Scientific background of the strategic board game „NomadSed“

Karin Frank[1]*, Ingo Breuer[2] , Andreas Gruschke[2], Birgit Müller[1] & Romina Drees[1]

[1] Helmholtz Centre for Environmental Research – UFZ, Leipzig, Department of Ecological Modelling (OESA) and Subproject E10 of the Collaborative Research Centre SFB 586
[2] University of Leipzig, Institute of Oriental Studies and Subproject A4 of the Collaborative Research Centre 586
* Corresponding author

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

1. Introduction

To understand socio-environmental consequences of the multitude of interacting global environmental change processes and to develop strategies of sustainable response are important fields of recent environmental research. Thus, the consideration of hotspot regions of global change is of particular relevance. One prominent example of such hotspot regions are the world's drylands. These regions are inherently exposed to challenging climatic conditions (water scarcity, rainfall variability) that are further amplified by climate change with the risk of increased pressure on natural resources.

Traditionally, mobile pastoralism ('nomadism') has been the main form of land use in drylands and found to be well adapted to the specific climatic conditions. For two reasons, it is strategically important to analyze the functioning of nomadic communities and to explore sustainability aspects of their resource use under the influence of global change: On the one hand, the livelihood of nomadic communities particularly depends on the productivity of the drylands' natural resources (esp. the pastures). To maintain the productivity is therefore mandatory but challenging as nomadic communities are often exposed to various additional transformation processes. On the other hand, nomadic land use strategies can be used as model system for studying ways of adaptation to impacts of increasing climate variability. For these reasons, this topic was addressed in the frame of a subproject (E10) of the DFG-funded Collaborative Research Centre 586 (Difference and Integration – Interaction between nomadic and settled forms of life) of the Universities of Leipzig and Halle-Wittenberg using ecological-economic modeling. In order to support transfer of knowledge from the research project to the public, it was decided to condense some insights gained into a strategic board game.

The Strategic Board Game NomadSed has been designed to provide insight into the everyday life of nomadic households, their strategies of resource utilization, and the complex challenges they have to master in order to secure their livelihood and to maintain their live support systems through enabling regeneration of their pastures. The game was developed in cooperation with the Berlin University of Arts.

2. Some facts on nomadic resource utilization

Nomadic regions are mainly located in the dryland belt of the earth. These regions are characterized by scarce and highly variable rainfall or – as is the case in high altitudes or subarctic regions – by a short vegetation period. Both impede agriculture with the implication of extensive livestock breeding (pastoralism) being an important form of land use and pastures a key resource for natural life support. When crossing nomadic regions, however, one will recognize that pastures do not resemble each other but differ in composition, density and productivity of the vegetation covering them. This is the result of the fact that the state of each pasture is influenced by various factors: soil type, climatic conditions such as precipitation and temperature, but also the way of using the

Figure 1: Degraded pastures in Surug (Yushu, Tibetan Highlands) (Photo: A. Gruschke)

pasture. Various studies have shown that shortage of rainfall and/or amplification of grazing pressure due to enlarged herd sizes or elongated standing times can reduce vegetation growth and cause degradation of the pasture (cf. Mueller et al. 2007a).

This, however, is merely one side of the coin. The decision of every nomadic household on the pasture use (e.g. when to move, to what pasture, supplementary feeding, when to sell how many livestock units) is also influenced by a bundle of factors: the income required for securing the livelihood, but also the resources available to the household (cf. Breuer 2007). The spectrum of relevant resources is manifold. Examples are available labor forces, monetary resources, access to pastures, but also the integration in social networks (relatives, neighbors, cooperatives) that are important for coping with risks. Moreover, decision-making is influenced by the institutional framework (e.g. governmental programs) as well as the recent market conditions (cf. Bretan 2010). Last but not least, the majority of the nomadic households nowadays have access to alternative sources of income (e.g. hired labor, collecting and selling plants, tourism) parallel to that from pastoralism that influence their decisions as well (cf. Gruschke 2011b). All these examples indicate that nomadic resource utilization is characterized by a complex interplay of climatic, ecological and socio-economic factors feeding back on the pastures and their temporal development. In the long term, this can adversely affect the regeneration ability of the pastures and, as a consequence, the livelihood security of the nomadic households (cf. Mueller et al. 2007b).

The mentioned factors are not constant, but are exposed to a multitude of change processes. One example is the widely discussed climate change. For nomadic regions, an increasing frequency of droughts, floods or snow catastrophes is observed resp. expected. Change, however, is also reported for important socio-economic conditions. Examples are the liberalization of agricultural markets, the introduction of governmental incentive programs, increasing tendencies of pasture-trading up to the global phenomenon of large-scale land grabbing through transnational trusts (cf. Gertel and Breuer 2007, Gruschke 2011a). All these processes can seriously influence nomadic resource utilization systems. This can open new opportunities, but also cause new restrictions. Job migration, for example, can open new sources of income, but in parallel reduces the number of labor forces available in the nomadic household and so the herd size that can be handled. This leads to the question to what extent nomadic communities are able to cope with the variety of global change processes and maintain livelihood security through appropriately designed adaptation strategies.

Nomadic communities have evolved various options to adapt their pasture use to change processes. In the case of drought, for instance, a nomadic household can sell livestock or purchase supplementary fodder or rent a truck for transporting water to so far non-usable pastures or livestock to distant more suitable regions. This example indicates that the availability of options is always also a question of the availability of resources (in the example, monetary resources). The range of options for adaptation is therefore not identical for all nomadic households, but dependent on their resource portfolio. Hence, there is heterogeneity indicating an additional risk: the risk of an increasing polarization between rich and poor resp. safe and vulnerable nomadic households. This also shows the urgency of understanding the complex functioning of nomadic resource utilization systems as prerequisite for mitigating such problematic developments.

3. Implementation of functional relationships in the board game NomadSed

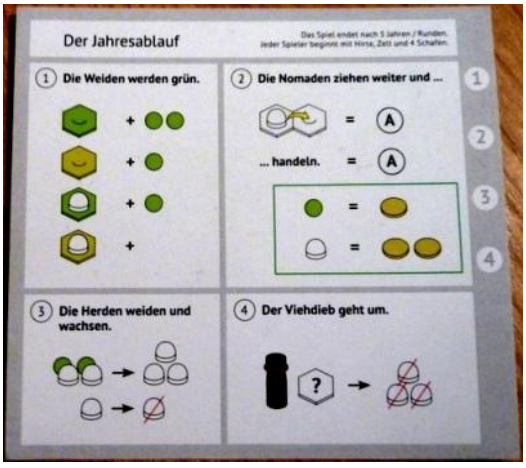
To reproduce the full complexity of nomadic resource utilization in a strategic game with significant knowledge addition already after few playing rounds is impossible. Instead, we decided to focus on highlighting selected essentials to give at least a rough picture of the complex interplay of climatic, ecological and socio-economic factors influencing the nomadic resource utilization and response to change. Central idea is that the players have to make the same type of decisions under similar conditions as real nomadic households. NomadSed is designed as board game for three to six players. Compared to a computer game, this has several advantages: (i) Players can communicate and cooperate with each other if interested in. (ii) Both players and viewers can learn from the development of the nomadic system during the play. (iii) This can help transferring knowledge but also starting a dialogue with stakeholders/ nomads to learn more about nomadic decision making and local knowledge. In the following, some examples for elements of the NomadSed game are given.

Game board consisting of a „Mosaic of pastures“

As was already mentioned, pasture land is not only of central importance for land use and livelihood security of nomadic households, but also a focal point for the co-occurrence of changes in essential framework conditions.

To embrace this importance, the game board of NomadSed is represented by mosaic of pastures. During the course of a game, the players can make decisions concerning e.g. where to allocate their tents with consequences for the safety of adjacent herds or where to go with the livestock in the recent round. Furthermore, pasture segments can be removed to reduce the playing field and/or increase the pressure on the remaining pastures. This functionality can be useful in case of less than six players or for didactic reasons such as the simulation of effects of a shortage of pasture land and of a restriction of accessibility.

Update rules for simulating vegetation growth on the pasture



The decisive constraint for livestock breeding and the development of the herd size is the amount of biomass available at a pasture as fodder.

In NomadSed, the vegetation cover of a pasture is represented by a number of forage pieces that will be increased at the beginning of each round depending on pasture type, rainfall (with/without drought) and grazing pressure (with/without livestock). In the course of the round, the number of pieces will be reduced again depending on the number of livestock grazing on the pasture. Furthermore, the player has the chance to buy fodder on the market.

Mobile pastoralism requires resources

Mobility or market activities cause costs and require monetary resources.

In NomadSed, this is simulated by per round ‘action points’ representing labor force and an initial budget that every household can invest.

Event cards on the nomads‘ daily life for incorporating global change processes

As was already mentioned, nomadic households are exposed to a number of challenging influences they have to cope with and respond to. These can be regional influences such as climatic (e.g. drought) or political events (e.g. new incentive program) or influences from the individual context of a household (e.g. job migration of a household member).

In NomadSed, these influences are simulated by the means of event cards. The events described on the cards relate to real-world phenomena. They are based on empirical findings that have been extracted from numerous interviews with nomadic households in various dryland regions (e.g. Syria, Morocco, Tibetan Highlands). These interviews have been conducted in the course of twelve years empirical socio-geographic research in the frame of the Collaborative Research Centre 586. Because of their authentic character, the event cards are probably the most informative elements of NomadSed that provide vivid insights into the nomads' daily life and an impression of real framework conditions. The set of event cards can be successively complemented for incorporating new findings. For better understanding of this principle, see the two info boxes ('Caterpillar fungus' and 'Governmental resettlement program') that explain the backgrounds for the respective event cards.

Info Box: Background of Event Card 'Caterpillar fungus'

Nomads live from their livestock: sheep, cow, goat. Since years, however, nomads in the Tibetan Highlands turn this principle upside down. Children get extra school vacations; the public transport collapses; stores are closed – everything for the same reason: Between April and June, thousands of Tibetan nomads and other inhabitants of the Tibetan Highlands swarm to the pastures to collect the mystery caterpillar fungus (cf. Gruschke 2011b).

What is this – a Caterpillar fungus? „In summer, it is grass and, in winter, it is living as a worm below ground“. This is a common explanation of the local people. Many people misunderstand the Tibetan name „Yartsagunbu“ („Summer grass – winter worm“), as it actually belongs to the group of fungi with the latin name *Ophiocordyceps sinensis.* This fungus is endemic on the Tibetan Highlands in altitudes between 3.500 und 5.000 m and parasiting the larvae of a butterfly species. Regardless of its hybrid character between animal and plant, the caterpillar fungus is famous for its properties as pharmaceutical. It is expected to strengthen the immune system and libido and seen as a mean against cancer.

Figure 2:
Nomadic traders of the Caterpillar fungus in Gyêgu, the capital of the District Yushu, Tibetan Highlands
(Photo: A. Gruschke)

Using active commodity chains, the Caterpillar fungus is transported over thousands of kilometers from the Tibetan Highland to the megacities at the south-eastern coast of China, but also beyond to Japan or Singapore. Rich Chinese people consider the fungus as a status symbol and use its consumption for demonstrating their richness. In 2010, they were willing to pay 120.000 Yuan (approx. 13.000 Euro) for one pound of the fungus. Evidently, the fungus is a cash crop also called ‘weak gold’. From 1988 till today, the price for the fungus has risen by a factor of 170 and is now higher than the price for gold. For 1-2 months, the Caterpillar fungus attracts more attention than the livestock. Today, many Tibetan nomads use pastoralism merely for covering their demands for animal goods; for covering all remaining demands, monetary resources are key. For poorer nomadic households, the Caterpillar fungus represents a unique opportunity for withstanding times of shortage in income from pastoralism and so for securing their livelihood. For all other households, the fungus is a source of prosperity. Large parts of the liquid assets of the nomadic households are nowadays coming from this source. In some places, the earnings are exceptionally high with the result of an increased living standard among the nomadic households. This is indicated by an increasing interest in new houses, cars or city clothes.

Info Box: Background of Event Card ‚Governmental resettlement program‘

Since a couple of years, China is implementing a large-scale governmental resettlement program is implemented in the nomadic regions. Main idea is to reduce the pressure on degraded pastures by offering opportunities to nomadic households to give up the pastoralism, leave their original regions and move to houses in the vicinity of cities that have been especially built for this purpose. In special contracts with the authorities, it is fixed that the nomadic households abstain from using the pastures for 5-10 years, sell their livestock and get a financial compensation during this time (this can be seen as special payment for an ecosystem service, namely the regeneration of pastures). The authorities also encourage the resettlement households to get accustomed to the life in a city, to find an appropriate job etc.. Theoretically, the resettled households can return and re-use their pastures after the term specified in the contract.

Figure 3:
Example of a resettlement area in the Province Gansu (Photo: K. Frank)

From the point of view of pasture regeneration, it would of course be best if households with large herds would resettle. Such households, however, are usually less interested in resettlement programs than impoverished households that cannot survive from their livestock anymore. As a result, the ‘ecological migration’ has become a ‘poverty migration’. Despite a large number of resettled households, the reduction of the number of livestock on the pastures is rather limited. This is amplified by the fact that numerous household do not sell the livestock but hand over it to relatives. This comes along with trade-offs: The pastures do not get the intended rest with the risk of ongoing degradation. For the relatives, such ‘merging’ can also be a chance if it helps enlarging their own herd beyond the minimum size required for securing their livelihood. In any case, the resettlement has the price that the nomadic households have to give up their former way of life that was closely connected with the livestock. Quite often, the former nomads do not find an entry point into an urban life.

4. Target group of the Board Game NomadSed

NomadSed is designed and already in use both for environmental education in e.g. schools, university courses or in the frame of public outreach activities (Girls' Day, Students' Camp, Long Night of Sciences etc.) and for the work with stakeholders such as non-governmental organizations working with nomads in drylands (e.g. Veterenaires Sans Frontiers Germany (www.togev.de) that are active in Kenya, Ethiopia, Sudan and Somalia with which we recently started a cooperation). In case of interest in using NomadSed for educational purposes, please, contact us.

5. Nomadic resource utilization in a computer model

A game such as NomadSed can provide a rough impression of the daily life of nomads. In the course of 3-5 playing rounds, however, merely the short-term consequences of the decisions made by the nomad-players can be revealed. The long-term consequences, however, cannot be addressed. Here, a board game reaches its limits. One powerful opportunity to overcome this drawback is the use of a computer model that is based on the same principles as NomadSed, namely rules describing functional relationships. The only difference is that now all nomadic decisions are made by the computer on the basis of a number of rules, as is the case in computer chess. In the result, however, the temporal development of the 'nomad community in the computer' can be tracked over long times in fast motion and explored in terms of key factors of the dynamics.

To build and analyze such computer models is the task of modelers, as they were active in the frame of Subproject E10 of the Collaborative Research Centre 586. Using computer models, they have analyzed, for instance, the long-term consequences of an increasing frequency of droughts as prominent impact of climate change on productivity and regeneration ability of the pastures, size and compositions of the herds and, last but not least, the income gained by nomadic households from pastoralism. Computer models are not only helpful in the context of 'diagnostics' and the determination and assessment of risks. They also can help identifying effective 'therapies' without risks or side-effects.

One example is a model-based analysis of chances and risks of supplementary feeding – a management strategy for avoiding destocking in times of fodder shortage. Main idea is the purchase of additional fodder (e.g. grain) for compensating under-supply with fodder from the pasture. In the last decades, supplementary feeding has become an increasingly popular element of the management strategies of nomads, as can be seen in the studies of the Collaborative Research Centre in the High Plateau in Morocco. Nonetheless, the strategy is controversially discussed. Major critique is the fear that keeping the herd size goes to the cost of the pastures which loose periods of resting for

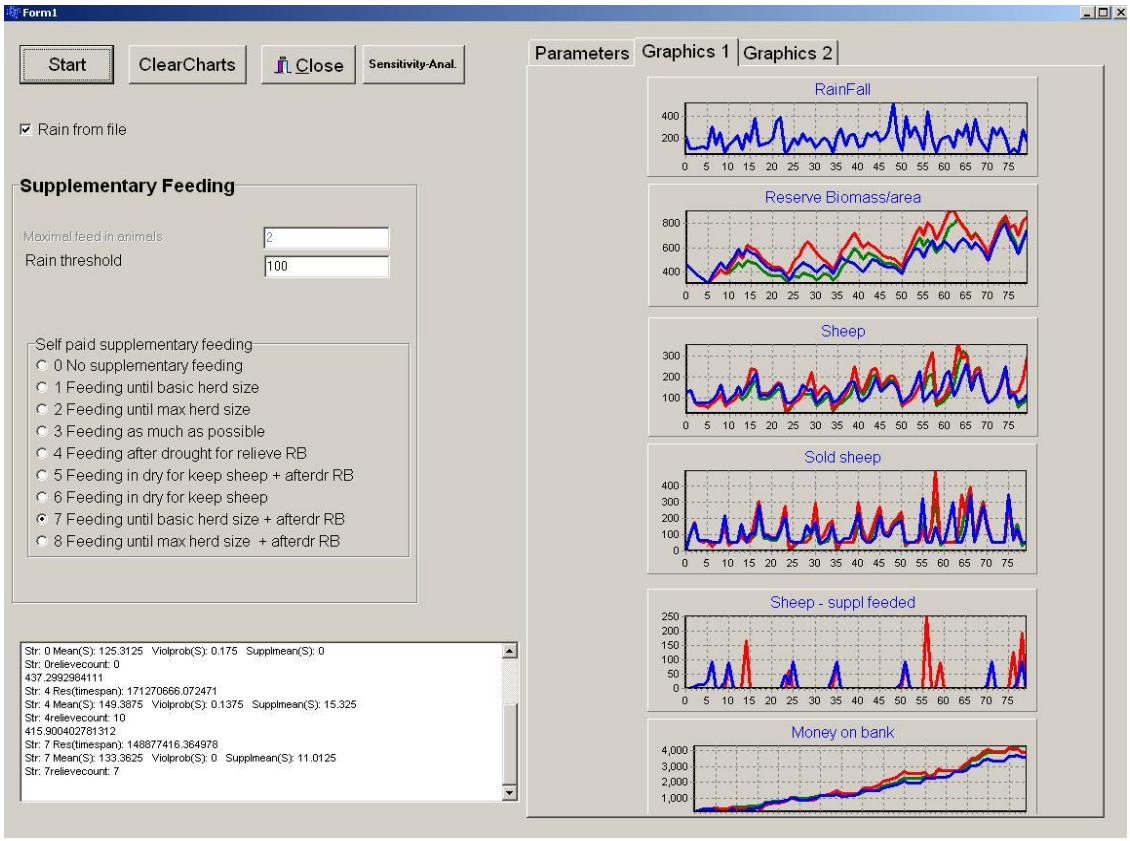


Figure 4: User interface of a computer model for the analysis of the long-term consequences of differently designed regimes of supplementary feeding. Special interest is in the impacts on various indicators of performance such as: vegetation cover on the pasture, herd size, number of sold livestock, or available monetary resources over 80 years. Different colors represent differently designed supplementary feeding regimes.

recovery after drought. In the long term, this can cause degradation of the pasture. A more comprehensive insight was provided by a computer model with which it was shown that the ecological and socio-economic impacts of supplementary feeding strongly depend on the timing of the supplementation – in or after a drought or in both phases (cf. Figure 4). These findings strengthen the knowledge base for the design of improved, more sustainable regimes of supplementary feeding without side-effects.

6. Literature

Bretan, A. (2010): Die syrische Steppe. Mobile Viehzucht, internationale Entwicklungshilfe und globale Märkte. Wiesbaden: Reichert

Breuer, I. (2007) Mobilität und Existenzsicherung im ariden Marokko. Wiesbaden (Nomaden und Sesshafte 8).

Gertel, J. und Breuer, I. (Hrsg.) (2007): Pastoral Morocco. Globalizing Scapes of Mobility and Insecurity. Wiesbaden (Nomaden und Sesshafte 7) 165–180.

Gruschke, A. (2011a) Konflikte im Weideland - Konflikte um Weideland? Neuaushandlung von Ressourcenzugang in tibetischen Nomadengebieten, Geographische Rundschau, 63,7/8, 20-26.

Gruschke, A. (2011b) Nebenerwerbsnomaden und Raupenpilzökonomie: Pastorale Existenzsicherung in Osttibet. In: Gertel, J. und Calkins, S. (Hrsg.): Nomaden in unserer Welt. Die Vorreiter der Globalisierung: Von Mobilität und Handel, Herrschaft und Widerstand. Transcript Verlag, Bielefeld. 126-137.

Müller, B., Frank, K. und Wissel, C. (2007a). Relevance of rest periods in non-equilibrium rangeland systems - a modelling analysis. Agricultural Systems 92: 295-317.

Müller, B., Linstädter, A., Frank, K., Bollig, M. und C. Wissel (2007b). Learning from local ecological knowledge: modeling the pastoral-nomadic range management of the Himba, Namibia. Ecological Applications 17(7): 1857-1875

7. Contact

Prof. Karin Frank
Helmholtz-Centre for Environmental Research – UFZ
Department of Ecological Modelling (OESA)
Permoserstr. 15, D-04138 Leipzig, Germany, e-mail: karin.frank@ufz.de

or

Dr. Susanne Ebitsch
Helmholtz-Centre for Environmental Research – UFZ
Department of Knowledge & Technology Transfer
Permoserstr. 15, D-04138 Leipzig, Germany, e-mail: susanne.ebitsch@ufz.de