Mongolian Journal of Biological Sciences 2004 Vol. 2(1): 23-27

Connectivity, Corridors and Stepping Stones: Conservation Implications of Roe Deer Distribution on the Eastern Steppe

Kirk Olson[1], Peter Zahler[2] and Daria Odonkhuu[3]

[1]University of Massachusetts Amherst, Amherst, Massachusetts, 01002, USA; email: kirko@forwild.umass.edu
[2]Wildlife Conservation Society, P.O. Box 485, Post Office 38, Ulaanbaatar 211238, Mongolia; e-mail: pzahler@wcs.org
[3]Department of Ecology, National University of Mongolia, 210646, Ulaanbaatar, Mongolia; e-mail: otto141@hotmail.com

Abstract

Information was collected on roe deer (*Capreolus pygargus*) distribution on the Eastern Steppe of Mongolia from 2000 to 2003. During this period, 65 roe deer were observed. Roe Deer were distributed throughout the Eastern Steppe region, but all sightings occurred in or adjacent to small woodland patches or riparian woodland. These woodland patches and riparian woodlands are likely to be critical roe deer habitat on the otherwise open grasslands of eastern Mongolia. From a management perspective, roe deer can function as an ecological focal species for preservation of these habitats, and conservation of roe deer and their woodlands can conserve a suite of other species also dependent upon this habitat and thus help conserve the biodiversity of Mongolia's Eastern Steppe.

Key words: *Capreolus pygargus*, connectivity, Mongolia, roe deer, steppe

Introduction

The extensive grasslands of the Eastern Steppes of Mongolia are well-known for their great herds of Mongolian gazelle (*Procapra gutturosa*). The gazelles on the Eastern Steppe number perhaps as many as three quarters of a million (Olson 2003, Zahler *et al*. 2004) and help define the landscape as well as serve as a flagship species for conservation efforts to preserve one of the last remaining stretches of pristine temperate grassland in the world (Schaller 1998).

Aside from domestic livestock, it is generally believed that Mongolian gazelle are the only ungulate to live in these grasslands. However, moose (*Alces alces*), red deer (*Cervus elaphus*) and roe deer (*Capreolus pygargus*) can all be found in small numbers in select locations. On the Eastern Steppe, moose may only be found along the rivers in Numrog Strictly Protected Area, while red deer are found only in a few remaining herds in scattered locales, mostly in protected areas such as Numrog SPA and Lhachinvandad Nature Reserve.

The Siberian roe deer (*C. pygargus*) is distributed throughout the north-central Asian region from the Caucasus to the Pacific (Hewison and Danilkin 2000). This small ungulate (around 40 kg) is considered to be a habitat generalist and can be found in forests, open woodland, scrub, or agricultural land as long as there is cover and food (Danilkin, 1996). Although roe deer in Mongolia can be found in regions without woodland where cover in the form of rock gullies or tall grass occurs (Danilkin 1996), woodlands are preferred across their range as they provide not only cover but browse during winter when snow may obstruct grazing.

On several occasions at various time of the year, roe deer (*Capreolus pygargus*) were observed. These observations offer insights into the importance of smaller patches of habitat across the Eastern Steppe, their contribution to biodiversity, and the need to ensure their future protection.

Methods

The Eastern Steppe of Mongolia includes the aimags of Dornod and Sukhbaatar and the south-eastern half of Khenti (Fig. 1). Topography consists of gently rolling hills with elevations between 575 and 1,400 meters. There are three main rivers flowing through the region: the Ulz, the Khalkh, and the largest, the Kherlen River. There are numerous springs and freshwater ponds scattered throughout the steppe. Broad alkaline basins are common. Common grasses consist of *Stipa spp*., *Cleistogenes spp*. and *Leymus chinensis*. Some common forbs are *Allium*, *Astragalus*, and

Potentilla, with common shrubs consisting of *Artemesia*. and *Caragana*. Trees and large shrubs are rare. Gunin *et al*. (2001) and Jigjidsuren and Johnson (2003) provide an excellent synopsis of vegetation patterns of this region.

From 2000 to 2003 roe deer (*Capreolus pygargus*) were observed in Mongolia's Eastern Steppe. Most roe deer were seen while conducting research on Mongolian gazelle – usually while driving line transects or while traveling to vantage points to listen for radio signals from collared gazelle. However, in October of 2002 we also performed a foot survey of ungulates in Nomrog Special Protected Area (Olson *et al*. 2004).

Although they are approximately the same size, roe deer are easily distinguished from Mongolian gazelle by their darker pelage, long tail, and bounding gait. They are distinguished from red deer by their smaller size. Roe deer usually were detected as they were running from the vehicle, making classification by sex and age difficult; on only one occasion while in a vehicle did we observe a roe deer (a solitary male) before being detected.

Results

A total of 65 roe deer were seen from 2000 to 2003 (Table 1; Fig. 2). Roe deer were seen in groups of one to 15. In one instance, the skull of a male roe deer with horns was found. A family living in that region confirmed that roe deer were seen in the region in the past, but they could not recall any recent sightings.

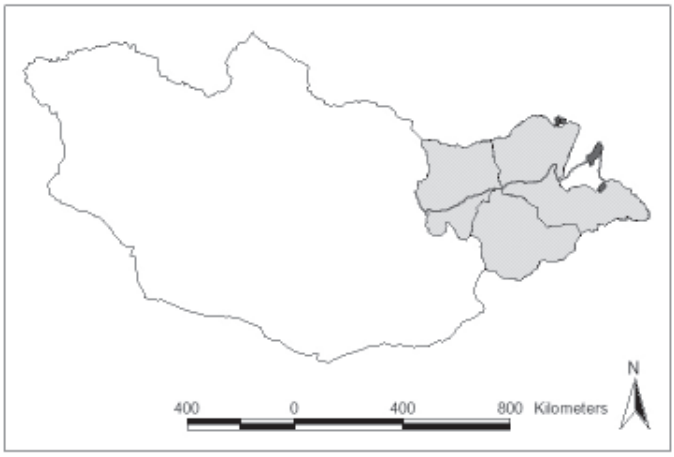

Fig. 1. Eastern Steppe region of Mongolia

All roe deer sightings occurred near cover (Fig. 3). During gazelle research efforts in the south, roe deer were sighted while in or near hilly habitat vegetated with shrubs and trees in the genus *Cotoneaster*, *Prunus*, *Lezpedeza* or *Ulmus*. Sightings in the northern regions were near small patches of birch (*Betula*) and near riparian areas where dense stands of *Salix* were common.

In October 2002, a preliminary survey of large mammals was made in the central portion of Nomrog Strictly Protected Area, the only protected

Table 1. Roe Deer (*Capreolus pygargus*) sightings on the Eastern Steppe

# Seen	Date	Latitude	Longitude
1	May 2000	115º30.5'	45º49.7'
1	May 2000	116º14.6'	46º23.3'
1 male skull	Fall 2000	115º04.0'	46º58.1'
2	January 2002	115º57.8'	46º04.9'
6	February 2002	114º49.5'	50º04.4'
4	May 2002	115º18.6'	48º37.1'
27	October 2002	Nomrog SPA	
8	February 2003	114º05.8'	49º03.5'
15	February 2003	114º50.7'	50º05.8'
1	May 2003	113º49.4'	47º33.1'

Fig. 2. Locations of roe deer sightings on the Eastern Steppe

area found within the Great Khingan Mountain Range. Here there exists extensive riparian habitat and large patches of birch and aspen (*Populus*). In this region roe deer were observed on foot, and we were able to determine age and sex of individuals. Within Nomrog SPA, roe deer were relatively abundant compared to other large ungulates. We observed a total of 27 (8 males, 9 females and 10 unidentified) in one week of searching. Four wolves (*Canis lupus*) were observed feeding on a recent roe deer kill, but we were unable to determine the sex or age of the deer.

Discussion

Roe deer were found to be widely distributed across the Eastern Steppe. However, in all cases, roe deer were found in or adjacent to small patches of woodland. This is not surprising, for while roe deer are considered generalists they are strongly associated with cover throughout their range.

For many vertebrates, cover is an essential part of the landscape, and for those animals that do not burrow, woodland can be a critical element, especially on the otherwise open steppe. No landscape is homogeneous, even Mongolia's Eastern Steppe, which often is erroneously considered to be 250,000 sq km of uniform grassland. It is more appropriate to consider the steppe a mosaic of different vegetation types, including scattered woodlands. However, how this mosaic is described is entirely dependent upon the scale at which one views the steppe and also which species, taxa or guild is being considered.

In Mongolia, ecologically important yet uncommon and isolated 'steppe woodlands' are likely to prove critical to roe deer and a wide variety of other mammalian and avian wildlife. For example, in northeastern China almost ¾ of red deer winter diet is browse (trees and shrubs), suggesting the seasonal importance of woodland to this species (Chen *et al*. 1998). Furbearers such as red fox (*Vulpes vulpes*) also use woodland, and a large number of migratory and tree-nesting birds depend upon them – for example, in arid areas of the southwestern USA, small ribbons of riparian (streamside) woodlands hold almost 50% of breeding birds found in the region (Bennett 1999).

It is important to distinguish two major forms of steppe woodland on the Eastern Steppe. The first are small individual and isolated patches of woodland – '*patch woodland*' – often associated with small elevational features that create a moisture gradient (e.g., steep gullies or gently sloping hills). The second are riparian woodlands along rivers and streams. In some cases these riparian woodlands may once have been contiguous

Fig. 3. Woodland patch habitat within Mongolia's Eastern Steppe

along particular watercourses, but now in many localities they have become heavily fragmented through human disturbance and livestock grazing.

Connectivity describes the spatial arrangement of elements in the landscape and how those elements affect the movement of wildlife across the landscape (Taylor *et al*. 1993). From an ecological perspective, these two steppe woodland types differ in important ways related to connectivity. On the one hand, riparian woodlands historically formed natural corridors across the steppe that enabled woodland wildlife to cross and even inhabit an otherwise open and hostile landscape. The standing water and high productivity associated with riparian zones may also have allowed these habitats to function as "sources" for wildlife from which less productive and more isolated woodland habitat patches could be colonized.

On the other hand, patch woodlands have probably never been connected in any way, and should be considered as a natural habitat mosaic of individual patches. These patch woodlands may still be critically important, as they can provide animals such as roe deer with a 'stepping stone' system of habitats (Bennett 1999) with which they can inhabit and disperse across the otherwise open steppe. Siberian roe deer are known to undertake extensive migrations in some areas due to heavy snows in winter (Danilkin 1996), and if roe deer in Mongolia undertake such movements patch woodlands may be an especially important stepping stone habitat element during this period.

However, from a conservation and management perspective these two woodlands differ in important ways. Patch woodlands are mainly threatened by local cutting for firewood and other uses. Because of their small size, wide spacing, and lack of information about their location, it is difficult to design a protected area management scheme that can preserve this mosaic. Therefore it is important that woodland patches be identified and mapped through remote sensing. A strategic conservation education effort then should be implemented targeting local communities and herders that use the areas around the patch woodlands to ensure that they are aware of the law and convince them to maintain and preserve these woodland patches.

Riparian zones, on the other hand, are easily identified as they are found along already mapped water courses. Riparian woodlands face similar threats as patch woodlands (cutting for firewood and other uses), but they also are threatened by overgrazing and general disturbance from large numbers of livestock that regularly use riparian zones for access to water. Since riparian zones are by definition contiguous, it is possible to identify critical stretches of riparian woodland that can be designated as duly gazetted protected areas. However, as water is a limiting resource for both wildlife and for people and their livestock, management must include sensible plans developed in collaboration with local herders. These management plans should allow continued access to water for livestock and people but maintain riparian woodland connectivity as corridors through controlling grazing to allow regeneration, and should even include reforestation efforts in areas of high degradation.

Both riparian woodland and patch woodland are protected under the *Mongolian Law on Forests* (1995), under *Chapter 3: Protected Zone Forests* (Wingard 2001). Under this law (*Article 13: Prohibited Strip Forests*), any riparian forest found within 5 km of a lake or the source of a river or stream, or any riparian forest found within 3 km of a river bank or source of mineral water or spring, is protected. For patch woodlands, the same law (*Article 10: Forests within Protected Zones*) identifies "forest areas covering up to 100 hectares" and "small tree groupings" as Protected Zones Forests. Unfortunately, this information has not been widely disseminated, and many local people (and even some government agencies) are not aware of the protected status of small woodlands.

The question of how to manage small parcels of land that have high value to biodiversity and thus to conservation is not an easy one. Yet it is critical that management plans consider spatial patterns across a landscape scale in order to promote the maintenance of species, communities, and ecological processes. Roe deer can serve as a flagship species that can help policy makers, land managers, and others identify and conserve critical habitat variables – in this case the isolated 'steppe woodlands' that appear critical for roe deer populations and other species of wildlife on the Eastern Steppe. It is also possible to combine species that use different elements of the landscape – such as roe deer and Mongolian gazelle – to create a suite of 'landscape species' (Sanderson *et al*. 2002, Coppolillo *et al*. 2004). Resource managers can focus on these landscape species to plan

effective strategies to preserve associated habitat elements and thus the overall biodiversity of Mongolia's Eastern Steppe.

Acknowledgements

This project was funded by The Wildlife Conservation Society, the Disney Wildlife Conservation Fund, and UNDP-GEF. Special thanks must go to Dr. George Schaller for sponsoring and leading the Nomrog surveys. We would also like to thank J. Ginsberg, L. Krueger, T. Fuller, L. Herb and Chinzorig J. for their support and encouragement.

References

Bennett, A. F. 1999. *Linkages in the landscape: The role of corridors and connectivity in wildlife conservation*. IUCN International Union for Conservation of Nature and Natural Resources, Gland, Switzerland and Cambridge, U.K.

Chen, H., Ma, J., Li, F., Sun Z., Wang, H., Luo, L. & Li F. Seasonal composition and quality of red deer *Cervus elaphus* diets in northeastern China. *Acta Theriologica*, 43(1): 77-94.

Coppolillo, P., Gomez, H., Maisels, F. & Wallace, R. 2004. Selection criteria for suites of landscape species as a basis for site-based conservation. *Biological Conservation*, 115(3): 429-430.

Danilkin, A. 1996. *Behavioural ecology of the Siberian and European roe deer*. Chapman and Hall, U.K.

Gunin, P., Vostokova, E., Dorofeyuk, N., Tarasov, P. & Black, C. 2000. Assessing present day plant cover dynamics. In: *Vegetation dynamics of Mongolia* (Geobotany, 26): Chapter 3. Kluwer Academic Publishers, U.K.

Hewison, A.J.M. & Danilkin, A. 2000. Evidence for separate specific status of European (*Capreolus capreolus*) and Siberian (*C. pygargus*) roe deer. *Zeitschrift fur Saugertierkunde*, 13-21.

Jigjidsuren, S. & Johnson, D. 2003. *Forage plants in Mongolia*. ADMON Publishing. Ulaanbaatar, Mongolia.

Olson, K. 2003. *Birthing synchrony, neonatal weights, first year survivorship, and density estimates of Mongolian gazelles in Southeastern Mongolia*. M.S. Thesis, University of Massachusetts Amherst, Amherst, MA.

Sanderson, E.W., Redford, K.H., Vedder, A., Ward, S.E. & Coppolillo P.B. 2002. A conceptual model for conservation planning based on landscape species requirements. *Landscape and Urban Planning*, 58**:** 41–56.

Schaller, G. 1998. Mongolia's golden horde. *Wildlife Conservation*. 101(6): 36-41

Taylor, R., Fahrig, L., Henein, K. & Merriam, G. 1993. Connectivity is a vital element of landscape structure. *Oikos*, 68: 571-573.

Wingard, J.R. 2001. *Compendium of environmental law and practice in Mongolia*. GTZ Commercial and Civil Law Reform Project and GTZ Nature Conservation and Buffer Zone Development Project. Ulaanbaatar, Mongolia.

Zahler, P., Olson, K., Ganzorig, K., Boldbaatar, B., Schaller, G., Grigg, G., Pople, T., Payne, N., Draisma, M., Hopwood, P. & Odonkhuu, D. 2004. Management of Mongolian Gazelles as a Sustainable Resource. *Mongolian Journal of Biological Sciences,* 1(2): 48-55.

Хураангуй

Дорнод Монголын бор гөрөөсний *(Capreolus pygargus)* судалгааг 2000 оноос 2003 оныг хүртэлх хугацаанд явуулав. Нийт 65 бодгаль тоологдсон нь тус бүс нутагт бор гөрөөс нэлээд тархсан олохыг харуулж байна. Бор гөрөөс ихэвчлэн уулын хээр болон ойт хээр түүний ойролцоох нутгуудаар тохиолдож байв. Дорнод Монголын талд алаг цоо байдлаар тохиолдох толгодорхог ойт хээрийн бүлгэмдлүүд болон гол дагасан зурвас нутгууд нь бор гөрөөсний тархалт, нүүдлийн гол эзэшил нутаг нь байж болох юм. Эдгээр алаг цоог ойт хээрийн зурвас нутгуудыг хамгаалалтанд авах нь бор гөрөөсний популяцийн тогтвортой байдлыг хангах, түүнчлэн Дорнод Монголын биологийн төрөл зүйлийг хамгаалахад чухал нөхцлийг бүрдүүлэх ба бор гөрөөс нь ойт хээрийн зурвас нутгуудын хамгаалалтанд үндсэн гол төлөөлөгч зүйл юм. Ойн талаарх Монгол улсын хууль нь ойт хээр нутгийг хууль ёсоор хамгаалдаг бөгөөд хүмүүс энэ хуулийг илүү сайн ухамсарлаж мэдэх шаардлагатай.

Received: 17 February 2004
Accepted: 30 May 2004