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Interdisciplinary investigations identify local knowledge important for pastoralist adaptation to climate change in Montesinho (Portugal)

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Key words: Rangelands; Mediterranean basin; local livestock breeds; co-participatory consultation.

Abstract

Pastoralists are among the most vulnerable groups to climate change and variability, as they depend on bioclimatic conditions for livestock forage biodiversity and production. In the complex socio-ecological system of the mountainous area of Montesinho Natural Park (north-east Portugal, Western Europe), traditional pastoralists are impacted by climate change in their rangelands (e.g. average monthly temperature increase, shifts in precipitation patterns) (Castro et al. 2021; Oliveira 2023).

To understand the adaptive responses of local pastoralists to environmental change, this interdisciplinary research applied a three-step method. Firstly, we performed walking ethnographies with shepherds for over two years and used dialogues and observations to identify perceptions and local adaptations. Secondly, adaptive practices from other pastoral groups that could be viable in the study area were identified from the literature. And thirdly, co-participatory consultation workshops with pastoralists and representatives of local and national entities were developed to discuss and assess the adaptive measures for its practicality and sustainability.

Shifts in precipitation patterns, drought and higher temperatures in the winter were identified as climate changes by local pastoralists, and several adaptive practices for water provision and conservation, additional fodder supply and livestock thermal comfort were listed by all local stakeholders involved in the project, as feasible solutions to overcome regional ecosystem shocks and trends.

Local knowledge and climate perceptions were important for the documentation of adaptations at the rangeland level. This integrative approach, which resulted in a good practices guide, promotes practitioners and decision-makers to identify and discuss measures that will contribute to the resilience of traditional mountain pastoralism in the protected area of Montesinho and similar agro-pastoral systems.

Introduction

Pastoralism is an ancient practice that requires flexibility and adaptability to respond to social, political and ecological landscape changes. Up to the 20th century, this practice was economically important in northern Mediterranean mountains and remains so in the Natural Park of Montesinho (PNM) in north-east Portugal, Western Europe. Here, traditional pastoralism contributes to landscape management, provides ecosystem services, is a source of animal protein in local diets, and represents cultural identity (Castro et al. 2021). Despite a significant reduction in the total number of animals and shepherds using the territory due to these historical

changes, pastoralism remains an important activity in PNM. As with mountain pastoralists elsewhere, however, we are yet to understand how these groups will overcome contemporary climate challenges, or the social and ecological impacts of this practice collapsing.

Future north Mediterranean landscape projections include increased aridification and desertification as a result of climate change and current exploitation rates (Lazarev 2022). In the PNM region, recent investigations on climatic normals over the past 70 years, reveal reduced spring and increased autumn rainfall, alongside consistently increasing annual average temperatures (Oliveira 2023). Such events can deplete drinking water resources and induce heat stress in animals and plants, degrading animal health and decreasing palatable biomass, culminating in reduced livestock productivity and increased livelihoods risks (Kgosikoma et al. 2018).

Elucidating pastoralists climate change perceptions, significant impacts on activities and adaptive responses is therefore urgent. In such socio-ecological systems, as complex as PNM, an interdisciplinary approach integrating anthropological, ecological and climate knowledge is crucial for pastoralism resilience.

In this study we aim to (i) obtain insights into regional climate change perceptions amongst shepherds, (ii) identify the feasibility of climate adaptations to strengthen livelihood resilience, and (iii) provide technical oversight regarding adaptations suitability and sustainability. Project outputs will include a regional good practices guide.

Methods

The Natural Park of Montesinho (PNM) was established in 1979. The mountainous area (approximately 74,000 ha) has an elevation range between 445 and 1,487 m, average annual rainfall between 1262 and 806 mm, and average annual temperature range of 8.5 to 12.5°C (INMG 1991). The park is rich in plant and animal biodiversity mainly due to its climate, geology, and the transboundary river system with the neighbouring country, Spain. Just over 4500 people live within the park and livelihoods include both rural and non-rural activities. Pastoralism is a practice performed by fewer people than in the past, but the park still sustains herds with totals of 20,001 sheep and 687 goats across 35,296 ha of shrublands, woodlands, and cultivated areas. The low number of residents, particularly shepherds, reflects ongoing social and economic change.

To firstly identify climate change perceptions and other socio-economic-political changes affecting pastoralism in PNM, seasonal walks were undertaken between 2022 and 2023 with local sheep and goat herders. An ethnographical approach using conversations and observations yielded data, which was analysed qualitatively to identify perceptions and knowledge on specific themes: transformations in land use and pastoral activities (historical and contemporary), political and economic challenges, agrosilvopastoral resilience, pastoralists perceptions on climate change and adaptive responses. The list of adaptations identified was complemented with adaptations applied in other mountain regions globally, which could be viable under the PNM ecological, political and social conditions.

These adaptations were reviewed and discussed in co-participatory consultations held with regional pastoralists in two villages within the grazing territory of the project shepherds. The sessions comprised of presentation and discussion of project results grouped into (i) pastoralism in the past and in the present, (ii) climate change perceptions, and (iii) how to address the future as a pastoralist. The first and second parts were presented using photographs portraying life in the past and present and a summary of the descriptions and perceptions of pastoralism and climate changes provided during the ethnographic walks, which instigated open discussions among participants. The third part comprised of a comparison between two photographs depicting a current productive landscape and a future drier scenario. The adaptive responses identified during the walking ethnography and the literature review were presented to the participants in the form of smaller photographs, which were either selected or discarded according to its practicality, efficiency and applicability in the PNM, and prioritised based on the pastoralists needs. A final workshop involving local stakeholders engaged with the agrosilvopastoral system of the park (members of national associations of local breeds and governmental

agencies) followed a similar structure. The participants were invited to contribute with their technical knowledge on discussions about the executability and enforcement requirements of each adaptation. Every person involved in this study was individually invited to participate, and informed about the research aims, outputs, and their rights to withdraw at any point.

Though this study aimed to present how PNM pastoralists are adapting to climate change, our work addressed a limited number of male only participants with a narrow age spectrum (50-69 years). Additionally, across the years, different researchers conducted the ethnographic walks which could have contributed to some bias as we did not follow an interview script. When conducting the co-participatory consultations, thinking of a future scenario with drastic water shortage and warmer periods was not always an easy task for some participants. Moreover, we believe some discussions among stakeholders were guided by their professional link to a regional/national entity.

Results

Walking ethnography yielded important insights on temporal changes in work organisation, dynamic agrosilvopastoral system resilience, and climate change perceptions. Furthermore, coping mechanisms were identified for the changing conditions pastoralists currently face. Climate change perceptions, suggest that seasons are less well defined compared to the past, winters are warmer, and there is less water in the soil (e.g. many springs and small streams have dried or have little water). Pastoralists further reported that rainfall no longer follows monthly patterns, frost and thunderstorms occur at unexpected times of the year, and snowfall frequency and quantity are lower. All these changes are believed to impact fodder productivity and drive higher resource and materials costs.

Adaptations implemented by PNM pastoralists and in other regions were reviewed by all parties (shepherds and stakeholders) involved in this traditional practice during the co-participatory consultations. The two consultations with local pastoralists resulted in the selection of 14 and 11 relevant adaptations, a difference most likely due to the edaphoclimatic characteristics of the west and east regions of the park where the shepherds graze their herds. We grouped the selected adaptations into three types: adaptations in the grazing territory, to the grazing of animals, and to the livestock production. Many of the response mechanisms were directed at providing water and forage for the animals, valuing and diversifying livestock products (e.g. added value product; production of cheese), and improving animal health. Priority among pastoralists was given to adaptations to be implemented by regional and national entities rather than by the shepherds themselves, probably due to the grazing territory being within a protected area with strong conservation enforcement and laws.

Discussion [Conclusions/Implications]

Pastoralists perspectives on precipitation and temperature variation, and other climatic hazards (e.g. lack of snow), reflect the changes taking place in PNM inferred from climatic data (Oliveira 2023). Moreover, they highlight the negative impact such events have mainly on water availability and crop productivity in PNM. As a response, all shepherds, regardless of their territories characteristics, apply coping mechanism frequently observed in other rangelands across the globe (Herrero et al, 2016): place water points in the territory, grow crops that are more drought resistant to feed animals in face of pasture shortage, adjust shepherding routes. Adaptations priority, however, appear to respond to the edaphoclimatic conditions of the grazing grounds. Planting trees and conserving pastures were top adaptations for pastoralists from the warmer and drier region of the PNM, while valuing livestock products more crucial for increasing pastoralism resilience among pastoralists from the colder region. The fact that most shepherding territory is located within a protected area that is under national administration could explain why in both consultations, priority was also given to large scale adaptations such as building water reservoirs, planting trees or implementing early weather warning systems. However, this result could also be due to individual strategies already being addressed and becoming less significant when compared to other major adaptations.

The stakeholders workshop confirmed some of the pastoralists perceptions on bureaucratic and legislative challenges to improve animal housing conditions or implementing water recovery systems. Though technology may benefit pastoral adaptations to climate change (Arjjumend 2018), in the PNM context, local protected area laws are somehow prohibitive. Moreover, other difficulties pointed out by stakeholders address the fact that many national strategies and policies are developed for pastoralism at a different scale than that of the PNM.

This investigation shows that pastoralists in PNM continue to adapt as they have done for decades, though we are unsure if these responses are enough to maintain the activity in times of accelerated and larger magnitude changes (Galvin, 2009). Indeed, worries emerged regarding the future of this traditional activity facing the impacts of a warmer and drier landscape, and political and social challenges (ex. unsuitable common agricultural policy, rural abandonment). Nevertheless, we hope that our research strategy of bringing together knowledge from pastoralists, stakeholders and scientists - "hybrid knowledge" (Dean et al. 2024) - will contribute to policy discussions at the regional and national levels on the complex Mediterranean pastoral systems and the need for climate change mitigation and coping strategies.

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