Beyond climate perception: what drives livestock management in Pakistan's Koh-e-Suleiman Range?

Waqar Ul Hassan Tareen, Eva Schlecht

Animal Husbandry in the Tropics and Subtropics, Universität Kassel and Georg-August-Universität Göttingen, Germany

Background

- Research on climate-stress responses in Pakistan mainly focused on cropping systems, not mountain rangeland livestock systems.
- Herders in the Koh-e-Suleiman Range meet forage and water shortages with several practices, each with its own conditions.
- Combining such practices into a single index can hide what drives each of them.

Objectives

- Identify household level, socio-economic, resource-stress and context factors behind livestock-management strategies **(LMS).**
- Test whether climate-perception accuracy adds power beyond material constraints and whether tribal affiliation explains which strategy is adopted.

Study area

- This study was conducted in Punjab tribal belt of the Koh-e-Suleiman Range, Pakistan (Fig. 2).
- About 450 km North–South, 100–2,300 m a.s.l., 100–230 mm rain yr^{-1}, mean 23.5 °C.

Methods

- Cross-sectional survey of 196 pastoral and agro-pastoral households, 10/2023 – 02/2024.
- Snowball sampling within three randomly selected tribes: Buzdar (n=107), Lighari (n=46), Gourchani (n=43).
- Climate stress recorded as months per year of open-grazing and drinking-water shortage, not as meteorological indices.
- Each LMS modelled separately by binary logistic regression (Fig.3).

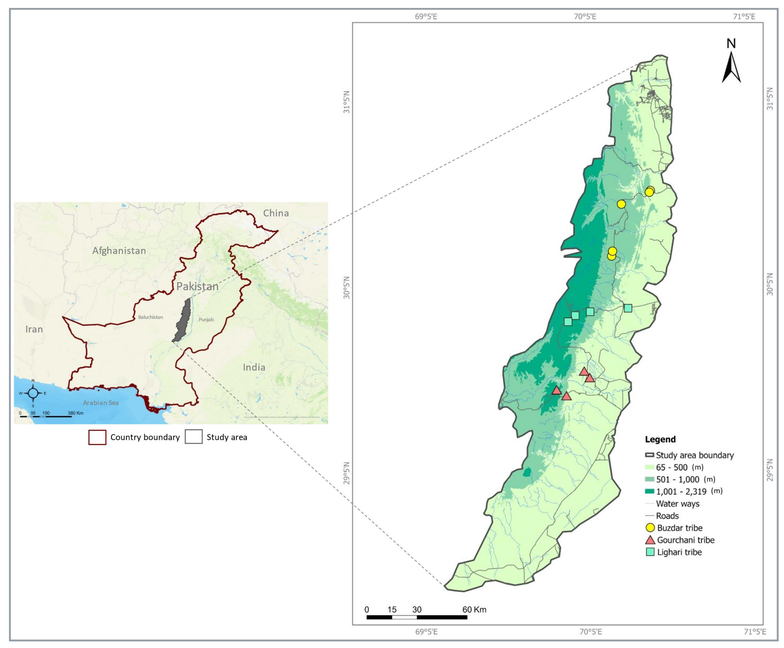

Fig. 2 Study area in Pakistan (left) and sampled villages of the three tribes along the elevation gradient (right). Map developed in Arc GIS pro 3.5 (https://www.esri.com/).

Fig. 1. Herder with a sheep flock grazing on sparsely vegetated rangeland, Koh-e-Suleiman Range, Pakistan, [January, 2024].

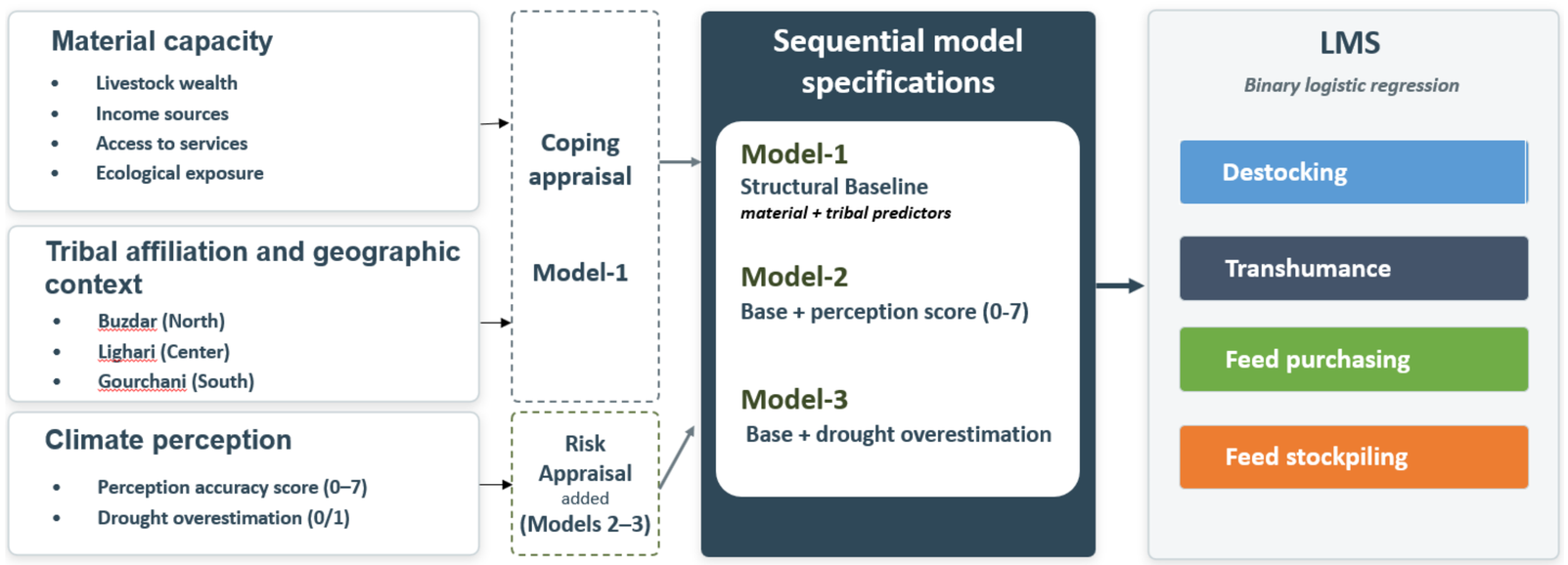

Figure 3. Analytical framework linking coping and risk appraisal to livestock management strategy adoption.

Results

a) Adoption of LMS

Two strategies were near-universal, two were used by roughly one third of households, but all applied at least one (Fig.4).

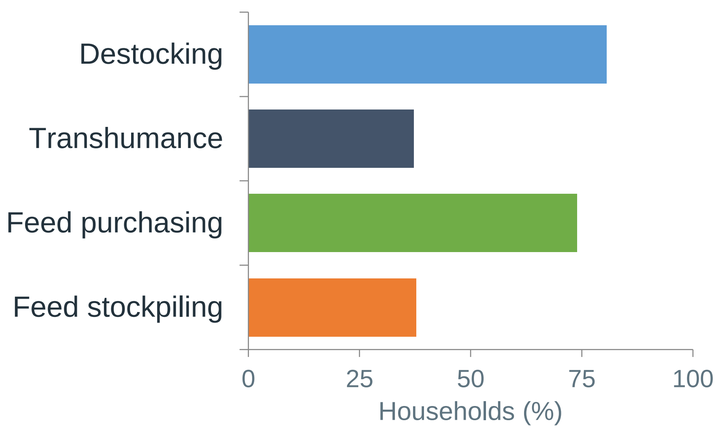

Fig.4 Adoption of the four coping strategies.

b) Tribal contrast in LMS adoption

Transhumance and feed stockpiling run in opposite directions (both P < 0.001) among tribes (Fig.5).

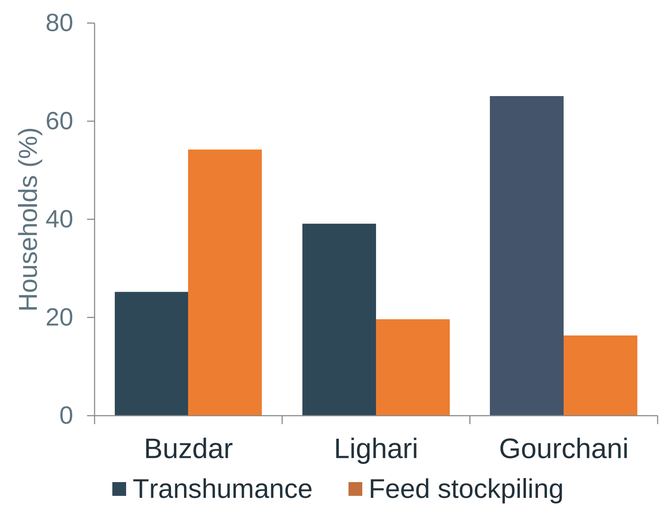

Fig. 5 Tribal differences in the practice of transhumance and feed stockpiling. Chi-square test of independence was applied.

c) Predictors of LMS adoption

Strategy	Significant predictors, OR [95% CI]
Destocking	Livestock income (log) 5.93*** [2.71–14.49]
Transhumance	Drinking-water shortage (mo) 2.31*** [1.76–3.15] Gourchani vs Buzdar 5.54** [1.65–20.04] Livestock income (log) 2.21* [1.04–5.08]
Feed purchasing	Crop farming 4.25** [1.77–10.97] Herd size 2.62* [1.06–6.68] Open-grazing shortage (mo) 1.61** [1.15–2.28]
Feed stockpiling	Lighari vs Buzdar 0.25** [0.10–0.61] Gourchani vs Buzdar 0.15*** [0.05–0.45]

*Note: significant at P < 0.05 in Model 1 are shown (n = 196; reference tribe Buzdar). * P < 0.05, ** P < 0.01, *** P < 0.001. OR = odds ratio; IRR = incidence rate ratio*

Conclusions

- Livestock-management strategies followed material capacity and experienced shortages, not climate awareness.
- Tribal and geographic context decided which strategy to be adopted.
- Awareness alone will not raise adoption: secure market access for animals and feed, and keep mobility routes to pastures and water points open.

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