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The Role of Key Resources to Ensure Livelihood Security and Ecological Sustainability: A Range Management Modelling Study

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Abstract

Semi-arid grazing systems are prone to ecological change due to rising climatic variability and land use change. While facing increasing vulnerability, range management needs to focus on ecological factors that limit livestock in the long term. We therefore present a mechanistic approach, which enables us to identify key resource areas for sustainable land use during droughts. Key resources are suspected to preserve livestock herds during scarce times while, in the absence of these areas, animal numbers decline. It is crucial that pastoral people whose livelihood depends solely on a minimum number of livestock identify limits of local key resources and determine the time when external resources are needed (bottle-necks).

We present an innovative holistic approach using resource portfolios to identify and to assess resources within the variable environment and within different socio-economic contexts. With a grazing model, simulating a heterogeneous distribution of vegetation, seasonal shifts of growth periods, and stochastic rainfall, we evaluate the relative value of each pasture to maintain the number of livestock. We show how different socio-economic contexts such as market access and external fodder resources change the importance of local key resources during droughts. We hypothesise that, when external fodder is supplemented, the relative contribution of natural resources in fulfilling the fodder demand decreases. However, during crisis (*i.e.* droughts, market crisis), the value of key resources may increase again. But for that, it is required that key resources have previously not been degraded by non-adapted use. Thus, times of crisis reveal potential pitfalls in a vulnerable rangeland if the maintenance of a certain amount of buffer was neglected.

Hence, our modelling approach allows the evaluation of how socio-economic conditions influence the role of natural resources for livelihood security and ecological sustainability in rangelands.

Keywords: Ecological sustainability, key resources, livelihood security, resource portfolio, semi-arid rangeland