Title: Conservation and the complexity of temperate grasslands: A view from Ugtam Uul Nature Reserve, Mongolia.

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Abstract: Temperate grasslands are amongst the most threatened landscapes in the world today. In part, this situation has been created, and is sustained, due to a perception that these grasslands are ecologically simple, i.e., that a true grassland is a monotonous landscape of climax vegetation and few fauna. Further, we assume that we understand how these landscapes function. This article presents data on a temperate grassland protected area in Mongolia, Ugtam Uul Nature Reserve, in order to demonstrate first, that temperate grasslands are actually quite complex and second, that much more research needs to be done on the few remaining extant temperate grasslands if we are to hope for successful grassland conservation. It is argued that ecologically and socially intact temperate grasslands are vibrant landscapes that contain springs, stream, lakes, wetlands, forest patches, drylands, and cliffs, as well as innumerable different grassland landscape communities. Data is produced to show how Ugtam Uul Nature Reserve, located on the Daurian Steppe of eastern Mongolia, is an example of such a complex grassland. The article concludes with some suggestions for projects to further the conservation of temperate grasslands in Asia and North and South America.

Index Terms: temperate grasslands, Mongolia, wolves, Inner Asia, nomads

Introduction:

The link between perceptions of particular landscapes and the actual state of conservation of those landscapes has been well established in the literature (e.g., Adams and McShane 1992 and Hummel (ed.) 1989, 1995). The implications of a negative perception towards a landscape are evident in the state of conservation of temperate grasslands around the world. The lack of articles and books on temperate grasslands would indicate that conservationists often see these landscapes as monotonous and even boring, especially when compared to perceptually dynamic mountains or tropical rainforests. Thankfully, what little work that has been done on temperate grasslands is often excellent, e.g. Olsen (ed.) (1990), Samson and Knopf (eds.) (1997), Licht (1997).

Nevertheless, one recent study (Henwood (ed) 1998) found that these grasslands are the most threatened major terrestrial landscape. In fact, no pre-Industrial temperate grassland landscape continues to exist in the Americas, and only a very few remain in Eurasia. The closest simulacrum in North America is Theodore Roosevelt National Park in North Dakota, where the visitor can see some native grassland flora and fauna, although no large predators. In the days of scarce conservation funding, how can battered prairie compete for funds with luxurious Pacific rainforest; what responsible supervisor would condemn the career of a graduate student by suggesting the s/he study the possibilities for the restoration of temperate grasslands when they can study charismatic caribou or grizzly bears?

The purpose of this article is to advocate grassland conservation through the construction of an understanding that these landscapes are as dynamic and ecologically

important as other landscapes. It is intended that this alternative image will give more impetus to new scientific studies of temperate grasslands and to new conservation and restoration efforts. The article is constructed around an examination of one particular grassland protected area, Ugtam Uul Nature Reserve, found on one of the few remaining ecologically extant temperate grasslands, the Daurian Steppe of Mongolia. The article begins with an introduction to the study area and a brief discussion of the methods used to collect the data presented in the following pages. A discussion of what these data reveal about the dynamic nature of the Ugtam grasslands is then presented. The article concludes with some thoughts on priorities for grassland conservation.

Ugtam Uul Nature Reserve

The 462 km^2 Ugtam Uul Nature Reserve was created in 1993 to protect the local monastery (established, 1830's: destroyed, 1934: re-established, 1991), its sacred mountain (or *uul),* and over 110 Bronze Age graves. The Reserve is located at approximately 49°19'33N - 113°45'11E, in the Daurian Steppe of eastern Mongolia and lies on the Uldz River, a small underfit steppe river (Map 1). The Reserve lies approximately 50 km from the Khentii Mountains to the west, and roughly 70 km from the Yablonovyy Mountains to the north. These separation zones are grass-covered hills with moderate relief (100 -200m) and occasional outcrops of sedimentary rock. To the south and east, the hills give way to flat steppe.

The average yearly high in northeastern Mongolia is 7.6 degrees C, the average yearly low –5.3 C, and the average yearly temperature 0.6 C (Government of Mongolia 1990). Summer temperatures reach the mid-40's C while winter temperatures fall to the

–40’s C. Average yearly precipitation is 247.7 mm, with large inter- and intra-year variability (Humphrey and Sneath 1999). Most moisture falls in the late summer as severe thunderstorms. Winters are dry with strong winds. Spring is the driest season of the year.

The Ugtam massif, with its numerous summits, appears to be a pluton of indeterminate size, which has penetrated through the layers of sedimentary Cretaceous rock. The maximum elevation of the massif is 1240m. The minimum elevation in the Reserve is 800m. The pluton creates one, or several, perched water tables that feed the seven perennial springs that form the streams that flow off the mountain in sheltered valleys. Neither the springs nor the streams freeze during the winter.

The soils around Ugtam are predominantly chestnuts and light chernozems resting on massive, unsorted deposits of sand of unknown thickness. Soils are much better developed in Ugtam stream valleys due to increased moisture, more organic material from trees, and much greater bioturbation. Buried soil horizons in these valleys suggest frequent seismic activity. Discontinuous permafrost is found throughout the Reserve, particularly in north-facing valley bottoms.

Flora and Fauna

One hundred and forty-four plant species have been identified, thus far, in the Reserve. A remaining 19 plants have been identified to the family level. The Reserve contains at least 43 families of plants. However, more species remain to be found in the Reserve, as the birch (*Betula platyphylla*) forest across the summit has been poorly sampled.

Thirty-one species of mammals were recorded at or around Ugtam Uul in 1999 - 2000, eighteen of which are considered threatened by the IUCN, CITES, and/or the Government of Mongolia (Ministry of Nature and the Environment, Government of Mongolia 1997; Baillie and Groombridge (compilers and editors) 1996; Hilton-Taylor (Compiler) 2000).

Table One: Threatened Mammal and Bird Species of Ugtam Uul Nature Reserve

Species	**English Common Name**
Rhinolophus ferrumequinum Schreber, 1774	Greater Horseshoe bat
Sciurus vulgaris Linnaeus 1758	Red squirrel
Marmota bobak sibirica Radde 1862	Siberian marmot
Ptermys volans Linnaeus 1758	Russian flying squirrel
Myopus schisticolor Lilljeborg 1844	Wood lemming
Lagurus luteus Eversmann 1840	Yellow steppe lemming
Micromys minutus Pallas 1771	Harvest mouse
Dryomys nitedula Pallas 1779	Forest dormouse
Sicista betulina Pallas, 1779	Northern birch mouse
Sicista subtilis Pallas 1773	Southern birch mouse
Canis lupus Linnaeus 1758	Wolf
Vulpes corsac Linnaeus 1768	Corsac fox
Ursus arctos Linnaeus 1758	Brown bear
Mustela eversmanni Lesson 1827	Steppe polecat

Gulo gulo Linnaeus 1758	Wolverine
Otocolobus manul Pallas 1776 (*Felis manul)*	Pallas's cat
Lynx lynx Linnaeus 1758 *(Felis lynx)*	Eurasian Lynx
Procapra gutturosa Pallas 1777	Dzeren, Mongolian gazelle
Ciconia nigra Linnaeus 1758	Black Stork
Cygnus cygnus Linnaeus 1758	Whooper Swan
Anser cygnoides Linnaeus 1758	Swan Goose
Haliaeetus albicilla Linnaeus 1758	White-tailed Eagle
Circus aeruginosus Linnaeus 1758	Marsh Harrier
Circus cyaneus Linnaeus 1766	Hen Harrier
Circus macrourus Gmelin 1770	Pallid Harrier
Circus melanoleucos Pennant 1769	Pied Harrier
Aquila clanga Pallas 1811	Spotted Eagle
Aquila nipalensis Hodgson 1833	Steppe Eagle
Aquila heliaca Savigny 1809	Imperial Eagle
Aquila chrysaetos Linnaeus 1758	Golden Eagle
Falco naumanni Fleischer 1818	Lesser Kestrel
Falco tinnunculus Linnaeus 1758	Common Kestrel
Falco subbuteo Linnaeus 1758	Eurasian Hobby
Falco cherrug Gray 1834	Saker Falcon
Falco peregrinus Tunstall 1771	Peregrine Falcon
Grus grus Linnaeus 1758	Common Crane

Grus monacha Temminck 1835	Hooded Crane
Grus vipio Pallas 1811	White-napped Crane
Anthropoides virgo Linnaeus 1758	Demoiselle Crane
Otis tarda Linnaeus 1758	Great Bustard

One hundred and thirty-one species of birds were identified at Ugtam Uul Nature Reserve in 1999. A UNDP fieldtrip to Ugtam in the early Fall of 2000 yielded a further 15 species of birds. This addition of slightly more than 10% of the original 131 species over only a few days of observation at new locations in the Reserve suggests that the avifauna of Ugtam Uul has not yet been fully censused (Hunter 1996; Shafer 1990). Even so, existing data indicate that Ugtam contains 32% of all birds found in Mongolia. Further, 22 (15%) of these bird species are threatened (Ministry of Nature and the Environment, Government of Mongolia 1997; Baillie and Groombridge (compilers and editors) 1996; Hilton-Taylor (Compiler) 2000). A full treatment of this data on avifauna is forthcoming in Wilson and Rosenthal (in preparation).

Another group of animals that are present at Ugtam in great numbers are insects. Unfortunately, no study of this taxon has yet been done at the Reserve. The same lack of knowledge applies to fish, reptiles, and amphibians.

Landscape communities

The above flora and fauna combine with local geomorphological features to produce at least 22 distinct landscape communities at Ugtam Uul Nature Reserve. These include five grasslands, nine forests, six aquatic communities, frost heaves, and cliffs. This initial landscape analysis of the Reserve was done using a modified Braun-Blanquet

method, whereby the larger landscape is divided up into distinct communities based on the presence or absence of dominant species, landscape elements, or ecological processes (Kent and Coker 1992; Forman 1995). Species are considered dominant either visually, e.g., a particular tree species, or procedurally, e.g., grazing animals. A landscape element was dominant in an ontological sense, i.e., its mere presence created a community. An example of such a landscape element from the Reserve is a cliff. Given the preliminary nature of the work at Ugtam, only gross landscape communities are recognized.

Communities dominated by a particular landscape element were labelled accordingly. Again, this was done only on the grossest level, i.e., only when it was clearly evident that the landscape element in question clearly dominated the community. The remaining communities were then divided into those with trees and those without. These two broad types of communities were then once again sub-divided according to clearly dominant vegetation species. Finally, the presence of grazing within a community was determined visually or by the presence of dung. In the event that grazing was clearly a dominant process, i.e., domesticated animals were always seen in the area, dung piles were always visible throughout the area, and biogeomorphological features such as trails and wallows were clearly evident throughout the area, the community was identified as a grazing community. No attempt has been made to understand the specific floristic or faunistic processes in the Reserve because the data are as yet too few to make such an analysis worthwhile.

The following pages provide descriptions of the ecological communities present in the 462 km^2 Ugtam Uul Nature Reserve.

Cliffs and Scree slopes

Cliffs and scree slopes are found in three parallel bands on the Ugtam massif. Each band is composed of distinct cliff complexes embedded in a forest steppe matrix. The uppermost cliff complexes, which form the various summits of Ugtam Uul, have predominantly northern and/or western aspects. This upper band of cliffs is associated with forest and averages 20 – 30m in height. Each complex is approximately 100 – 200 m long. The rock is uniformly andesite.

The second band of cliffs exists approximately 100 m in altitude down the mountain. This band exists predominantly on the north face of Ugtam and has a northern aspect. These cliffs are also 20 – 30m high, although each complex is <100m in length. These cliffs are sometimes associated with trees, although they are more commonly surrounded by grass, and are composed of granites and various black, green, and purple minerals.

The lowest band of cliffs is found exclusively on the north side of Ugtam Uul where they form the summits of two ranges of parallel “foothills” separated from Ugtam proper by stream valleys. These cliffs are commonly associated with extensive scree slopes, some of which were transformed into "rock rivers" by periglacial processes during and immediately after the last glaciation. Another form of scree slope has a peculiar “imploded” look, i.e., a portion of the cliff has collapsed upon itself, in much the same way as a modern high-rise is demolished with explosives. Lichen growth on the rocks in these imploded formations is quite extensive, indicating that they are quite old.

All these lower cliffs are 10-15 m high, only a few tens of meters long, and may have any aspect. Trees are rarely associated with these cliffs, although *Caragana spp.*

often cover slopes with a southern aspect. The rock is granite, which weathers in large "flakes."

Cliffs and scree slopes are important landscape communities in the Reserve. For instance, they provide nesting spaces for approximately 79 bird species, including various raptors, corvids, and passerines. In previous years, a pair of Black Storks (*Ciconia nigra* Linnaeus 1758) had nested in cliffs at the Reserve, although in 1999 their site had been taken over by a pair of Upland Buzzards (*Buteo hemilasius* Temminick and Schlegel 1844). Cliffs and scree slopes also offer important habitat for mammals, i.e., various rodents and lagomorphs use these rocky areas for denning purposes. Further, tracks in the snow indicate that elk (*Cervus elaphus* Linnaeus 1758) use the cliffs to escape wolf (*Canis lupus* Linnaeus 1758) by leaping from one cliff section to another (often over a 10 – 30 m drop) and by venturing out to the cliff edge. The tracks indicate that wolves hesitate to follow elk out onto the rock. While this escape behaviour has been documented for sheep and goats (Schaller 1977), it has not been previously recorded for elk (Geist 1998). On a final note, cliffs are the only places where lynx (*Lynx lynx* Linnaeus 1758) spoor was found in the Reserve.

While birch (*Betula platyphylla)* is dominant across the top of Ugtam, an *Ulmus sp.* and a *Prunus sp.* that could not be identified to the species level using existing Mongolian flora (Malyshev 1968) are also associated with the upper most band of cliffs. These trees are Manchurian species at the very westward edge of their range. The existence of these trees supports the notion that the cliffs are acting as *refugia* for plants that were once common in the area under different climatic conditions (Larson, Matthes,

and Kelly 2000). Finally, many of these cliffs support a rich growth in 1m tall reeds at their base, a plant otherwise found only alongside the Uldz River.

Further, these cliffs have been and are important to the human population of the Reserve. First, the lower cliffs provided the material to build the Bronze Age graves in the Reserve. Second, the cliffs serve the modern human population as a site for medicinal plants. Finally, the cliffs serve two spiritual purposes. First, they are understood to be the "homes" of many local spirits, including departed shamans. As such, one finds small shrines along the cliffs where individuals have built fires or left offerings. Further, the many high points throughout Ugtam, particularly near cliffs, are the sites of *ovoos,* or sacred cairns, used to mark spots of worship for both Buddhists and shamanists. Second, the cliffs are seen as special hiding places for spiritual items. This has been the case particularly since the 1930's when the monks at the monastery on Ugtam hid many of their sacred texts and other items in the cliffs before they were "disappeared."

Significantly, none of the cliff had any signs of grazing, nor were any domesticated animals seen there. Lhagva held that the local herders avoided having their animals near the cliffs because there were too many poisonous plants and dangerous animals in those locales.

Fossilized periglacial frost heaves.

The valley of the Uldz contains numerous massive piles of sand that form either collapsed cones, e.g., doughnuts, or long, i.e., >300 m, sinuous structures. Following French (1996), these features have been identified as fossilized periglacial frost heaves of various morphological types. Satellite photos have also revealed the presence of circular patterned ground throughout the valley. These old periglacial features support distinctive

landscape communities in the Reserve. In the first place, a particular *Ulmus sp.* grows to a height of 10 + meters and offers nesting and feeding opportunities to the avifauna of the surrounding grasslands. Further, the sandy soil of these features provides ideal denning material for numerous carnivores, particularly wolves (*Canis lupus*). However, grazing does occur on all these features, in part because the trees offer some shade during the hot summer days.

Lakes

The Reserve contains three types of lakes. The first type is represented by a single example, Mirror Lake. This almost circular, roughly 300m wide lake rests approximately 80m above the level of the Uldz River. While an old inflow channel does exist on the south end of the lake, no outflow exists to the Uldz River. This lake is at least 25m deep, as determined by a weighted line. The presence of drowned trees along the margin of the lake suggests a growth in surface area over the last several years. All this evidence suggests that the lake is supported by a hanging water table created by the Ugtam pluton.

One of the great mysteries of the Reserve is the fish population in Mirror Lake, which supports the Reserve's only population of cormorants (*Phalacrocorax carbo* Linnaeus 1758). These cormorants were observed catching and eating 20-30 cm long fish from the lake. The Head Warden does not have any information as to the origin or type of these fish. Finally, although some free ranging livestock, particularly horses, occasionally water from the lake, there is no sustained or regular grazing on the lakeshores.

There are also pothole lakes on the grasslands on the western edge of the Reserve along the Uldz's main tributary. Again, these lakes do not have inflow or outflows. Indeed, they appear to exist in several very small internal drainage basins formed by the

low hills in the area. Although no measurements were taken, these lakes appear much shallower than Mirror Lake. Yet, they do not dry up, or even diminish seriously in size, throughout the year. Nor, are they alkaline. Further, Lhagva held the lakes existed when he was a child. All this would argue that these bodies of water do receive some continual inflow, again, perhaps from springs.

These pothole lakes do not support any shoreline vegetation but do support important populations of various water-birds, including several pairs of threatened whooper swans (*Cygnus cygnus* Linnaeus 1758). Grazing does occur all around these lakes, and domestic animals often drink from these bodies of water.

Finally, some of the fossilized frost heaves are associated with small lakes, or ponds. These bodies of water are surrounded by extensive marshes and wetlands, fed by springs coming off Ugtam Uul. No grazing occurs in these wetlands, nor is there any concrete information as to the presence of fish in either of the last two types of lakes.

Springs, streams, and rivers

The smallest moving bodies of water in the Reserve are the seven surface springs found on Ugtam Uul. Their existence could be accounted for with the hanging water table mentioned above. These springs flow year-round and are considered both sacred and medicinal in nature. Indeed, each spring is supposed to cure a particular type of ailment. This water source also supports wildlife, as well as extensive fern beds. Little or no grazing occurs near these springs, perhaps a reflection on the perceived power of the water.

The springs feed several streams that flow off Ugtam Uul. Data were not collected on the precise rate of flow but water moved swiftly in channels over a meter

wide and up to half a meter deep. All these streams also periodically disappear underground and then re-appear several hundreds of meters downstream. All the north and east flowing streams fail to reach the river and disappear into dense willow thickets. The streams on the west and south do flow into tributaries of the Uldz. The streams themselves support insect life but, as far as could be determined, no fish or amphibians.

The largest tributary of the Uldz River within the Reserve flows through its own large valley just within the western boundary. This stream begins in the town of Bayandun and, by the time it reaches the Reserve, has grown to be several meters wide, over a meter deep in places, and very swift. This stream contains insects, fish, and supports many types of aquatic birds. The adjacent wetlands are habitat for cranes (*Grus spp*.) and shore birds, including Von Schrenck's Bittern (*Ixobrychus eurhythmus* Swinhoe 1873). This tributary is very important for local herders, who use its water for livestock and gardening. According to Lhagva, some herders who do not have access to well water also use the stream for drinking water.

The Uldz River, itself, is over 10m wide and several meters in depth. The importance of this river is compounded by the large number of oxbow lakes and wetland complexes it has formed over the centuries. The river is swift and clear with a sand bottom and supports extensive aquatic vegetation and numerous insects, fish, and aquatic mammals, as well as many species of aquatic and passerine birds, including globally endangered species of crane (*Grus monacha* Temminck 1835 and *Grus vipio* Pallas 1811) and duck (*Anser cygnoides* Linnaeus 1758). Downstream from Ugtam Uul Reserve, the Uldz forms a vast protected wetland known as Mongol Daagur National Park, where large numbers of threatened cranes (*Grus spp*.) breed each year. One of the real

conservation threats on the eastern steppe is the possibility that water contaminated from the tailings of at the abandoned uranium mines at Marta and from the active gold mines on the northwestern border of Ugtam Uul Reserve could begin to flow into the Uldz and, therefore, destroy these vast and ecologically important wetlands. The uranium mines are approximately 30 km south of the Reserve on a tributary of the Uldz, while the goldmines are on the Uldz flood plain less than five kilometres from the Reserve boundary.

Forests and wooded areas

There are nine types of forest in the Reserve. First, on the top of the mountain is a dense birch (*Betula platyphylla*) forest that supports woodland birds and mammals, e.g., elk (*Cervus elaphus*) and several species of woodpeckers. This area is never grazed, but does serve as a source of trees for shaman ceremonies, which require the sacred birch. The bark of this tree is also used to make special containers that are decorated with designs created by biting and/or scraping the bark. These containers are considered very special gifts and, while each family might have one or two, they are uncommon. No birch is ever cut down for firewood, although the trees can be sawed up and burned after they have used for a shamanic ceremony.

Another, as yet unidentified, species of birch (*Betula sp.*) forms corridor forests along the upper reaches of the streams that flow off Ugtam Uul. These trees provide habitat for roe deer (*Capreolus capreolus* Pallas 1771), wild pig (*Sus scrofa* Linnaeus 1758), and many species of birds. These birch are also considered sacred, but not as sacred as trees from the top of Ugtam. No intentional grazing occurs in these forests, although animals may stray into them occasionally.

As mentioned above, very small (< 1000m^2) elm (*Ulmus sp*.) groves grow on the old periglacial frost mounds found on the Uldz River flood plain. These open meadow-steppes are grazed quite extensively, probably because of the shade they provide, and, being several meters off the valley floor, because they catch more wind and therefore have fewer insects. These trees are never used for any household purpose.

There are many scattered and small (< 4000 m^2), poplar (*Populus sp.*) forests scattered on the northern and western slopes of the massif. These stands are very dense and appear to have spread through suckering. These groves have very distinct borders, i.e., one crosses from open grassland to dense interior forest over a mere 2 or 3 meters. These poplar stands are practically devoid of either birds or mammals, e.g., only one elk (*Cervus elaphus*) was ever observed in a stand and only three species of birds were recorded here, all generalists: Great Tit (*Parus major* Linnaeus 1758), Citrine Wagtail (*Motacilla citreola* Pallas 1774), and Black-Billed Magpie (*Pica pica* Linnaeus 1758). This absence of fauna may have something to do with the low floral diversity in these stands; apart from poplar trees there are only a few small bushes and sprigs of grass. Lhagva insists that these trees were not in the area when he was a boy but is at a loss to explain their presence today. The local commonly accepted theory is that they are the result of fires. These stands do not support any grazing but are the main source of firewood in the Reserve.

Two types of pine (*Pinus sylvestrus*) savannah exist in the park. On the north- and west-facing slopes of Ugtam an extensive open savannah of generally larger (>6m) and older trees has established itself. A much denser savannah with younger trees exists on the hills that form the extreme southwestern boundary of the Reserve. In fact, most of this

latter type of savannah lies outside the Reserve's current boundary. The generally even age of these pines suggests some sort of control by fire. While the open savannahs cover large areas of the Reserve, particularly on northwestern slopes, they are not used for grazing nor are the trees used for firewood. Further, while the trees offer important nesting habitat for several larger birds, particularly the threatened White-tailed Eagle (*Haliaeetus albicilla* Linnaeus 1758) and Black Stork (*Ciconia nigra* Linnaeus 1758), the savannah is almost totally devoid of larger mammals such as gazelle (*Procapra guttarosa* Pallas 1777), elk (*Cervus elaphus* Linnaeus 1758), or roe deer (*Capreolus capreolus*). Given the density of similar large ungulates on similar landscapes in North America, the emptiness of Ugtam's savannahs is the strongest indication of the level of hunting that Ugtam has experienced in the recent past.

Although not currently considered to be within the Reserve by all concerned parties, Kharkhan Mountain on the northwestern edge of the Reserve is important, in part, because it is the only site of dense pine forest in the area. The pines here are also *Pinus sylvestrus.* The processes leading to two such morphologically different, yet contiguous, types of forest formed of the same species are unclear at this point. To compound the puzzle, the Kharkhan pines are penetrated by dense stands of older poplar, i.e., poplar that are older and larger than those that make up the poplar stands within the Reserve.

Regardless of the vegetational processes that underlie this forest, it is important habitat for several forest dwelling species, including wolverine (*Gulo gulo* Linnaeus 1758), that are found nowhere else in the Reserve. This forest is also one of only two nesting sites for Black Stork (*Ciconia nigra*) in the area, the other being the dense savannah outside the southwest boundary of the Reserve. Note that both these nesting

sites are in large pine trees and that both sites are outside the Reserve's current boundaries. This forest is grazed occasionally by horses and serves as a resting spot for pilgrims visiting the Buddhist shine on top of the mountain. The forest remains outside of the Reserve because of the power of international mining companies in local politics.

Scrub dry forests of *Caragana spp.* and *Prunus spp.* exist on the rocky, south facing scree slopes of the massif. These short forests provide nesting and denning habitat for several types of fauna, including wolves (*Canis lupus*), corsac foxes (*Vulpes corsac* Linnaeus 1768), and various raptors. They are ungrazed because the herders recognize that they are excellent hunting grounds for wolves.

The final type of forest are the dense willows (*Salix spp.*) growing along the Uldz and the lower reaches of the perennial streams coming off the massif. These forests provide some firewood for local people and are heavily grazed. The willows also provide nesting sites for the majority of passerines in the Reserve, as well as cover for other birds, such as cranes, shore birds, and some waterfowl. These forests are prime habitat for the Reserve's population of roe deer (*Capreolus capreolus*).

Grasslands

There are at least five different types of grassland within the boundaries of the Reserve. Starting at the river, there are very dense stands of tall reeds and sedges. Tracks indicated that these grasses served as habitat for smaller weasels (*Martes spp.* and *Mustela spp.*), roe deer (*Capreolus capreolus*), corsac foxes (*Vulpes corsac*), muskrat (*Ondatra zibethicus* Link 1795), raccoon dog (*Nictereutes procyonoides* Gray 1834), and a wide variety of birds. No grazing occurs in this area and the local inhabitants make no use of the reeds.

A rich sedge and forb meadow runs immediately along the Uldz River and its major tributary on the west side of the Reserve. This very wet meadow floods easily during the rains. It has a dense population of water-birds and passerines. Portions of this meadow are grazed every day and hay is harvested every fall after the seeds have fallen from the plants. Each family uses traditionally held haying grounds.

A heavily grazed grassland exists as a strip along the south side of the Uldz from the edge of the wet meadow to the lower reaches of the massif, as strips on both sides of the western tributary from the water meadow to the edge of the pine savannah, and throughout the lower reaches of the valley that contains the monastery on the south side of Ugtam. The majority of the grazing in the Reserve occurs this area and this is where the impact of domestic animals is greatest. Plants here are rarely more than 10cm tall and species are difficult to identify accurately. Domesticated animals have also created various trails and wallows throughout this grassland. Finally, this is where all the dwellings in the Reserve are located. Not surprisingly, this grassland is not particularly rich in fauna, which are confined, for the most part, to bird and animal species that are symbiotic to humans or domesticated animals or both. However, the area is also used by certain mammal species that are either nocturnal or that spend most of their time underground, including the threatened Daurian hedgehog (*Erinaceus dauricus* Sundevall 1841). Finally, this is where the Russians created the majority of their wheat fields, the scars of which are still visible today.

Above this well-used grassland is a medium-tall (approximately 50 – 60 cm) grass and forb meadow that forms the matrix between the popular and streamside forests on the northern and southern mid-reaches of the massif, and covers the hills on the eastern side

of the Reserve. It also grades into the savannah described above. This meadow is the largest landscape community in the Reserve, by far, and is fall and winter grazing land for migrating herds of Mongolian gazelle (*Procapra guttarosa* Pallas 1777) and for the elk (*Cervus elaphus*) and the roe deer (*Capreolus capreolus*) that hide in the adjoining forests. Not surprisingly, this meadow (particularly to the east) is also the hunting ground for at least two wolf communities. In addition, the meadow supports many rodents and grassland birds, including raptors. Finally, this meadow held most of the butterfly and insect species that were observed during research. This grassland is rarely grazed, although some locally used plants are harvested for medicinal and household uses. In addition, this eastern side of the Reserve is where many local inhabitants go on horseback when they feel the need to think and make decisions.

Finally, some pockets (100 m^2) of taller (approximately 1 meter) grasses are found within the birch forest on top of the massif. These patches of grass are usually associated with more boggy areas at the base of cliffs or close to springs. Unfortunately, time constraints did not allow a full faunal census of this grassland. Elk (*Cervus elaphus*) were found in these grasses in the fall, as well as sign of wolf (*Canis lupus*). There were no signs of domesticated animals in these patches of grass, and Lhagva stated that he was not aware of anyone ever grazing their animals that high. That being said, the oldest inhabitant in the valley, a man from western Mongolia named Doktor, aged approximately 70 years, claimed that he and others had grazed their animals in these high pastures in the winters during the time when the large collective herds had used much of the grass in the valley bottoms, i.e. during the 1950's – 1970's. As proof of this activity,

he told us where to find his old sheep pens, half-moon structures made of rubble from the destroyed monastery.

Discussion

The above data indicate several reasons for conserving Ugtam Uul Nature Reserve as an important area for biological conservation. First, of course, the sheer number of species present in the Reserve is impressive. Second, the number of these species that are considered somehow threatened, either nationally or internationally, is significant. Third, several mammal species found in the Reserve are important from a conservation point of view because at Ugtam they continue to exist on a temperate grassland landscape, a habitat that has been denied them virtually everywhere else in the world. These animals are wolf (*Canis lupus*), elk (*Cervus elaphus*), Eurasian lynx *(Lynx lynx*), and wolverine (*Gulo gulo*). Few of these animals have ever even been studied on a grassland landscape, where behaviours are very different from what is reported from populations resident in forest biomes (e.g., Mech 1981; Bauer 1995; Geist 1998; Hummel and Pettigrew 1991; Schmidt 1999; Warren, Mysterud, and Lynnebakken 2001; Breitenmoser 1998). For instance, observations made over a two week period in October, 1999, suggest that wolves (*Canis lupus*) on the east side of the Reserve hunt Mongolian Gazelle (*Procapra guttarosa*), not in packs, but individually, in a manner reminiscent of cheetahs (*Acinonyx jubatus*). This behaviour has also been observed by Head Warden Lhagva over the years. Other observations by local nomads suggest that the Eurasian lynx *(Lynx lynx*) in the Reserve hunt in groups, a behaviour previously unreported in this species.

Fourth, the data indicate that Ugtam Uul serves as a biological meeting ground for the flora and fauna of several different ecosystems; species were found which represented boreal, desert, grassland, Manchurian, and Central Asian mountain flora and fauna. In other words, the Reserve sits in a rich ecotone between many different ecosystems. Such sites are important for several reasons. First, they offer individuals within species the chance to modify their behaviour to meet the requirements of other ecosystems, resulting in distinct populations who may have an evolutionary edge over their more conventional cousins. Second, these areas serve as important movement corridors as ecosystems change their temporal extent and location; what is an ecotone today may be located wholly within a particular ecosystem ten years from now. In the day and age of spreading desertification, sites such as Ugtam, on the border between different types of grasslands, are vitally important.

Thus, far from being simply another monotonous grassland protected area, the Reserve is quite obviously a very diverse and dynamic ecological and social landscape. Both this diversity and the ecological stability of the local landscape communities are important for what they have to say about the nature of the temperate grasslands, about its indigenous management by nomadic pastoralists, and about the conservation of these landscapes. The picture of Ugtam Uul Nature Reserve presented in this article is, for instance, quite different than the picture of the Great Gobi National Park provided by Reading, Amgalanbaatar, and Lhagvasuren (1999). In that paper, Great Gobi is portrayed as a uniform space upon which the scientists in question can complete mathematically complex surveys and then predict sizes of local populations of various species of animals. These figures can then be used for management purposes to “improve” the practice of

local nomads. This paradigm of spatial science is based on the notion that places, with all their complexity, can be replaced (at least for management purposes) with a notion of uniform space, across which geographical processes can be studied.

Given the great size and landscape diversity of Greater Gobi National Park, it is difficult to see how this approach could be justified, except by assuming that the whole park was somehow heterogeneous "grassland." Unfortunately, that does seem to be the prevailing view regarding grasslands within the article cited and within the scientific community. This view arises first, from the idea that vegetation progresses through some ordered (thus, predictable) process to achieve some sort of "climax" state. It is often forgotten that Clements (1916, 1928) arrived at his theories through studies of temperate grasslands in the American Middle West. While these theories have now been called into question (at least) for many other vegetation communities, and even other grasslands (see Warren 1995 for a review), they remain strong among managers and inhabitants of the industrialized temperate grasslands (Saskatchewan Environment and Resource Management 1997; Holechek, Pieper, and Herbel 1995).

These theories of homogenous climax communities receive more support from the desire of many managers and scientists to work "efficiently" using high tech advances in the computer sciences. In the time of shrinking budgets, this desire to have the ability to derive management plans for large areas through the statistical manipulation of data gathered in small areas is, understandably, tempting. While the study mentioned above (Reading, Amgalanbaatar, and Lhagvasuren 1999) is a particularly good example of this desire, it is by no means unusual. Any acquaintance with other conservation or management efforts for temperate grasslands quickly reveals the strength and prevalence

of the desire to see this landscape as statistically knowable and malleable space (Holechek, Pieper, and Herbel 1995).

Conclusion

Hopefully, studies such as the one presented here, or the recently completed management plan for Nomrog Special Protected Area that also stresses the diversity of the grassland (Government of Mongolia/UNDP 2000), will persuade scientists and managers that they need to see and understand the underlying diversity within grasslands. Of course, it might be countered that Ugtam Uul Reserve, or any other equally diverse grassland, is not really a grassland landscape: That it is, instead, a mosaic of forests and wetlands and grasslands; that a true grassland is a stable, i.e., monotonous, landscape of climax vegetation. The circular nature of this argument should be obvious to all. Ecologically and culturally intact temperate grasslands not the equivalent of large seeded pastures; they are vibrant landscapes that contain springs, stream, lakes, wetlands, forest patches, drylands, and cliffs, as well as innumerable different grassland communities. Further, these intact landscapes have supported culturally intact nomadic pastoral societies for millennia.

What grassland conservationists need to do to further grassland conservation is three fold. First, we need to work within science to replace the notion of grasslands as uniform space with the knowledge of temperate grasslands as a mosaic of places. Second, we need to study and publicize the remaining temperate grassland areas of the world, mostly in Central and Inner Asia. One goal of this exercise must be the engagement of the powerful conservation public in the West to allow them to see examples of

ecologically and socially intact temperate grasslands. Of course, it goes without saying that the primary goal of this work must be the conservation any remaining temperate grasslands. Finally, we must do the historical and political work necessary to restore ecologically temperate grasslands to the Americas, both South and North. To achieve this, we must mine historical records, conduct scientifically valid feasibility studies that build on the excellent work already accomplished (Olsen (ed.) 1990; Samson and Knopf (eds.) 1997; Licht 1997), work with remaining pockets of indigenous grassland cultures, and most importantly, show the conservation public how special and exciting ecologically and culturally intact temperate grasslands can be.

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