



University of Kentucky  
UKnowledge

---

International Grassland Congress Proceedings

XXIV International Grassland Congress /  
XI International Rangeland Congress

---

## Towards a Holistic Understanding of Pastoralism

M. Cabeza

*University of Helsinki, Finland*

P. Manzano

*University of Helsinki, Finland*

D. Burgas

*University of Jyväskylä, Finland*

L. Cadahía

*University of Oslo, Norway*

J. Eronen

*University of Jyväskylä, Finland*

*See next page for additional authors*

Follow this and additional works at: <https://uknowledge.uky.edu/igc>



Part of the [Plant Sciences Commons](#), and the [Soil Science Commons](#)

This document is available at <https://uknowledge.uky.edu/igc/24/6/22>

**This collection is currently under construction.**

**The XXIV International Grassland Congress / XI International Rangeland Congress (Sustainable Use of Grassland and Rangeland Resources for Improved Livelihoods) takes place virtually from October 25 through October 29, 2021.**

Proceedings edited by the National Organizing Committee of 2021 IGC/IRC Congress

Published by the Kenya Agricultural and Livestock Research Organization

---

This Event is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in International Grassland Congress Proceedings by an authorized administrator of UKnowledge. For more information, please contact [UKnowledge@lsv.uky.edu](mailto:UKnowledge@lsv.uky.edu).

---

### Presenter Information

M. Cabeza, P. Manzano, D. Burgas, L. Cadahía, J. Eronen, Á. Fernández-Llamazares, S. Bencherif, Ø. Holand, M. Fortelius, O. Seitsonen, María E. Fernández-Giménez, K. A. Galvin, and N. Chr. Stenseth

# Towards a holistic understanding of pastoralism

Cabeza, M.\* †; Manzano, P.\* †; Burgas, D. ‡; Cadahía, L. #; Eronen, J. †; Fernández-Llamazares, A.\* †; Bencherif, S. ††; Holand, Ø. §; Fortelius, M. §§; Seitsonen, O. ###; Fernández-Giménez, M.E. \*‡; Galvin, K.A. ¶; Stenseth, N. Chr#.

\* Global Change and Conservation Lab, Organismal and Evolutionary Biology Research Programme, Faculty of Biological and Environmental Sciences, University of Helsinki, FI-00014 Helsinki, Finland; † Helsinki Institute of Sustainability Science (HELSUS), Faculty of Biological and Environmental Sciences, University of Helsinki, FI-00014 Helsinki, Finland; ‡ Department of Biological and Environmental Sciences, University of Jyväskylä, FI-40014 Jyväskylä, Finland; # Centre for Ecological and Evolutionary Synthesis (CEES), Department of Biosciences, University of Oslo, NO-0316, Oslo, Norway; †† Faculty of Nature and Life Sciences, Department of Agronomic and Veterinary Sciences, University of Djelfa, 17000 Djelfa, Algeria; § Faculty of Biosciences, Norwegian University of Life Sciences, NO-1430 Ås, Norway; ### Archaeology, Faculty of Humanities, University of Oulu, FI-90570 Oulu, Finland; §§ Department of Geosciences and Geography, University of Helsinki, FI-00014 Helsinki, Finland; \*‡ Department of Forest & Rangeland Stewardship, Colorado State University, Fort Collins, Colorado 80523, USA; ¶ Department of Anthropology and Geography, Colorado State University, Fort Collins, Colorado 80523, USA;

**Key words:** pastoralism; global change; international development; transdisciplinarity

## Abstract

Pastoralism is a globally-important livelihood, with large social, environmental and economic importance across much of our planet. Yet, it is also a vulnerable practice with widespread crises, urgently calling for better systemic understanding. The current disciplinary compartmentalization of research not only hampers this but allows perpetuation of unfortunate misconceptions. Furthermore, a long-standing marginalization of the livelihood prevails, with pastoralism being largely overlooked in international environmental and economic forums or sustainability agendas.

Here we call for transformative approaches to pastoralism research that can advance an integrated understanding of these social-ecological systems through a comparative lens. We develop a framework that uses: i) timescales from the distant past to the present, ii) social, economic and environmental dimensions, and iii) diverse geographic contexts and scales, to capture emerging properties allowing for cross-cultural comparisons. We provide specific guidelines for formally developing a coherent set of sustainability indicators that are transferable across time and space, and can track sustainability. In an exploratory exercise, we also show that very distinct pastoralist systems have undergone similar transitions across time, approaching critical thresholds and then either collapsing or recovering. An integrated view of the interactions between the environmental, social and economic dimensions of these transitions allows for an improved understanding of potential tipping points, hence supporting more proactive and informed decision-making. We conclude that the need for a paradigm shift in pastoralism science and policy is pressing. Determining when, where and how is pastoralism not only sustainable, but also the most adaptive livelihood, has become a priority.

This paper is based on Manzano et al. (2021).

## Introduction

Pastoralist social-ecological systems have risen and fallen since their origins millennia ago, but the last decades have witnessed an increasing frequency and magnitude of sudden livestock production losses (Cottrell et al 2019). This global pattern threatens the future of pastoral livelihoods and poses great challenges for achieving many of the U.N. Sustainable Development Goals (UN 2015) in many nations. In contrast, forecasted climatic changes threaten agricultural production in many limiting environments where, in turn, pastoralism may remain the most resilient and adaptive livelihood. Such characteristics, coupled with a growing human population, make investing in pastoralism research—and supporting policies—a timely endeavor.

We propose a comparative research approach based on aligning the trajectories of diverse pastoralist systems through history, which allows the inclusion of key elements. We build on the qualitative similarities of these trajectories and theorize that if thresholds or tipping points could be identified through systematic empirical data collection and analysis, interventions could be undertaken to prevent collapses or accelerate recoveries across all domains. We believe that such a diachronic, multi-scale analysis will not only add to the science of pastoralism but will also reveal the shortcomings of different development and governance interventions. Such analysis will help uncover novel and transformative approaches to sustainable futures, thus laying out potential pathways to help solve some of the problems pastoralist systems face today. We discuss

the use of suitable sustainability indicators adapted to pastoralist systems, along with participatory methods that support the identification of metrics that are locally-based, but globally-relevant.

## Methods

This paper uses a social-ecological resilience framework to develop a theory of pastoralism that incorporates multiple slow, controlling and fast-moving social, ecological, and institutional variables operating at multiple scales from the local to the global (Folke et al. 2010). Maintaining resilience thus entails the management for a diverse set of parameters and their feedbacks. Social, ecological and political processes are path dependent (Hodgson 2001), such that legacies of past events affect the dynamics of the current socio-ecological systems.

This social-ecological resilience framework includes both adaptive co-management and adaptive governance approaches, that operationalized through institutional arrangements, have the potential to empower local decision-making and link local communities to vertical and horizontal organizations (e.g., for funding, policy), and emphasize the role of collaboration and social learning (Duit et al. 2010).

We show how moving towards a more holistic, transdisciplinary and global understanding of pastoralism will support the 2030 Agenda for Sustainable Development (UN 2015). In order to advance in this direction we endorse an approach that uses (i) evidence across the social, economic and environmental dimensions of sustainability, (ii) diverse geographic contexts and scales to capture emerging properties and allow for cross-system comparisons, and (iii) timescales from the distant past to the present, allowing for the analysis of trajectories of pastoralist societies.

## Results: Integrative knowledge management methods towards a solution

### Exploring pastoralism transitions

We believe the concept of Kuznets curves and related theories (Stern 2017) is useful for comparing disparate pastoralist systems that are undergoing transitions and are at different development stages. Indeed, we find some examples where pastoralism has been used in the representation of such curves (Sobhee 2004).

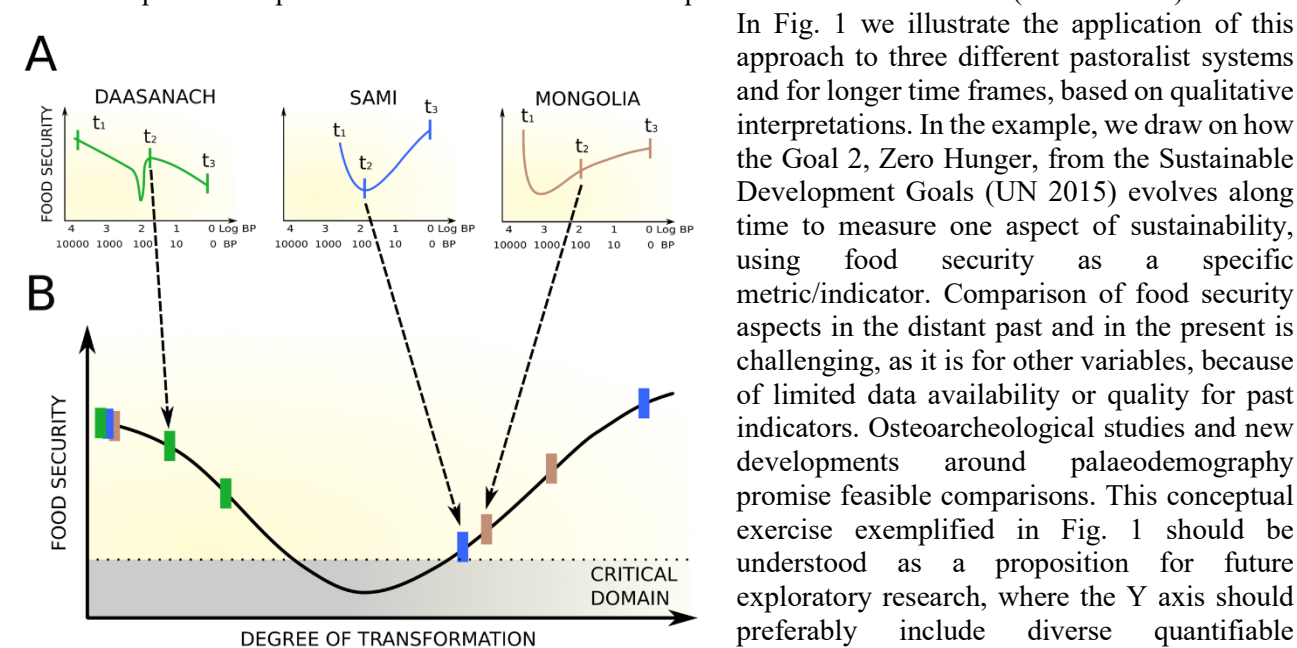


Figure 1. Dynamics and comparability of different pastoralist systems.

Mongolia; Fig. 1A), or combine disparate pastoralist societies (East Africa, Central Asia, Arctic; Box Fig. 1B) in a single curve and at different points in time using an appropriate X-axis. The metrics we plot here on the Y-axis indicate that a system may move from a situation of high sustainability (e.g., high food security) and down to levels that approach sustainability limits when crossing critical domains. From those critical domains, the system may either collapse or recover as in the panarchy adaptive cycle (Holling and Gunderson 2001). Such critical domains could be determined empirically through the comparisons of multiple systems, and considering sustainability indicators pertaining to different dimensions. Such representations allow us to add temporal depth and compare trajectories looking for common patterns in transitions across systems. The drivers of major inflection points may be particular and revealed only when simultaneously studying

In Fig. 1 we illustrate the application of this approach to three different pastoralist systems and for longer time frames, based on qualitative interpretations. In the example, we draw on how the Goal 2, Zero Hunger, from the Sustainable Development Goals (UN 2015) evolves along time to measure one aspect of sustainability, using food security as a specific metric/indicator. Comparison of food security aspects in the distant past and in the present is challenging, as it is for other variables, because of limited data availability or quality for past indicators. Osteoarcheological studies and new developments around palaeodemography promise feasible comparisons. This conceptual exercise exemplified in Fig. 1 should be understood as a proposition for future exploratory research, where the Y axis should preferably include diverse quantifiable indicators across sustainability domains. We also show in Box 1 how one can similarly explore trajectories for single pastoralist systems through time (e.g. Pastoralism in

connections with variables in multiple domains. Transferability of policies and management measures from the right-hand side of the curve to the left side should be encouraged, allowing tunneling through critical domains while avoiding points of no return (Munasinghe 1999).

We insist that the approach illustrated by Fig. 1 should not be limited to one indicator in a single domain (“food security” in the figure) but instead explore transformations in all domains, and their interactions. But to move forward, from the qualitative conceptualization presented to empirically based theories of pastoralism, requires first the development of a relevant set of sustainability indicators.

### ***Sustainability indicators for pastoralism research and policy development***

Such research approach is not only useful to explore past transitions. Some of the key metrics used to identify important transitions and tipping points of past pastoralist trajectories can, similarly, be used to monitor current pastoralism sustainability and suggest paths for improving it in the future.

Considerable indicator work has been conducted for livestock production systems, but either for intensive livestock farms or for particular regions (Rigby et al. 2000, Mitchell 2010, Lebacqz et al. 2013). The shift in focus we call for here highlights the need to consider pastoralism characteristics such as mobility dependence, common-pool resources, low-input/low-output processes and coexistence with natural or semi-natural values. We stress that relevant indicators should thus capture changes in these characteristics in addition to other indicators identified as relevant for strongly linked social-ecological systems. In fact, despite all the promising indicators identified, researchers call for (i) further development of particular indicator themes, (ii) a more manageable list of indicators that can better evaluate impacts and ease of data collection, and (iii) to empirically test interactions between indicators, within and between dimensions (Mitchell 2010). The approach to explore trajectories presented here may offer this opportunity.

Different proxies may be needed for different periods. Importantly, indicators should be comparable for different geographical contexts and should not be susceptible to small differences in methods or measures across settings. We echo the calls for locally relevant yet globally applicable indicators, and when possible, consider interactions that link local to global sustainabilities in an increasingly interconnected or telecoupled world, noted as particularly important in the global livestock production system (Torres et al. 2017).

To fill data gaps and identify indicators that are relevant for local community decision-making, it is paramount to work with pastoral communities within transdisciplinary, collaborative research settings that are co-designed and co-produced (Wyborn et al. 2019).

## **Discussion**

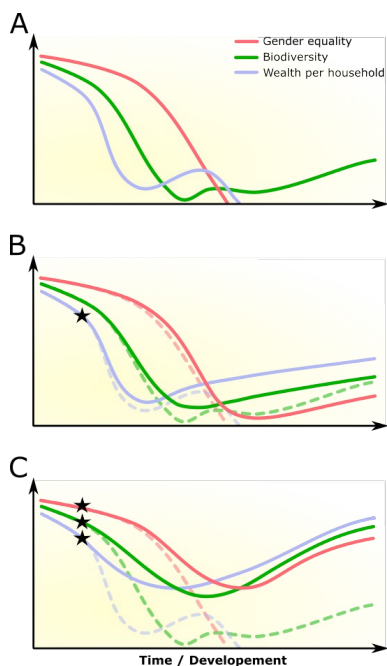


Figure 2. Evolution of indicators of sustainability domains under different policy/intervention scenarios.

The identification of solutions for pastoralism is inherently complex, not only because they are challenging to trace but also because the trajectories of the different sustainability domains are tightly interdependent. While progress can be observed e.g., in the trajectories of economic and environmental domains, deep shortcomings in the social domain can drive the whole system to collapse. An example of this would be the differential emigration of women (Manzano Baena and Casas 2010). The loss of women’s knowledge and capacities, as in, e.g., dairy production (Flintan 2018), renders generational continuity impossible (Fig. 2A). Conversely, while well-directed early action in one single domain could avert total collapse, approaching tipping points that are dangerously close to collapse would erode existing knowledge. For instance women’s emigration may not reach the level of system collapse, but may be high enough to affect women-associated dairy processing knowledge, such as the elaboration of cheese varieties whose sale can boost the pastoralist economy. Such unsatisfactory social outcomes would negatively impact the future economic and environmental outcomes of the livelihood, even if total collapse is avoided (Fig. 2B). Other losses caused by approaching critically low sustainability levels include species extinctions in the environmental domain, or loss of culturally-adapted product consumption patterns in the economic domain. Only by understanding the need to act simultaneously across domains, early enough and through well-informed action, loss of knowledge, adaptation options and wasted economic development potential would be minimized (Fig. 2C).

To enable such identification of solutions, it is essential to establish global databases (preferably open access) that collect and avail data from a wide array of different pastoralist systems, and that turn such data into comparable, transferable indicators. Transdisciplinary teams must learn from the crossed interactions

between such indicators in past situations in order to design adequate interventions in pastoralist projects. In all phases they should include pastoralists from the pastoralist systems that are targeted by the interventions. This includes adaptive co-management where users and resource managers, operating at different scales, can have the means to experiment, monitor, deliberate and reactively manage resources at the local level (Hasselman 2016). It also includes adaptive governance, where the social dimensions associated with management and decision-making can be addressed (Folke 2010).

In summary, we encourage an approach where: 1) sets of relevant indicators are compiled across scholars, practitioners and pastoralists globally; 2) the transferability of indicators across systems, temporal dimensions and scales is evaluated, and suitable standardizations applied; 3) their suitability to identify system transitions, especially tipping points, is assessed; and 4) the subset of indicators found useful is collaboratively appraised and their use further promoted to monitor pastoralism sustainability both globally and locally, aiming at enhancing favorable policies across scales. It is important to underline that these approaches should include pastoralists in their development, evaluation and policy formulation. We believe that the indicators developed through the proposed research approach may become better integrated into global science-policy interfaces and assessments, contributing to better recognize pastoralism in global environmental and economic forums or sustainability agendas. This will pave the way for producing better informed and more effective policies and interventions, which will ensure pastoralism resilience and sustainability in the long run.

## Acknowledgements

This research was funded through the International Union of Biological Sciences (IUBS), the Helsinki Institute of Sustainability Science (HELSUS), Letterstedskat Föreningen, and the UiO:Life Science program at University of Oslo.

## References

- Cottrell, R.S., Nash, K.L., Halpern, B.S., Remenyi, T.A., Corney, S.P., Fleming, A., Fulton, E.A., Hornborg, S., John, A., Watson, R.A., Blanchard, J.L. 2019. Food production shocks across land and sea. *Nat. Sustain.* **2**, 130–137.
- Duit, A., Galaz, V., Eckerberg, K., Ebbesson, J., 2010. Governance, complexity, and resilience, *Glob. Environ. Change* **20**, 363-368.
- Flintan, F. (2008). Women's empowerment in pastoral societies (WISP-IUCN, 2008).
- Folke, C., Carpenter, S.R., Walker, B., Scheffer, M., Chapin, T. Rockström, J. 2010. Resilience thinking: integrating resilience, adaptability and transformability, *Ecol. Soc.* **15**, 20.
- Hasselman, L. Adaptive management; adaptive co-gestion; adaptive governance: what's the difference, *Australas. J. Environ. Manag.* **24**, 31-46 (2016).
- Hodgson, G.M. 2001. *How economics forgot history: The problem of historical specificity in social science* (Routledge).
- Holling, C.S., Gunderson, L. 2002 "Resilience and Adaptive Cycles", in Panarchy: Understanding transformation in human and natural systems, C.S. Holling and L.H. Gunderson, Eds. (Island Press), pp. 25-62.
- Lebacqz, T., Baret, P.V., Stilmant, D., 2013. Sustainability indicators for livestock farming. A review, *Agron. Sustain. Dev.* **33**, 311.
- Manzano, P., Burgas, D., Cadahía, L., Eronen, J., Bencherif, S., Holland, Ø., Seitsonen, O., Byambaa, B., Fortelius, M., Fernández-Giménez, M., Galvin, K.A., Cabeza, M., Stenseth, N.C. (2021) Towards a holistic understanding of pastoralism. *One Earth (submitted)*
- Manzano Baena, P. Casas, R. 2010. Past, present and future of trashumancia in Spain: nomadism in a developed country, *Pastoralism* **1**, 72-90.
- Mitchell, J.E. (ed.). 2010. Criteria and Indicators of Sustainable Rangeland Management. Laramie, WY: University of Wyoming Extension Publication No. SM-56. 227 p.
- Munasinghe, M. 1999. Is environmental degradation an inevitable consequence of economic growth: tunneling through the environmental Kuznets curve, *Ecol. Econom.* **29**, 89-109.
- Rigby, D., Howlett, D., Woodhouse, P. 2000. A review of indicators of agricultural and rural livelihood sustainability (CAFRE).
- Sobhee, S.K. 2004. The environmental Kuznets curve (EKC): a logistic curve?, *Appl. Econ. Lett.* **11**, 449-452.
- Stern, D.I. 2017. The environmental Kuznets curve after 25 years. *Journal of Bioeconomics* **19**, 7–28.
- Torres, S.M., Moran, E.F., Silva, R.F.B. 2017. Property rights and the soybean revolution: shaping how China and Brazil are telecoupled, *Sustainability* **9**, 954.
- UN General Assembly, Resolution 70/1 adopted by the General Assembly on 25 September 2015. Transforming our world: the 2030 Agenda for Sustainable Development (United Nations, 2015).
- Wyborn, C., Datta, A., Montana, J., Ryan, M., Leith, P., Chaffin, B., Miller, C., Van Kerkhoff, L. Co-producing sustainability: Reordering the governance of science, policy, and practice, *Annu Rev Environ Resour* **44**, 319-346 (2019).