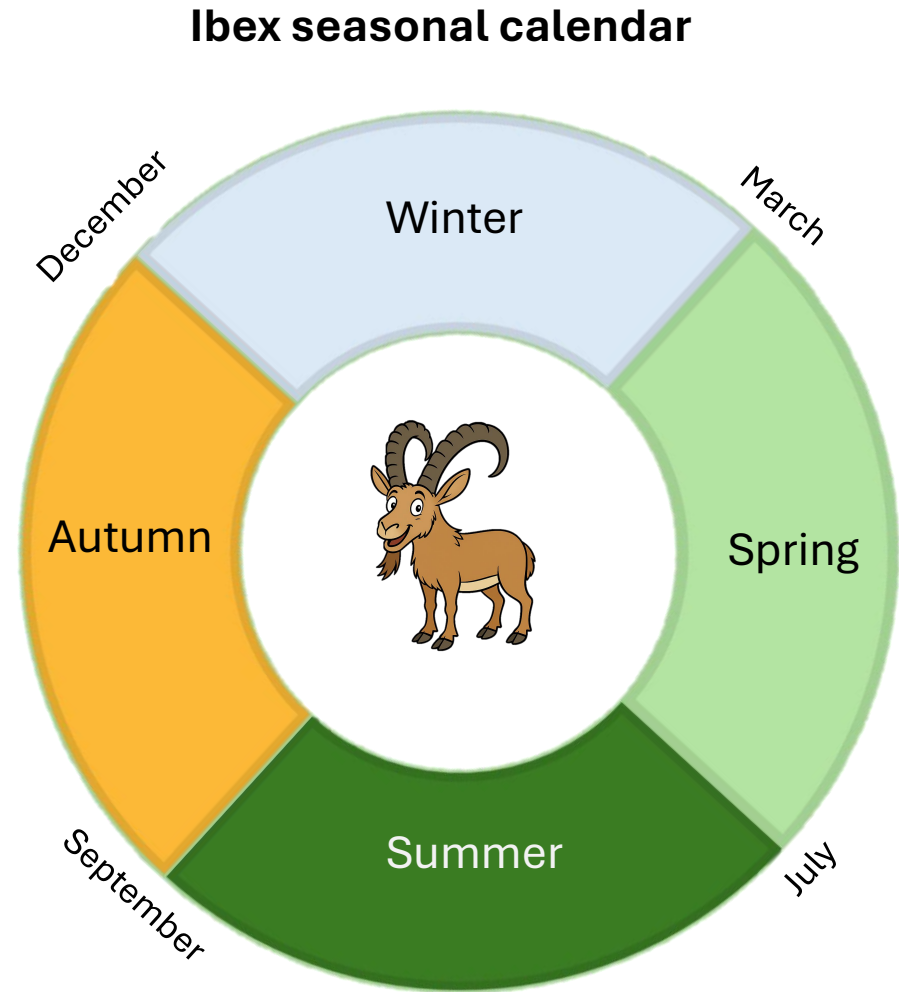
GPS data

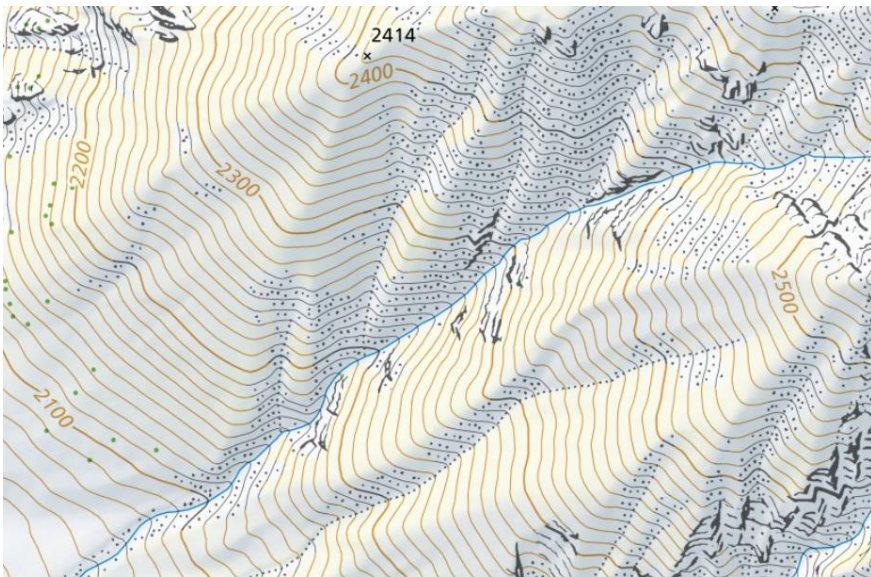
- 🐐 21 GPS-collared adult ibex of both sexes (13 males, 8 females)
- 🐐 Collared between 2008 and 2017
- 🐐 Study area: Swiss National Park (altitudinal range between 1800 and 3100 m a.s.l.)
 - 🐐 Val Trupchun and neighbouring areas



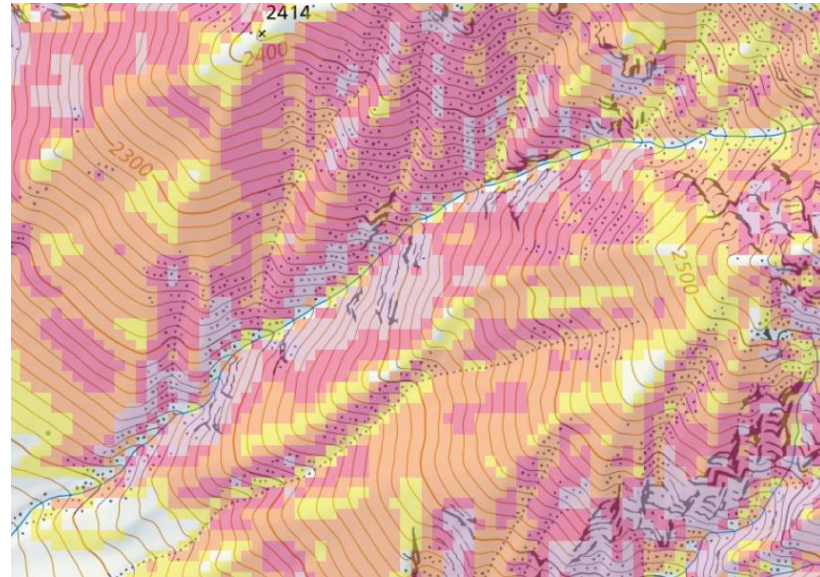
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- 🐐 Summer: July – September
- 🐐 based on ibex' coat changes (Signer et al. 2011)
- 🐐 GPS fixes every 1h, 2h, 4h → for analysis interpolated at 4h hours





Elevation



Slope



Aspect





What we expect?

Thermoregulation

01

Ibex at **higher elevation** during warm days

Why?

Temperature are lower, seek more suitable temperatures.

02

Less probably to find ibex in **southerly slopes**

Why?

Avoidance of warmer slopes, seek cooler places.

What we expect?



Seeking of shelter

01

Ibex at lower elevation during strong rainfalls

Why?

Less exposed to extreme conditions

02

Stronger selection for steep slopes

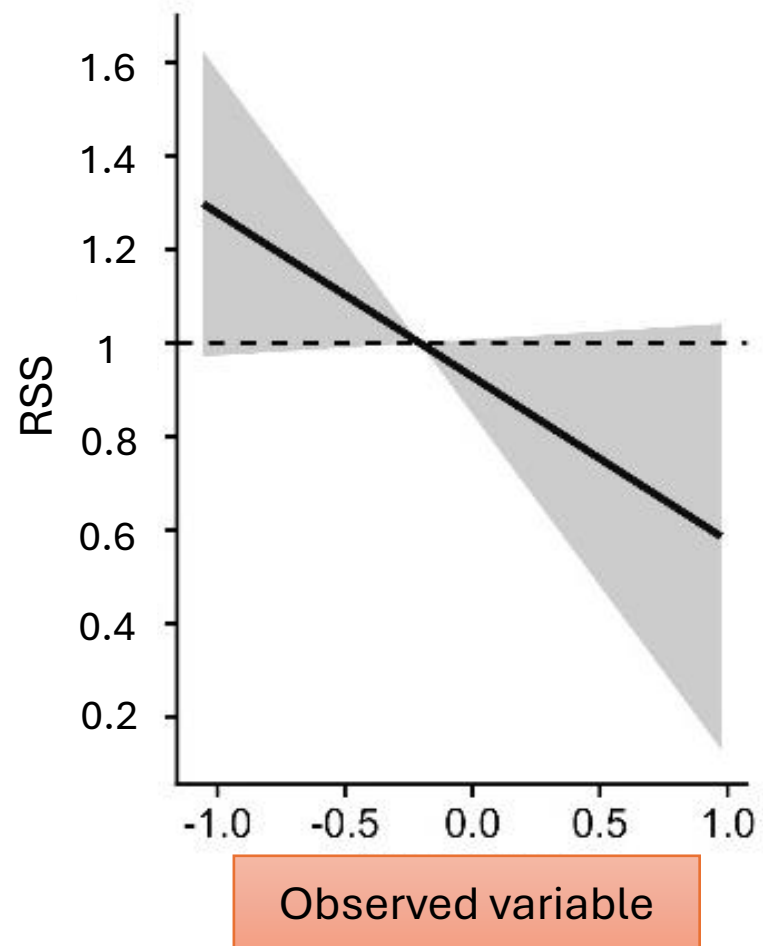
Why?

Seek physical shelter under rocks.
Refuge from predators.

RESULTS

What did you
find out?



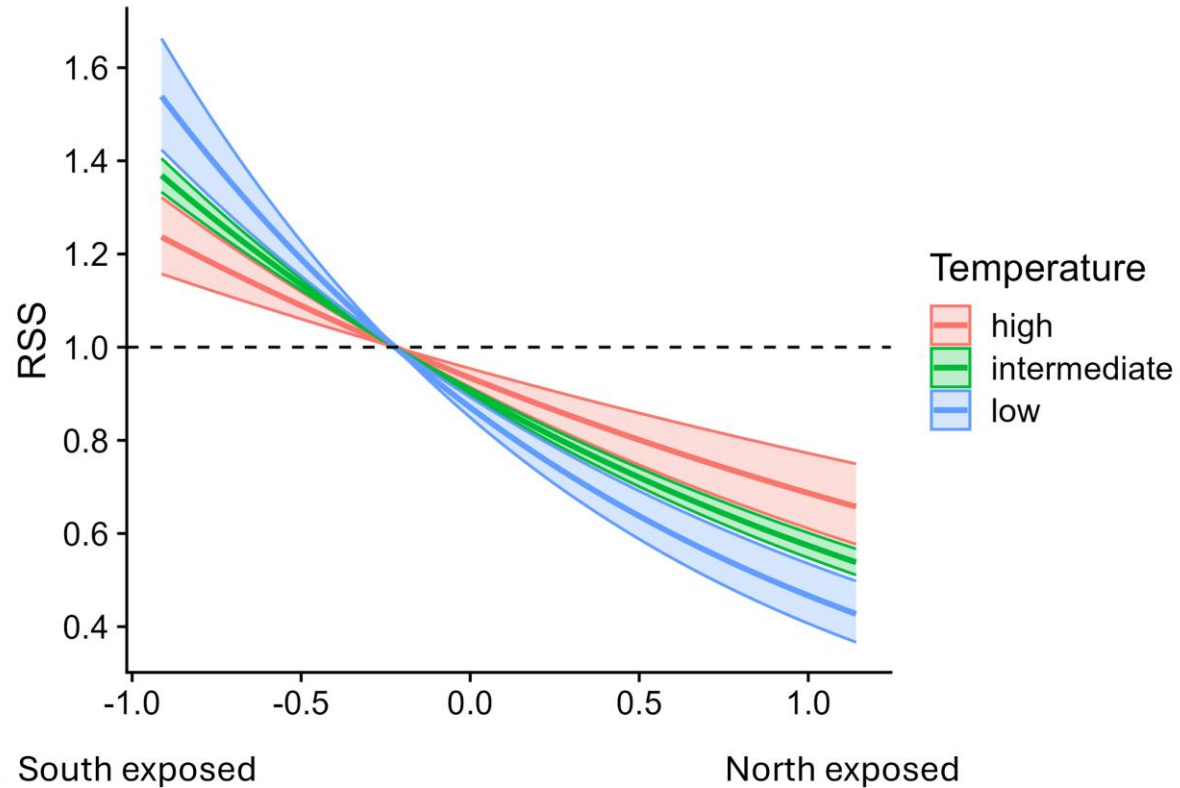


RSS = Relative Selection Strength:
➤ > 1 selection,
➤ < 1 avoidance



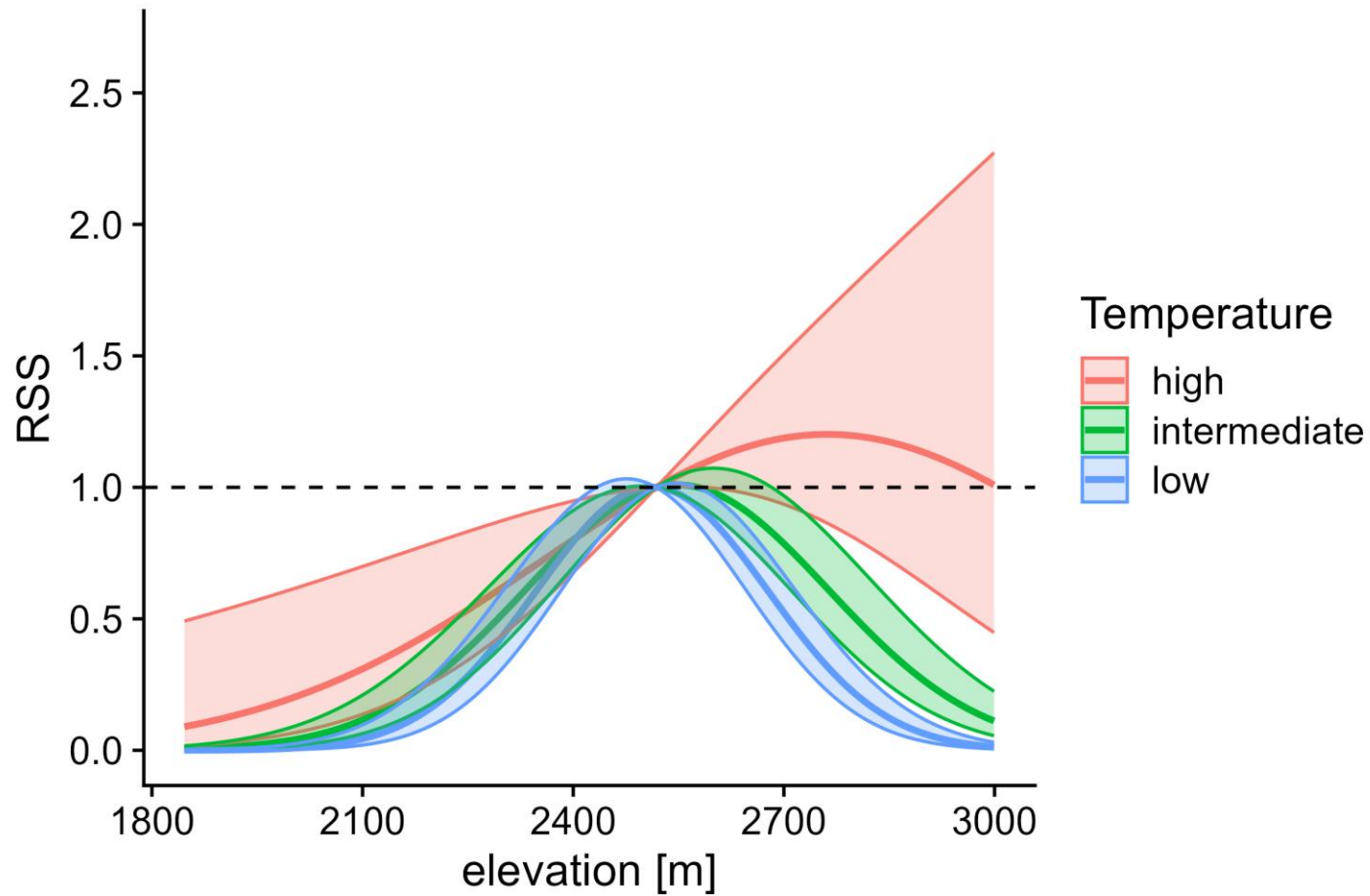
How do Alpine ibex use their habitat during the warmest days?

Warm days and aspect



Ibex show weaker selection of southern slopes in hot weather

Warm days and elevation

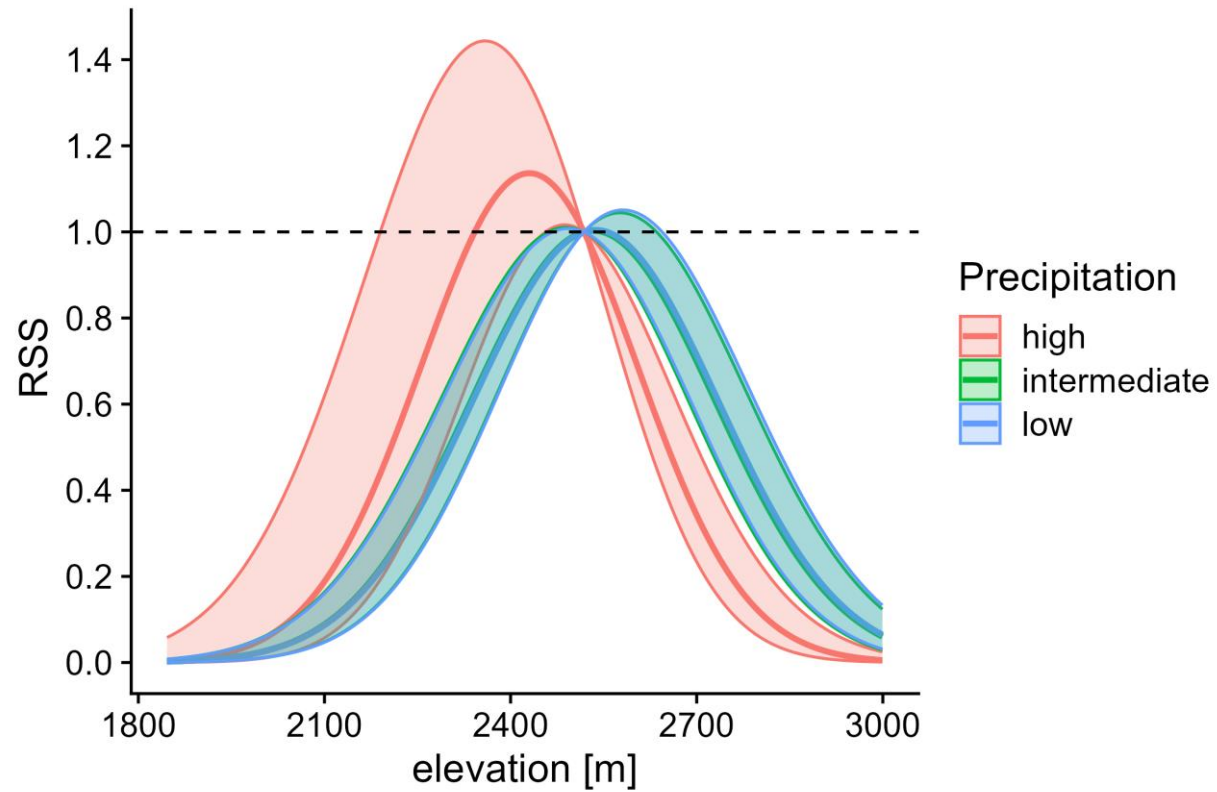


Ibex move to higher elevations to escape the heat.



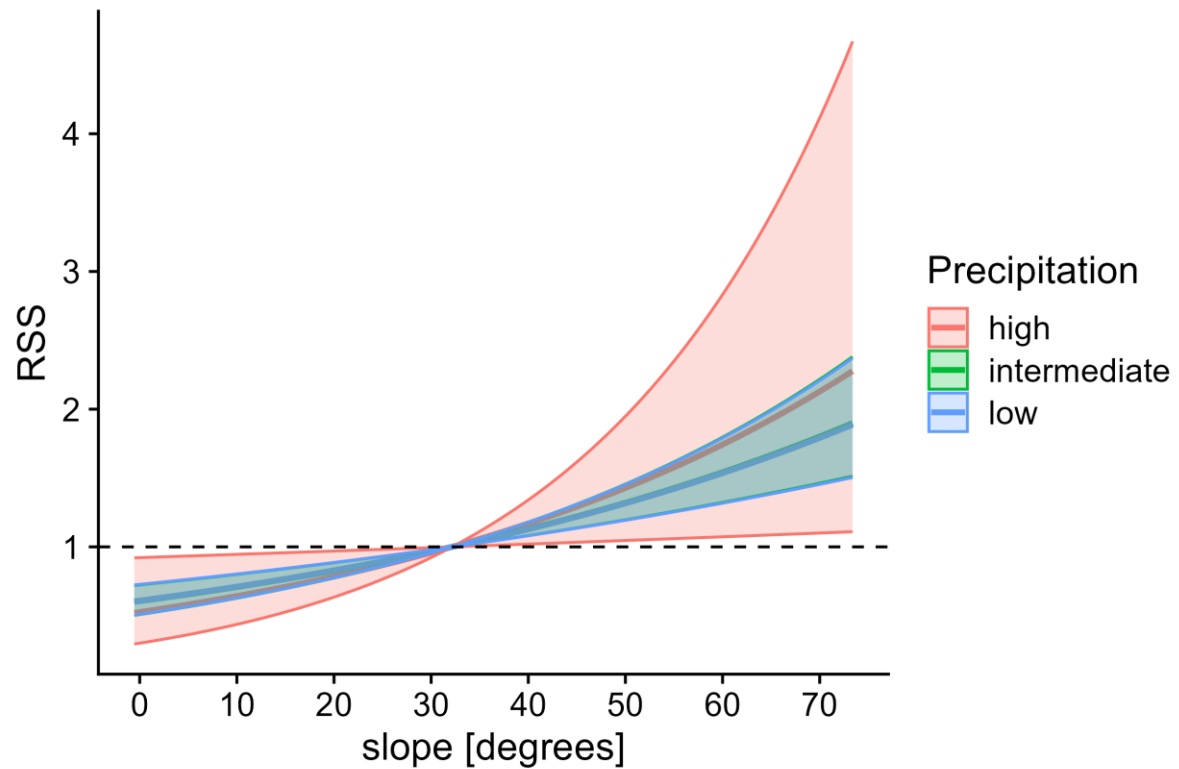
**Do Alpine ibex
respond to
strong rainfalls?**

Strong rainfalls and elevation





During strong rainfalls
ibex seek shelter at
lower elevations

Precipitation and Slope



Strong rainfalls do not influence the selection of steep slopes

Summary

| Expectations | |
|--|---|
| Seek more suitable temperature at higher elevations (thermoregulation) |  |
| Escape from the heat of southerly slopes |  |



Summary

| Expectations | |
|--|---|
| Seek more suitable temperature at higher elevations (thermoregulation) | ✓ |
| Escape from the heat of southerly slopes | ✓ |



| Expectations | |
|--|---|
| Seek shelter at lower elevations | ✓ |
| Seek shelter and refuge from predators (reduced detectability because of the rain) | ✗ |



Take home messages

- 🐐 Alpine ibex respond to severe weather conditions by fine-scale adjustments in habitat selection, particularly by altitudinal movements.
- 🐐 Rising temperatures are likely to force ibex to move to higher elevations where resources are scarcer. → **Trade off!**
- 🐐 Ibex show the potential to adapt to changing climate conditions. But with extreme weather events becoming more frequent and intense, it's still unclear whether they will be able to further adapt to those changes.






Outlook

- 🐐 And what happens when the severe conditions take place during winter?
- 🐐 Strong precipitation in winter leads to hard challenges for ibex
- 🐐 PhD project: Alpine ibex and Snow in progress... 😊



Acknowledgment

-  All the park rangers to have collared the animals
-  Flurin Filli and Thomas Rempfler for organizing the collaring
-  My co-authors Pia Anderwald and Benedikt Gehr

Thank you for the attention!