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Traditio et Innovatio

Aus der Professur für Grünland und Futterbauwissenschaften
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Thesen der Dissertation

The Ecology and Management of Pastures in Western Tien-Shan, Kyrgyzstan:

Strengths, Weaknesses, Opportunities and Threats

zur Erlangung des akademischen Grades
Doktor der Agrarwissenschaften (doctor agriculturae)
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The rationale of the research

- Over the last decades, changing environmental factors and management practices have altered the structure and properties of mountain pastures (Ionov, 2003; Ionov and Lebedeva, 2003).

- The inherent ecological complexity of mountain grasslands and interactions between social, economic and environmental effects make proper pasture use planning or devising effective management plans difficult.

- For developing sustainable pasture management, it is important to integrate management aspects with ecological as well as socio-economic processes.

- Scientific data and decision support tools for vegetation monitoring and environmental decision-making are needed in Western Tien-Shan, Kyrgyzstan, to develop sustainable pasture management schemes and safeguard pasture biodiversity.

Essential research results

- Over 42-years, vegetation composition showed a homogenization across vegetation types in mountain pastures under lasting grazing with different management schemes and changing climatic conditions.

- In mountain ecosystems, the response of vegetation to global warming may not always be direct: elevational changes in one vegetation type may lead to indirect changes in other vegetation types.

- The studied mountain pastures are more sensitive to precipitation variations and increasing soil-moisture availability than warming-induced changes.

- Vegetation cover and the interactions between species in a response to grazing and environmental factors change much faster than estimated based on historical data results.

- In mountain pastures, vegetation degradation, i.e. changes in compositional structure of swards while the total vegetation cover remains unchanged, can be assessed by using eMODIS250NDVI datasets combined with ground-based survey data.

- The interpretation of qualitative changes in mountain pastures based on greenness reflectance and NDVI values may differ from assessments of quantitative changes: Thus, high NDVI values may refer to pastures with a lot of biomass that may still be degraded.

- High NDVI values at greenup and senescence, so far interpreted as signs of a prolonged growing season due to climate change, could also be effects of long-term shifts in species composition.

- Farmers' decisions for increasing livestock numbers are in Kyrgyzstan associated with insecurity and economic factors, while decreases are related to environmental changes. Decisions on land use change are influenced by difficulties with farming practices, changing conditions of pastures, and increasing incidences of livestock disease.
- Sustainable pasture management strategies are possible only when factors beyond the pasture-livestock-grazing scope are taken into account.

Conclusions and outlook

- Our findings showed that current pasture condition, pasture degradation issues and decision-making under social, economic and environmental uncertainties at the individual and community level fit the concept of the 'wicked problem' (Rittel and Melvin, 1973). The problem is complex, there is no way of knowing that a solution is final, i.e. there is no clear stopping rule, and a single appropriate solution does not exist (Dewulf and Biesbroek, 2018).
- Long-term historical resurvey studies are important to design further global climate-vegetation interactions models for predicting further changes in mountain ecosystems and ecosystem functioning and to reassess pasture use planning.
- Developed datasets on vegetation degradation assessments from remote sensing may contribute to create feasible grassland monitoring metrics and to answer a number of global change questions.
- Agropastoral systems are complex and change dynamically due to effects of various drivers. Understanding the inter-relationships between ecosystem processes and agropastoralists' behavior can be achieved by integrating scientific, social and other knowledge from involved specialists with different fields of expertise.
- Economic incentives for pasture users should be encouraged in the formulation of natural resource management policies and should consider uncertainty and risk management and enhance the adaptive capacity to climate change.