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## **Pitfalls of institutional change : rain-index insurance may impair the sustainability of rangeland management**

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**Key words** : ecological-economic modelling , livestock grazing , resting strategy , risk management , semi-arid

**Introduction** In the context of global change , recently new institutions become available for farmers worldwide to hedge income risk . These institutions are especially important in (semi-) arid regions where the livelihood of the majority of people depends on livestock farming . At these rangelands the highly variable and uncertain precipitation translates into a highly uncertain income . A second challenge for range management is that inappropriate grazing strategies can lead to land degradation , i . e . loss of pasture productivity .

In this study one particular institution-rain-index insurance-is under focus . This type of insurance provides an indemnity payment to the farmer if rainfall does not reach a prior defined strike level . The aim of the presented research is to investigate the implications of introducing such rain-index insurances on strategy choice of the farmer and therewith on the long-term dynamics of the overall system .

**Materials and methods** The starting point for the analysis of different grazing strategies is the case study of a farm in Namibia , which is successful in ecological and economic terms (Müller et al . 2007 , Quaas et al . 2007) . The key element of the grazing strategy is resting of a part of the pasture in rainy years . Using an ecological-economic simulation model , the farmer's income risk with and without insurance for different grazing strategies is compared . Furthermore long-term impacts on rangeland condition are investigated for different scenarios .

**Results and discussion** The results reveal strong feedback mechanisms between the ecological and socioeconomic subsystem . Two results are emphasized here . Firstly , resting pastures during rainy years helps to build up an intrinsic buffer of the system-the reserve biomass (describing non-photosynthetic reserve organs below and above ground of the plant) . Such grazing strategy leads to a reduction of income risk . Apart from this short-term insurance effect , resting pastures in rainy years enables the farmer to maintain high pasture productivity in the long term . Hence it serves as investment in the future . However , access to an economic buffer i . e . to the financial institution rain-index insurance , can create adverse effects : Farmer may change to less sustainable strategies . The study shows that these findings strongly depend on the design of the insurance contract , and in particular on the strike level .

**Conclusions** These results have far-reaching implications for policy makers . It is revealed that in order to design suitable risk management measures , the structure of the social-ecological system , and in particular intrinsic buffer mechanisms , have to be taken into account . Policy makers should be aware of the influence that these economic risk management measures could have on farmer's choice of grazing strategies . Otherwise these measures may have detrimental effects on the resilience of the rangeland ecosystem and , therewith , on the long-term well-being of farmers .

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