



Trade-offs among grass-based veal production systems along an altitudinal gradient

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Context

- Fattening dairy males can reduce the need for beef cattle
- Calf transport is a source of stress
- How to locally fatten male calves from the dairy sector?
- Potential solution:
Grass-based veal production



Context

- Grass is a non-expensive resource that can grow everywhere
- Grass can affect:
 - Meat quality
 - Enteric methanogenesis
 - Animal welfare



Willems et al (2013) Vegetation-type effects on performance and meat quality of growing Engadine and Valaisian Black Nose sheep grazing alpine pastures

Hassan et al (2025) Effect of multispecies swards on ruminal fermentation, methane emission and potential for climate care cattle farming – an in vitro study

Poutaraud et al (2017) Grasslands: A Source of Secondary Metabolites for Livestock Health

Context

- Grass types result from the interaction of environment and management
- Different grass types provide different ecosystem services
- Trade-offs between ecosystem services





Question

- What are the trade-offs among grass-based veal production systems along an altitudinal gradient?



Male calves (3-6 m.o)
N = 72



Pasture



Hay

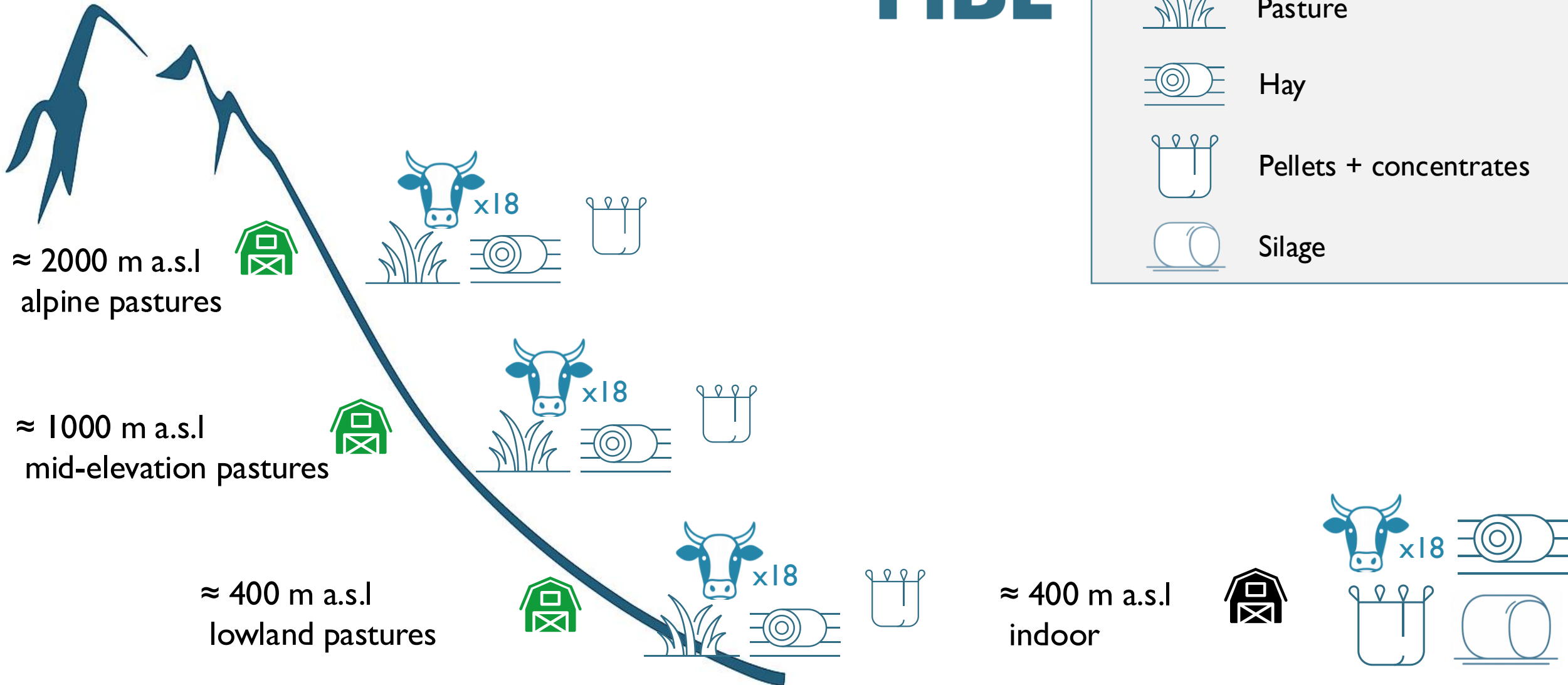


Pellets + concentrates



Silage

Experimental setup



Data collection

- Monthly botanical assessment
- Rumen fluid in vitro fermentation
HGT protocol, 6 m.o.
(Mesbahi et al., 2026)
- Blood composition (Leiber et al., 2025)
- Carcass weight
- Meat quality: colour, tenderness and composition
- Carcass price



(Werner et al., soon)

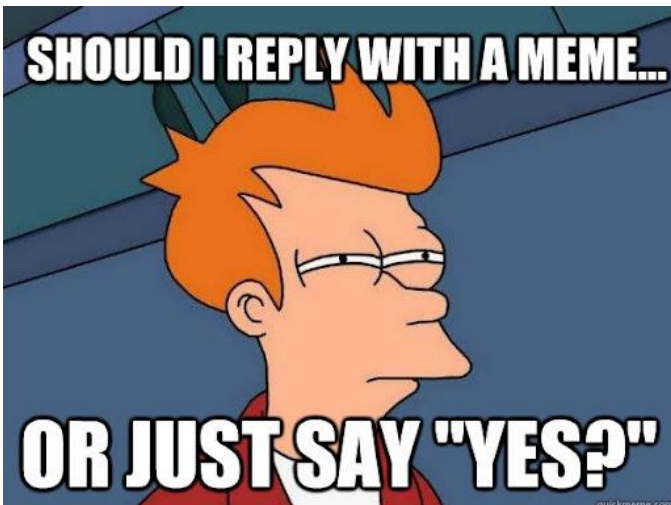
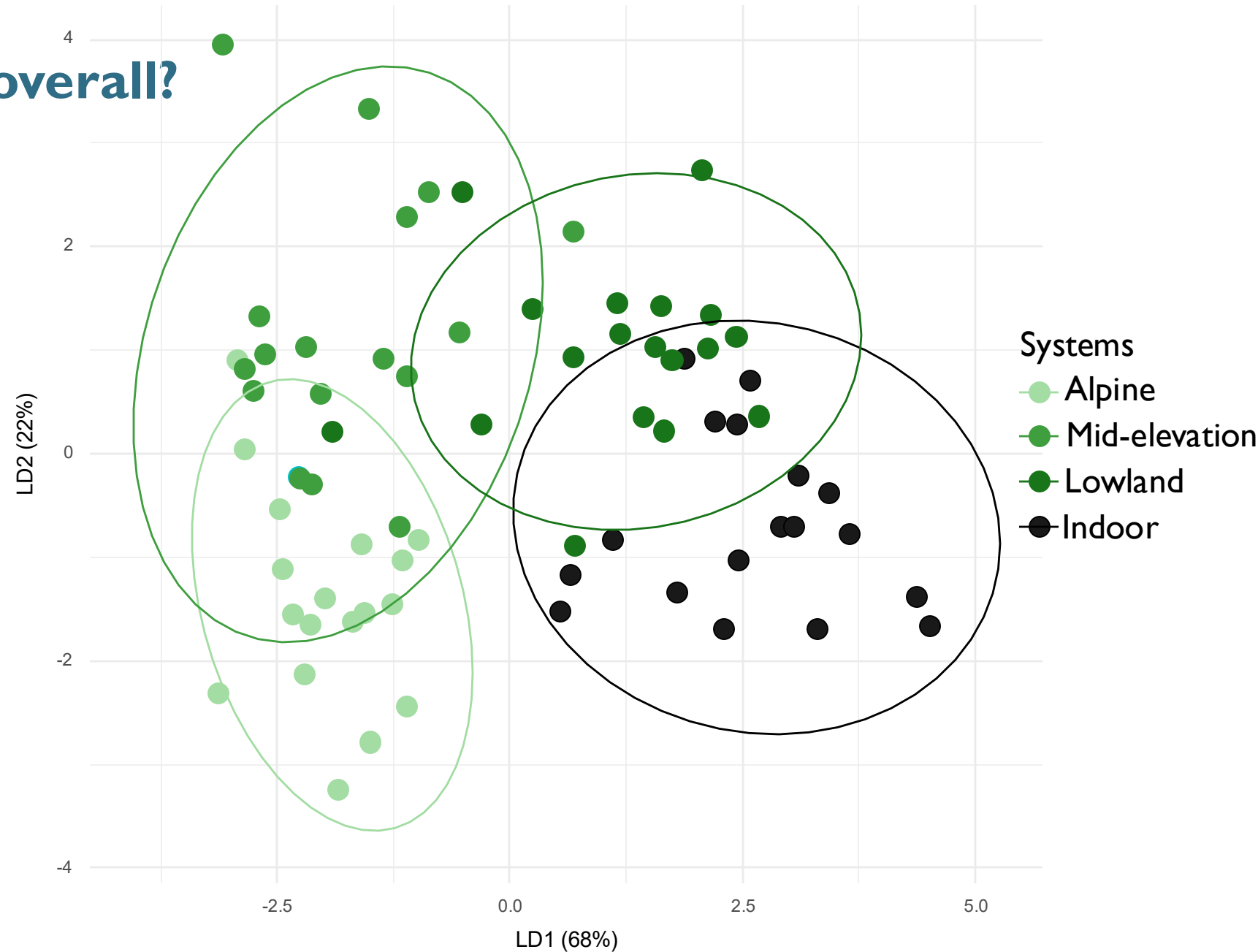
Statistical analysis

- Do systems differ overall?
 - ➔ Multivariate differences among systems
 - ➔ Permutational multivariate analysis of variance (PERMANOVA)
- What drives these differences?
 - ➔ Traits discriminating systems
 - ➔ Linear discriminant analysis (LDA)



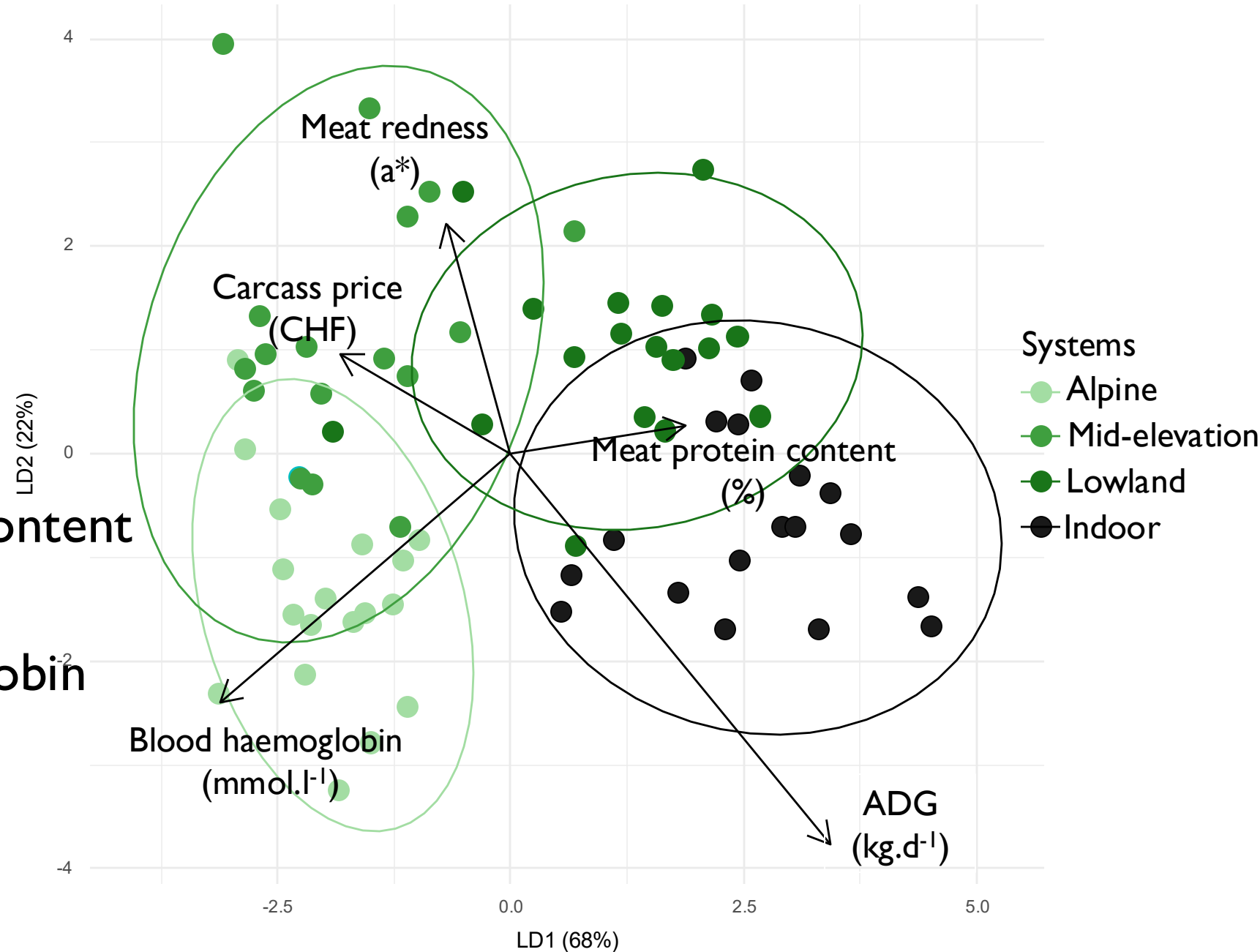
Do systems differ overall?

- YES ($p < 0.001$)

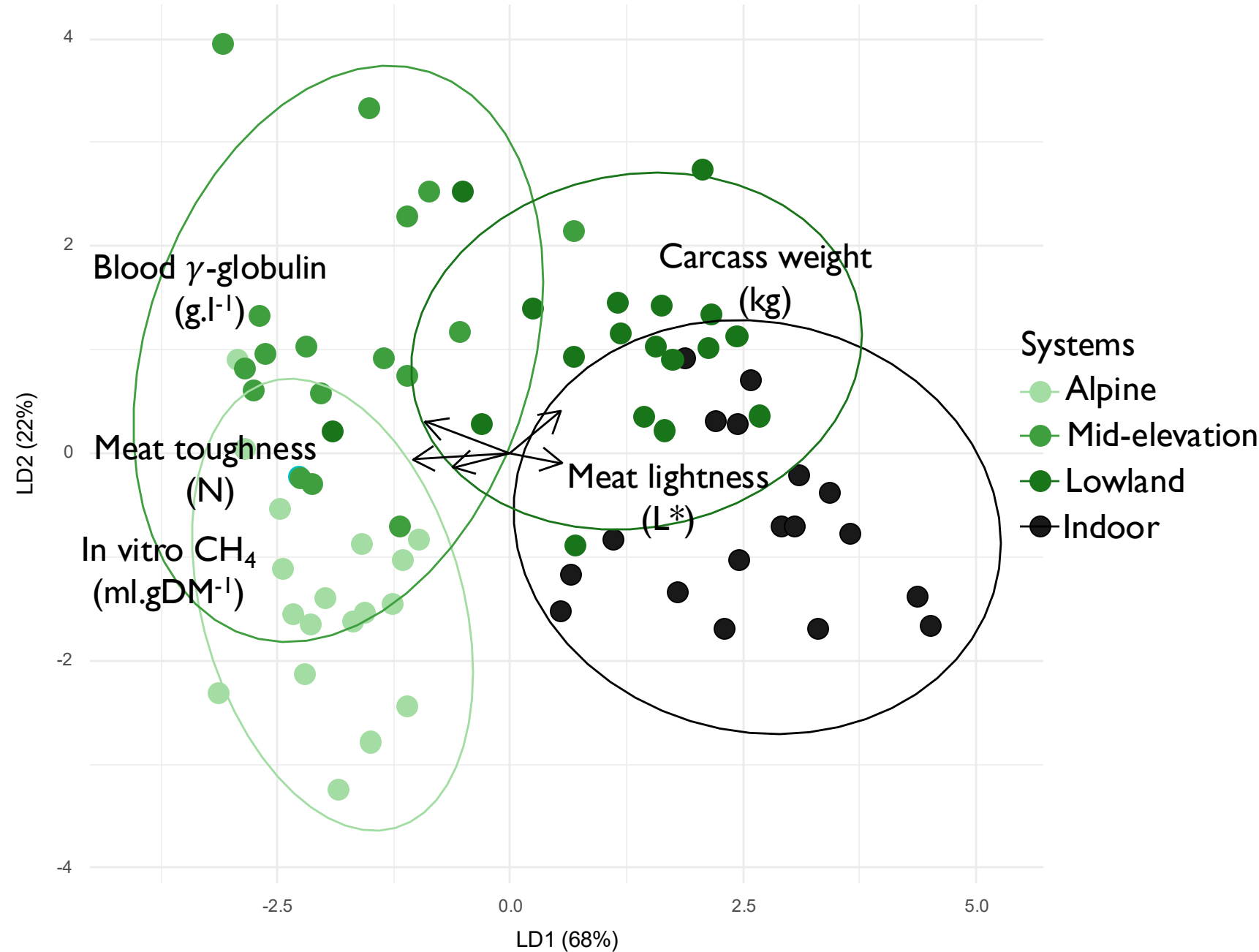


What drives these differences?

- Productivity
ADG
- Quality
Meat redness
Meat protein content
- Health
Blood haemoglobin
- Economy
Carcass price

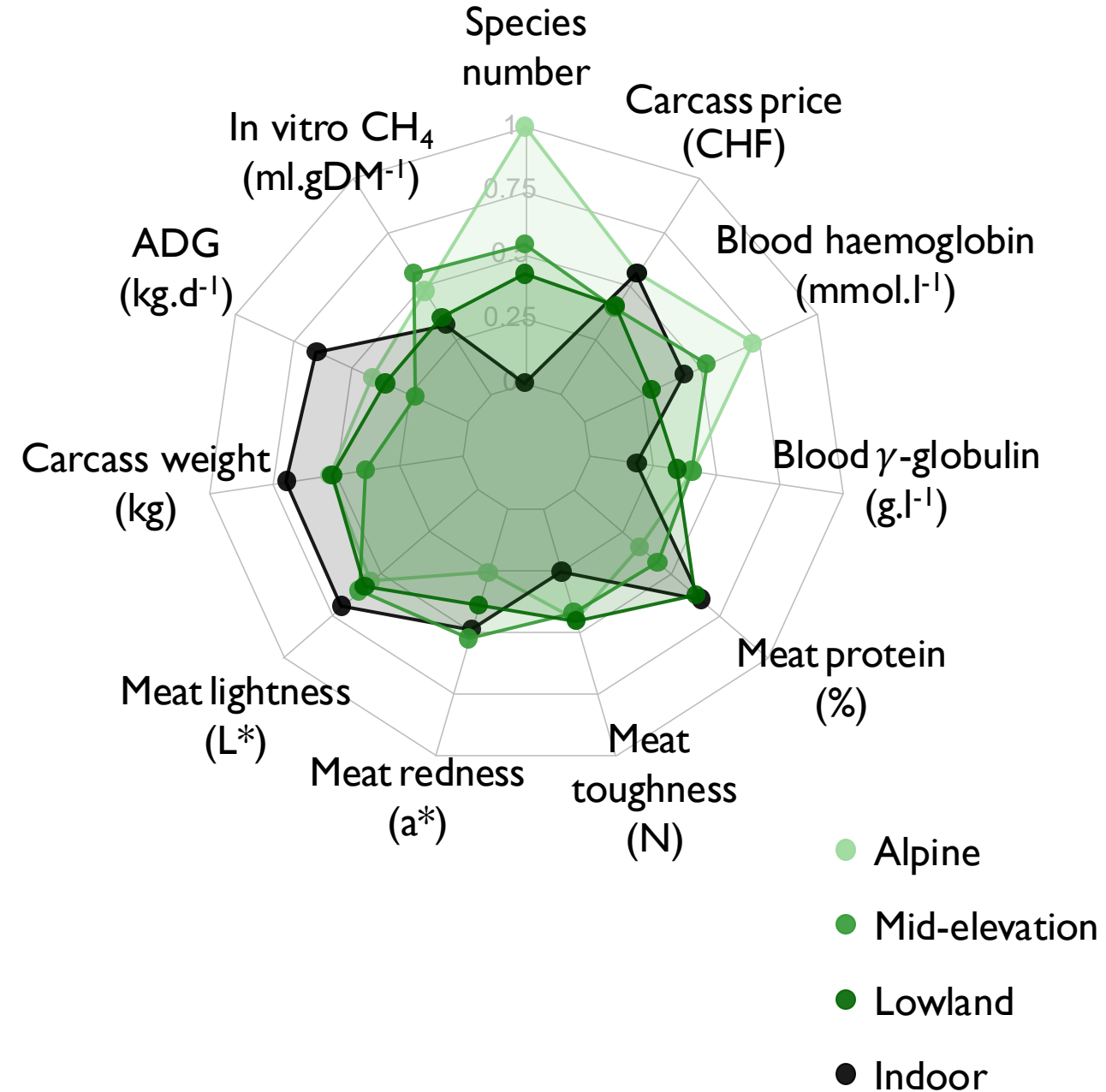


doesn't
**What drives these
differences?**



0 = lowest individual value
1 = greatest individual value

Discussion



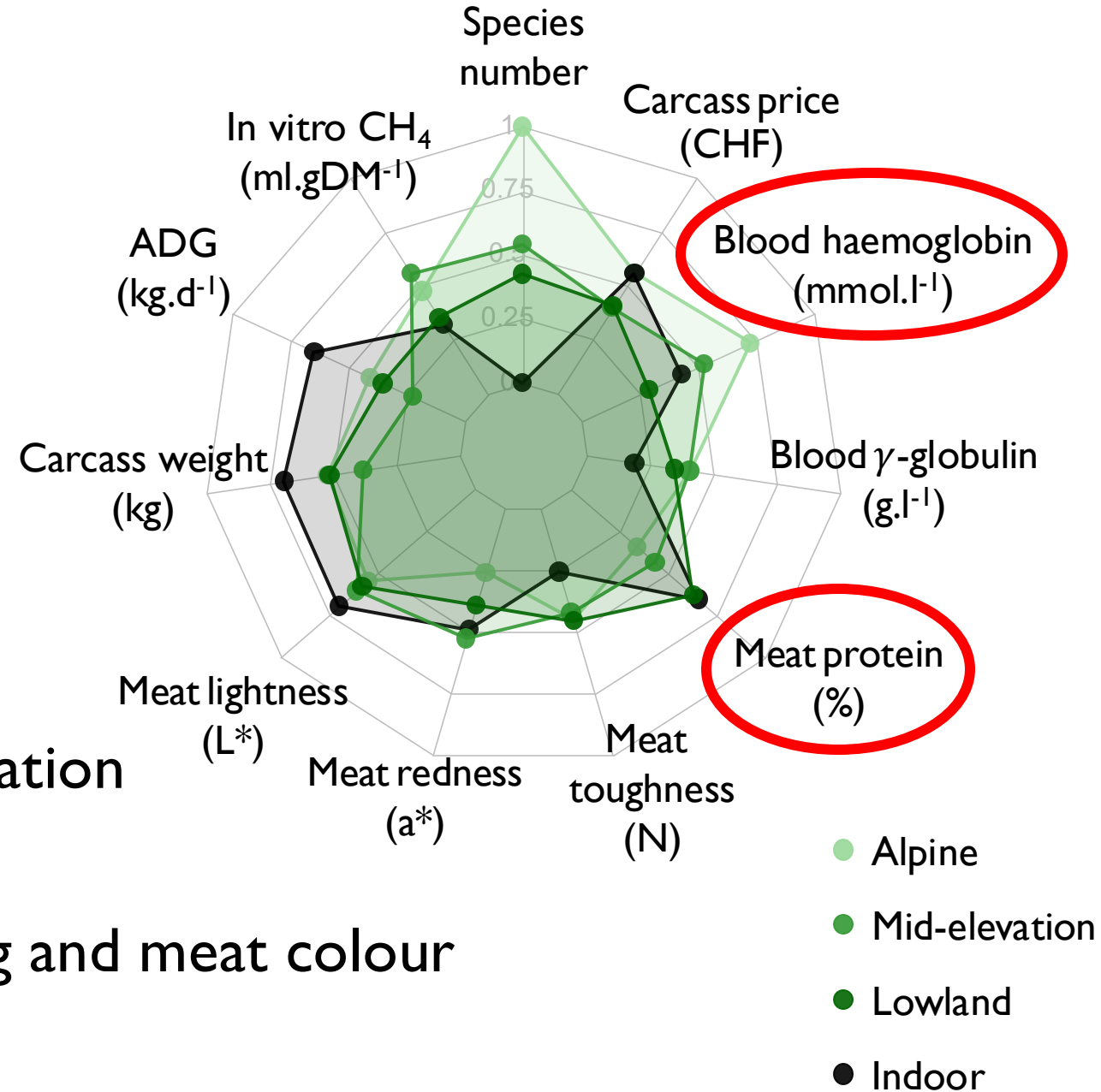
0 = lowest individual value
1 = greatest individual value

Discussion

- Lowland vs mountain systems
 - **Meat protein content**
 - **Blood haemoglobin**

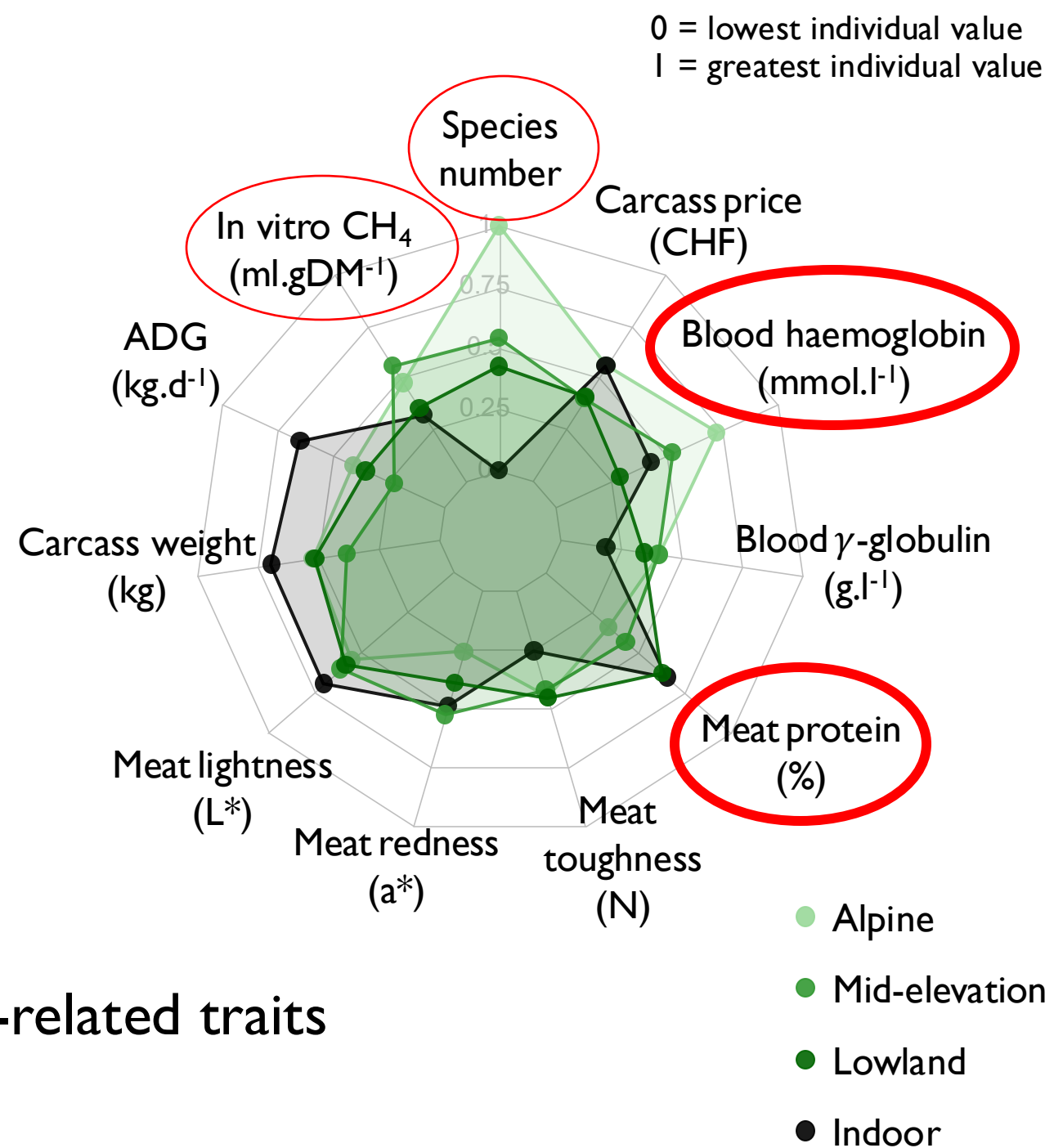
Haemoglobin increases with elevation
but not related to meat redness

➔ Poor relation between grazing and meat colour



Discussion

- Lowland vs mountain systems
 - **Meat protein content**
 - **Blood haemoglobin**
 - Botanical diversity
 - In vitro CH₄



Trade-offs between environment-related traits

0 = lowest individual value
1 = greatest individual value

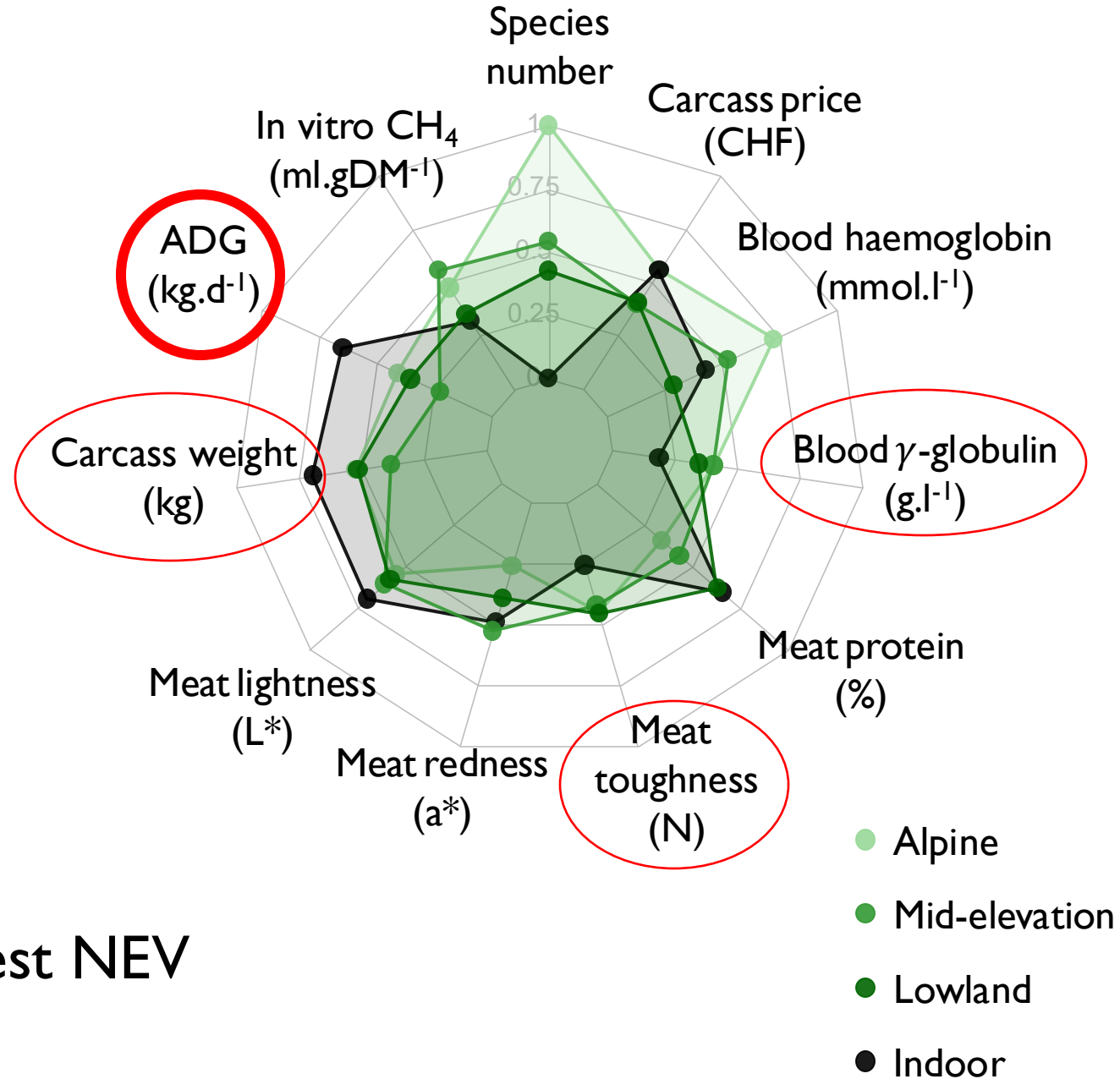
Discussion

- Indoor vs pasture systems

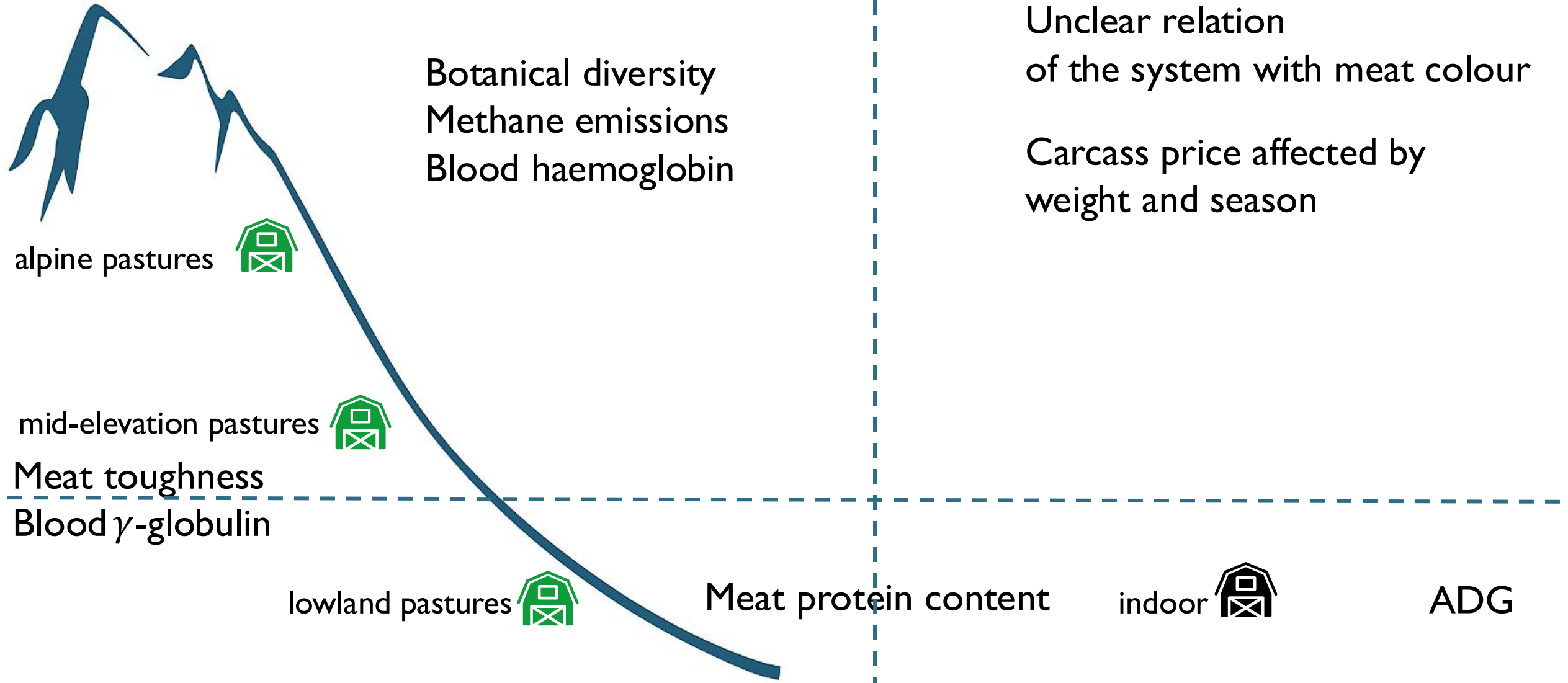
- **ADG**
- Carcass weight
- Meat toughness
- Blood γ -globulin

Better pasture nutritive value =
greater ADG

Alpine system: lowest CP, greatest NEV



Conclusion





Re-Livestock
RESILIENT FARMING SYSTEMS



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Mesbahi et al., Mountain Grassland and Livestock Joint Conference 2026

More results from the ReLivestock project:

Leiber et al. (2025) Grazing enhances immune parameters and complete blood count in calves. *Swiss Agricultural Research*

Mesbahi et al. (2026) The methanogenic potential of grass-fed dairy calves is mostly impacted by the feeding system, not the genotype. *Livestock Science*

Neujahr et al. (in progress) Validation and application of the RumiWatch noseband sensor for measuring grazing behaviour of veal calves. *Applied Animal Behaviour Science*

Werner et al. (in progress) Growth rates, carcass and veal quality of male dairy calves grazing multispecies pastures. *Grass and Forage Science*