Anthropogenic drivers of biodiversity change in the mountain forest steppe of Mongolia

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A Siberian Stone pine forest (Khentey Mountains). Nowadays primeval dark taiga is limited to very remote sites. Photos: K. von Gadow

Mongolia, the world's least densely populated country, harbours vast natural landscapes and pristine mountain ranges. At a mean altitude of 1,500 metres, no part of terrestrial Mongolia is located lower than 518 metres. In northern Mongolia a mixture of different plant communities occur as the steppe transitions over several hundred kilometres into the Siberian taiga. Mongolia's mountainous profile has a large influence on the richly diverse plant and animal life of this region. The most southern taiga outposts are limited to higher elevations and north facing slopes, whereas lower elevation and southern slopes are covered by steppe vegetation. This diverse landscape however is increasingly in danger due to different kinds of anthropogenic impact.

Diversity of life in the north Mongolian mountain forest steppe

Northern Mongolia's extreme continental climate is marked by winter temperatures dipping below minus 35 degrees centigrade, short summers and annual precipitation between 200 and 400 millimetres mean. Despite these harsh climatic conditions, the actual biological diversity of this landscape is surprisingly high. The Baikalian and transbaikalian region is also known to harbour a relatively high number of endemic species (Potapova et al., 2000). Topographic features, such as aspect and altitude, create patterns of special microclimatic conditions (e.g. insular permafrost). Common plants of the open and mixed steppe sites are species of the daurian forest steppe such as different species of wormwood. On stony and dry slopes with sufficient moisture availability, savanna-like troops of Siberian elm exist (Dulamsuren, 2009). Along moist riversides, riparian forests composed of different poplar and willow species prevail. The transbaikalian taiga located southeast of Lake Baikal and the almost 2,800 metres high Khentey mountains can be divided into several different mountain forest habitat types ranging from light taiga formations at the lower altitudes to dark taiga formations at the higher altitudes (Mühlenberg et al., 2004). The often grassy and disturbance prone light taiga is mainly composed of species with pioneer attributes: Siberian larch, Scots pine and Manchurian birch. The dark taiga is composed of Siberian Stone pine, Siberian spruce and on some very favourable and long time undisturbed sites of Siberian fir (Mühlenberg et al., 2004). The border region between the Selenge and the Bulgan province is a grassland-forest zone composed of open pine and larch; the Selenge-Orkhon forest steppe.

These diverse habitats are home to numerous species, some of them internationally endangered like the Musk deer. Others are currently facing decline at regional scales, like the Siberian newt. Both are representatives of the taiga system. Recent studies by a group of German, Mongolian, Russian and Polish scientists in an exceptional area of some hundred square kilometres in the Western Khenthey Mountains identified 16 plant species new for Mongolia. Even several arthropod species new to science have been found during these surveys (e.g. Bayartogtokh, 2000).

Lack of appropriate land use management

Livestock production (horse, camel, cattle, sheep and goat) is the primary commodity in Mongolia's economy and the most important source of employment for the rural population. According to the National Statistical Office of the Ministry for Nature, Environment and Tourism, the number of livestock has risen from about 26 million in 1990 to 33 million in 1998 and 43 million in 2008. Almost 50 percent of this total is goats. The upward trend in livestock numbers is

only interrupted by so- called dzuds, which are catastrophic weather events (Ykhanbai et al., 2004). Over-grazing has become a serious and widespread problem, grassland degradation is obvious when comparing non-protected sites with those under some form of national protection (e.g. the Khustai national park). The influence of livestock grazing on forest ecosystems bordering the steppe are not yet well understood.

The forests are another source of important natural resources for the rural population. The nutritious and large seeds of the Siberian Stone Pine for example, are a valued non-wood forest product. Inappropriate legislation and lack of control have facilitated extensive illegal logging. This, and more severe and frequent fires, supported the decrease of forest area, which annually amounted 0.5 - 1 percent between 2000 and 2005 (FAO, 2007). Most fires are human induced. Abundant occurrence of birch is an indication of previous large scale disturbance (e.g. fire or logging). Especially forests close to the centres have become degraded and birch has become the main tree species. Disturbed light taiga has lower basal area and stem number and a more clumped distribution pattern, which allows more openings for fire prone dense grass vegetation. Dark taiga needs a longer time to recover and therefore it is likely that dark forest habitats will further decrease in area if the current trend continuous. The Mongolian government responded to these challenges in 2007 by implementing a new law to reform the domestic forest sector. Currently the newly established Forestry Agency is charged with the task of developing the institutional framework for this law. Capacity building of the staff and institutions of higher education are main factors for sustainable success.

Illegal hunting and fishing are also widely practiced and had a noticeable influence on Mongolia's wildlife in recent years. Species that were once quite abundant are now experiencing sharp decline. Examples include the Red deer, the moose, the marmot or the Taimen - the world's largest salmonid.

On regional scale mining activities have negative impact on water quality, river habitats and vegetation. On sites where unregulated ore extraction is practiced EIA and restoration projects are seriously challenged.

Air pollution is a seasonal and regional problem, especially in the capital where coal is the main fuel source for private heating. During the winter months, coal effluent creates a dense layer of smog that lingers over urban areas. This has an obvious negative effect on human health, as indicated by a rise in the number of respiratory diseases.

Overgrazing by goats and other livestock changes plant communities and enforces erosion (Tuv province). Photo: N. Tiralla

Climate Change

As pointed out by the Intergovernmental Panel on Climate Change (IPCC), global warming will impose significant stress on natural resources. This is first expected to become obvious in zones where vegetation types already exist at their ecological limitations. Mongolia's forest steppe transition zone is a prime example. Permafrost soil and length of vegetation period are two of the main determining forces of vegetation patterns and are considered to be crucial for many of the forest islands. Mongolia entered the new millennium with a couple of droughts and dzuds that caused major damage to the agricultural sector (Ykhanbai, 2004) and supported the trend of population movement from the remote and dryer regions towards the centres and their surroundings in central and northern Mongolia. Climate change may also be one cause for the recent occurrence of severe pest outbreaks, especially in larch forests.

Conclusion

Weaknesses of the legal framework and institutions, lack of sufficient implementation and lack of capacity are often mentioned threats for

the future of Mongolian nature. Basically a leading vision that unites people's livelihoods and biodiversity conservation instead of separating the two is needed. Concerning land use management and response to climate change the Forestry Agency, FAO, DED and GTZ are cooperating to facilitate the necessary processes by supporting policy (e.g. transfer of management rights to local population) and capacity building activities through participatory methods on regional and national scale.

A recently burned Siberian spruce - Siberian fir forest. Dark taiga is not disturbance prone but if it catches fire, it burns until most of the trees die (Khentey mountain range). Photo: N. Tiralla

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