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Dressler, Gunner; Frank, Karin; Groeneveld, Jürgen; and Müller, Birgit, "Pasture degradation as a consequence of non-compliance with social norms: exploring behavioral strategies with an agent-based simulation model" (2016). *International Congress on Environmental Modelling and Software*. 12. [https://scholarsarchive.byu.edu/iemssconference/2016/Stream-D/12](https://scholarsarchive.byu.edu/iemssconference/2016/Stream-D/12)

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Pasture degradation as a consequence of non-compliance with social norms: exploring behavioral strategies with an agent-based simulation model

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Abstract: Pasture resting as a key strategy for sustainable grazing management has been in place for centuries in the form of social norms in rangeland systems. Most of these areas are drylands, characterized by low and variable rainfall and scarce resources that require well-adapted resource use strategies to avoid pasture degradation. However, in many areas such traditional norms are at stake as new management strategies are introduced by government authorities, new herders belonging to different ethnic groups enter the system, or former communal grazing land is converted into private property or agricultural land. As a result, compliance with traditional norms declines, leading to a change in household behavior that affects pasture and livestock conditions. To analyze when such a behavioral change can lead to pasture degradation and livestock loss, we have developed an agent-based simulation model that captures the interaction between pastoralist households, their livestock and the pastures they use in a common property grazing system. We implement and compare three stylized household behavioral models that are grounded in theory and reflect empirical observations, namely a traditional descriptive norm actor, a rational short-term maximizer and a bounded rational satisficer. These strategies differ in their herd size goal, their intrinsic preference to follow a social norm and the social influence of others’ behavior on their own decision. We conduct simulations with respect to the long-term development of pasture condition, herd sizes, and households remaining in the system. Our analysis shows that the traditional household type conserves the pasture state but gets increasingly under pressure as household density in the system increases. A transition towards rational actors has short-term advantages but leads to pasture degradation and livestock loss in the long term. In a mix of all three strategies, both pasture and livestock conditions can be improved for certain shares of bounded rational satisficers in the agent population. Thus, we show with our stylized model that changes in household behavior can drastically alter the long-term systems dynamics and need to be considered to achieve sustainable land use in common property systems.

Keywords: agent-based model; human decision making; social norms; livestock; pasture; grazing; natural resource use; sustainability.