~ Evaluating the impacts of carnivore hunting in the grasslands of Mongolia ~

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Introduction

The grassland steppes of Mongolia harbor an impressive diversity of carnivores. They include several small species like the corsac fox (*Vulpes corsac*), red fox (*V. vulpes*), Pallas' cat (*Otocolobus manul*), and European badger (*Meles meles*) as well as several large species such as the grey wolf (*Canis lupus*) and Eurasian lynx (*Lynx lynx*) (Mallon 1985; Heptner and Naumov 1992). Many of these species overlap in range throughout Mongolia and represent key components of steppe ecosystems.

In recent years, steppe carnivores began facing a myriad of threats. Following the collapse of the Soviet Union in the early 1990's, dramatic social and economic change occurred in Mongolia. The government transitioned abruptly from a central-planned communist state to a more US-style, free-market democracy. The consequences of the transition to wildlife have been overwhelmingly negative. Surrounding countries, such as China, now have greater access to Mongolia's natural resources and created large demand for wildlife products (Pratt et al. 2004). As a result, over-hunting occurs in many regions and has dramatically depleted wildlife populations (Wingert, in press). The once ubiquitous corsac fox, for example, now occurs in fragmented populations and appears to be declining throughout Mongolia. A recent IUCN workshop upgraded its conservation status from 'Least Concern' to 'Near Threatened' (King, et al. in press). Actions need to be taken now to prevent the future declines, not only of corsac foxes, but other steppe carnivores.

Over hunting represents perhaps the most imminent and paramount threat to wildlife in Mongolia (Reading et al. 1998; United Nations Environment Programme 2001; World Bank Group 2001; Pratt et al. 2004). Although an integral part of Mongolian culture, hunting is on a trajectory towards unsustainability. The situation is exacerbated by lax (and often corrupt) law

enforcement, few wildlife use regulations outside of 'strictly protected areas', and little management of natural resources in Mongolia (Pratt et al. 2004).

An important first step towards managing the threat of hunting is to understand the magnitude and impacts it has on wildlife populations. With the generous support of the Rufford Foundation Small Grants for Nature Conservation, we launched a year-long project to do just that. Our project aimed to evaluate the impacts of hunting on the carnivore community in grassland steppe ecosystems. We used the results of the project to implement a long-term, science-based conservation programme for carnivores in the central steppes.

Methods

We based our project in the Ikh Nartiin Chuluu Nature Reserve, which is located in the Dalanjargal soum (county) of the Dornogobi aimag (province; geographic coordinates: N45.723° E108.645°; Figure 1) (Reading et al. 2006). The reserve is administered locally by the soum and receives little formal protection. In many ways, the region is typical of most rural steppe areas in Mongolia. Hunting of carnivores is common, unregulated, and largely illegal. No formal management plans exist to protect carnivores and the habitats they inhabit. Conservation efforts are needed and soum administers are keen to develop a strategic management plan for the reserve, but lack the resources and expertise to do so.

Our project aimed to 1) evaluate the direct impacts of carnivore hunting; that is, to what extent carnivore numbers change throughout the year in response to hunting; 2) quantify the indirect effects of carnivore hunting on the small mammal community; this allowed us to understand to what extent carnivores regulate rodents (*i.e.,* functional role of carnivores in steppe ecosystems); 3) assess the magnitude of hunting and what factors drive hunting pressure, and 4) develop a community-based conservation programme for carnivores in the region.

To evaluate the direct impacts on carnivores, we surveyed carnivore abundance each season inside and outside of the reserve. To evaluate indirect effects, we surveyed the small mammal community across major habitat types each season (also inside and outside of the reserve). The magnitude of hunting was assessed through direct observations of hunting activities and extensive interviews with the herding community. We combined this information to develop a conservation programme that involves local herders, government administers and effectively monitors hunting each season in the reserve and surrounding areas.

Results and Discussion

The following is a summary of our results:

1. *Direct effects of hunting* – the abundance of carnivores changed dramatically throughout the year. We observed a tremendous decrease in the density of corsac, red foxes, and badgers during the early winter months. Hunting pressure was extremely intense from the end of October to the end of February, when fur bearing species possess their winter coats. Of 18 known, individual carnivores monitored during the study, 92% of known mortalities (n = 12/13) was from human hunting (Figure 2). Carnivore abundance rebounded slightly in late spring of 2006. The increase probably reflects the influx of young born earlier in the year. Corsac foxes, in particular, can whelp up to 16 pups per litter (Heptner and Naumov 1992) – a characteristic that probably allows them to rebound from intense periods of hunting. Red foxes, by comparison, are probably able to rebound by occupy more complex habitats that allow them to successfully elude hunters. We had difficulties measuring Pallas' cat abundance. However, they appeared to occupy similar habitats as red foxes, which may have allowed them to elude hunters to some extent. The increases among all species did not reach levels from the previous summer (2005), suggesting a strong negative effect from hunting pressure. The abundance of carnivores was slight higher inside the reserve than outside. However, hunting occurred intensively (and illegally) in the reserve boundaries, so the higher abundance does not necessary reflect better protection.

2. *Indirect effects of hunting on the small mammal community* – During the study, we surveyed small mammal abundance at 6 sites inside and outside the reserve (Figure 3). We also surveyed insect abundance at each small mammal trapping site and collected and analyzed scats from fox species (Figure 4). Through the surveys, we captured 12 small mammal species including gerbils (*Meriones* spp.), jerboas (*Allactaga* and *Dipus* spp.), hamsters (*Cricetulus* spp.), dwarf hamsters (*Phodopus* spp.), and voles (*Alticola roylei*). We also recorded 59 species of insect, most of which were beetles (Coleoptera). The overall density of small mammals was quite high at the beginning of the study. At some sites, density of rodents exceeded 60 per hectare. Small mammal density, however, declined substantially, probably due to limited rainfall during the study. Carnivore abundance did not correlate with small mammal abundance. The diet of the most common carnivores (corsac foxes, red foxes, and badgers) also did not vary in accordance with small mammal numbers. Our results suggest that carnivores exert little 'top down' regulation of

small mammals. This is not overly surprising as carnivore numbers appeared largely reduced (*i.e.,* well below carrying capacity) due to hunting. We observed no appreciable differences in small mammal numbers between survey sites inside and outside the reserve.

3. *Magnitude of hunting* – we evaluated the magnitude of hunting by examining hunting characteristics per family living in the reserve and surrounding regions. We conducted interviews with all families living at least part of the year in the northern part of the reserve. This included 35 families. Our interviews generated tremendous details on hunting pressure, hunting methods, wildlife uses, markets, and perceptions of wildlife conservation among the herding community. Herders hunt carnivores mostly for their skins, which fetch between $10-20 per skin and body parts that are either sold to market or used local for medicinal purposes. Pallas' cat fat, for example, is used to sooth and heal frostbite. Some animals are also sold to live markets across international borders. We estimated hunting rates per family for several carnivores (# hunted per season: corsac = 3, red fox = 2, badger = 0.5, and Pallas' cat = 1). We also obtained data about wolves and lynx, both of which are heavily persecuted in March and October and hunted for furs in December and January. Most hunting methods were illegal and wildlife laws and regulations rarely followed. Knowledge of reserve boundaries was also limited, but herders felt a genuine sense to maintain the integrity of carnivore communities, steppe ecosystems, and Ikh Nart reserve. Market price largely determined hunting efforts over other factors, as did mean family size and income. The interviews were particularly valuable in allowing us to determine, not only hunting rates, but areas most hunted. This allowed us to identify key regions most in need of protection and where most illegal hunting occurs. For example, illegal hunting often occurs at marmot (*Marmota sibirica*) colonies. Many smaller carnivores depend on marmot burrows for shelter and protection from other predators. Hunters often target these regions to capture foxes and Pallas' cats. Carnivores are also inadvertently captured in traps set for marmots in the summer. These results will allow managers to greatly prioritize anti-poaching efforts.

4. *Conservation programme* – we combined the results collected on carnivore and small mammal abundance and hunting magnitude to develop an interdisciplinary conservation programme. The programme includes four main components: 1) a comprehensive monitoring system run by biologists from the Mongolian Academy of Sciences and local herders living in and around the Ikh Nartiin Chuluu reserve. We actively monitor carnivore abundance and small mammal populations across all

major habitats in the reserve each season. The results are analyzed and entered into a database created by the programme. All biologists and herders involved in the programme received training in using the database. 2) Ranger training. During the study, we hired additional rangers, in conjunction with supplementary funding from the World Bank and Trust for Mutual Understanding. Our project provided valuable training in research and monitoring methods (*i.e.,* wildlife survey and census methods) as well as help controlling illegal poaching. 3) A system of disseminating ongoing results from the project. We drafted a management plan from the results of our project that lays out a strategic plan for protecting carnivores and reducing threats from over hunting, illegal hunting, and poisoning, and bolstering reserve protection. We established a system of disseminating results each season with aimag, soum, government and non-government agencies, and herders in the region.

Conclusions

Carnivore hunting in the Ikh Nartiin Chuluu Nature Reserve, and across most of the grassland steppes of Mongolia, occurs intensely and represents the paramount threat to most species. In the Ikh Nartiin Chuluu Nature Reserve, carnivore hunting occurs mostly from late October to late February. The main direct effect of hunting included a dramatic decrease in carnivore abundance in winter. Some species appear to recover, perhaps due to high litter rates and habitat preferences, but long term studies will be necessary to determine the severity of the threat. Hunting appears to be unsustainable in the region for most species. Because little carnivore management or monitoring occurs, the danger of localized extinctions (*i.e.,* possibly through Allee effects) is relatively high. We recorded slightly higher carnivore abundance inside versus outside of the reserve.

The indirect effects of hunting on small mammals seem minimal. Small mammal populations did not vary in accordance with carnivore abundance. Similarly, carnivore diet did not vary according to small mammal abundance. However, carnivore populations appeared to be depressed and well below carry capacity when the study began. Because of their low density, it is likely that they exert little affect on the small mammal community. Longer term studies will elucidate subtle predator/prey relationships.

We also interviewed all herders in the region to obtain social and economic information on hunting in the reserve. Our results provided valuable information on hunting rates, methods, markets, and perceptions of wildlife conservation that will be used to prioritize anti-poaching efforts and develop an

effective carnivore management plan for the reserve, soum, and aimag. Most families hunted regularly during the winter months and harvested multiple species. Harvest rates correlated strongly with market prices rather than other socio-economic factors.

The project developed a unique conservation programme based on the data collected during the project. The programme is the first for the region and receives support from the Mongolian Academy of Sciences, soum, aimag, and government/non-government agencies and includes substantial local involvement. The programme trained, and continues to provide training, to rangers, monitors carnivore and small mammal communities, and disseminates information on the ecological health of the region to local communities, scientists, and all other interested parties. Our hope is that the programme will allow us to chart population trends over time and monitor the ongoing effects of hunting. Ultimately, we will use this information to protect carnivores and the fragile grassland steppes they inhabit.

Project Staff

James Murdoch served as project leader. An outline of his professional experiences was submitted on the initial grant application. The following includes the principle team members:

Tserendorj Munkhzul – Munkhzul is a biologist of the Mongolian Academy of Sciences, Institute of Biology. She is small mammal expert that studied pika (*Ochotona* spp.) as a M.Sc. student. She served a project manager and coordinated all data collection efforts. Munkhzul entered a Ph.D. program in 2005 and will focus her degree research on carnivore biology in the reserve.

Maikhant Otogonbayar – Maikhant serves as the head game ranger for the Ikh Nartiin Chuluu Nature Reserve. He lives in the reserve and has detailed knowledge of flora and fauna of the region. Maikhant assisted in carnivore surveys and interviews.

Buyanasuri – Buyana graduated from the Mongolian National University in 2004 and contributed to all data collection efforts, including carnivore and small mammal surveys, scat analysis, herder interviews and training. Buyana plans to enter a M.Sc. program in 2007. Her research will focus on carnivore biology in the reserve.

Jargalsaikhan – Jagga is currently a student at the Mongolian Pedagogical University and served as a field assistant for the project. Jagga helped with carnivore surveys, herder interviews, and training.

Collaborations

Our project worked with several institutions, organizations, and individuals. We collaborated closely with the Mongolian Academy of Sciences and their Mammalogy Laboratory (Institute of Biology). We also worked closely with the Denver Zoo – Mongolia Program and the Mongolian Conservation Coalition – a not-for-profit group dedicated to the conservation of Mongolia's wildlife and wildlands. The Wildlife Conservation Research Unit of the University of Oxford also provided valuable scientific advice and assistance.

During the project, we also collaborated with a project that aims to improve the management and infrastructure of the Ikh Nartiin Chuluu Nature Reserve. The project is sponsored by the World Bank and Trust for Mutual Understanding. We participated in local and regional meetings and presented our findings directly to soum, aimag, and ministry representatives. Our efforts ensured that carnivores are fully represented in the management of the reserve.

Future Directions

The future objectives of the project include the following:

- Investigating the fine-scale biological requirements of the most common carnivores in the reserve, including corsac and red foxes, badgers, and Pallas' cats. We intend to launch a comprehensive radio-telemetry study to understand spatial (and habitat) requirements of each species. With this information, we will be able to use satellite imagery to develop predictive models of species occurrence. Model results will allow us to identify 'hotspot' zones in the reserve that carnivores rely on most. This will help reserve managers prioritize protection efforts.

- Document trade routes and sources of illegal trade in the Dornogobi aimag. This will involve investigating the mechanics of wildlife trade in the soum and aimag centers, as well as the towns along the rail line (~50 km from the reserve).

- Add two components to the conservation programme. We would like to establish formal ties with universities in Ulaanbaatar and provide field courses for aspiring undergraduate students in wildlife biology, management, and conservation. We would also like to provide additional training to rangers in methods to curb illegal poaching.

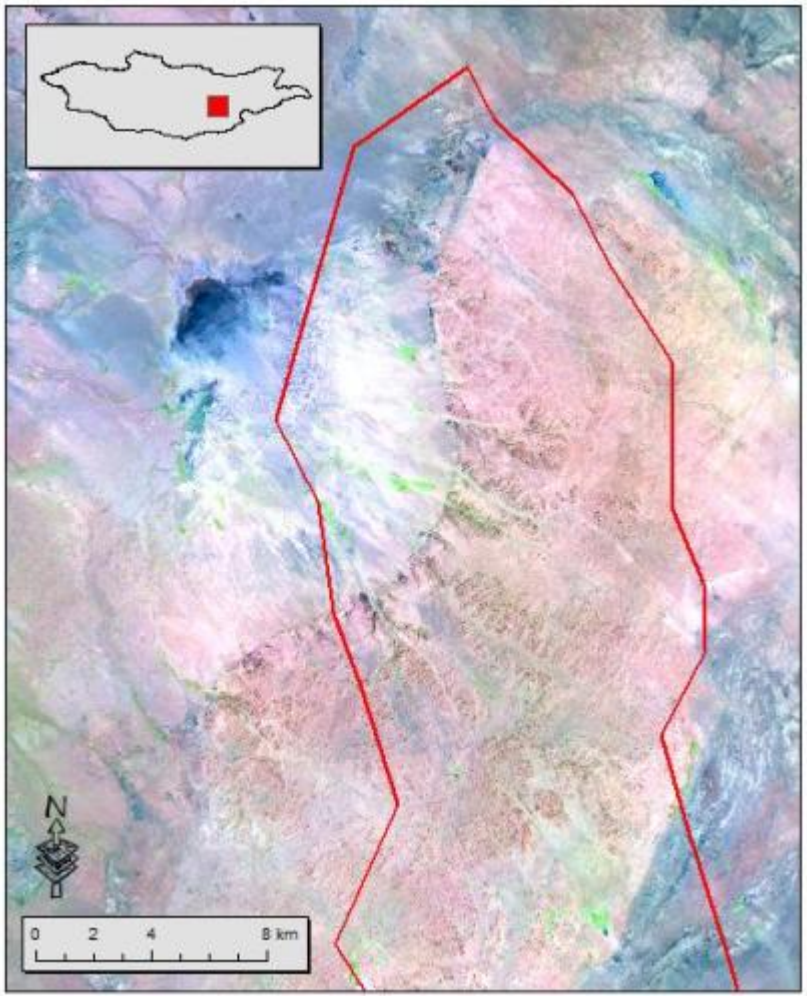

Figure 1. Landsat satellite image (bands 1,2,3) of the study region in the northern half of the Ikh Nartiin Chuluu Nature Reserve (red line). The inset shows the location of the reserve (red box) relative to Mongolia.

Figure 2. Sources of mortality among 18 carnivores, including corsac fox (*Vulpes corsac*), red fox (*V. vulpes*), badger (*Meles meles*), and Pallas' cat (*Otocolobus manul*) monitored during the study.

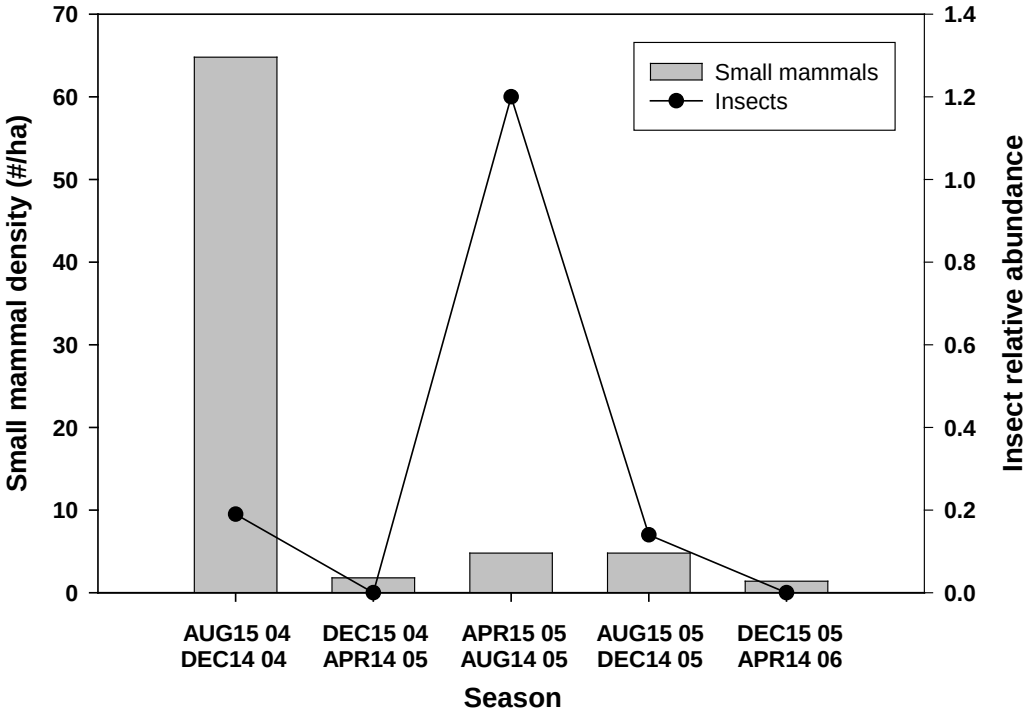

Figure 3. Small mammal density and insect relative abundance in the Ikh Nartiin Chuluu Nature Reserve monitored during the study. Small mammal density calculated using mark/recapture surveys across major habitats. Insect relative abundance obtained using pit fall traps and calculated as the # captured insects/# trap days (effort).

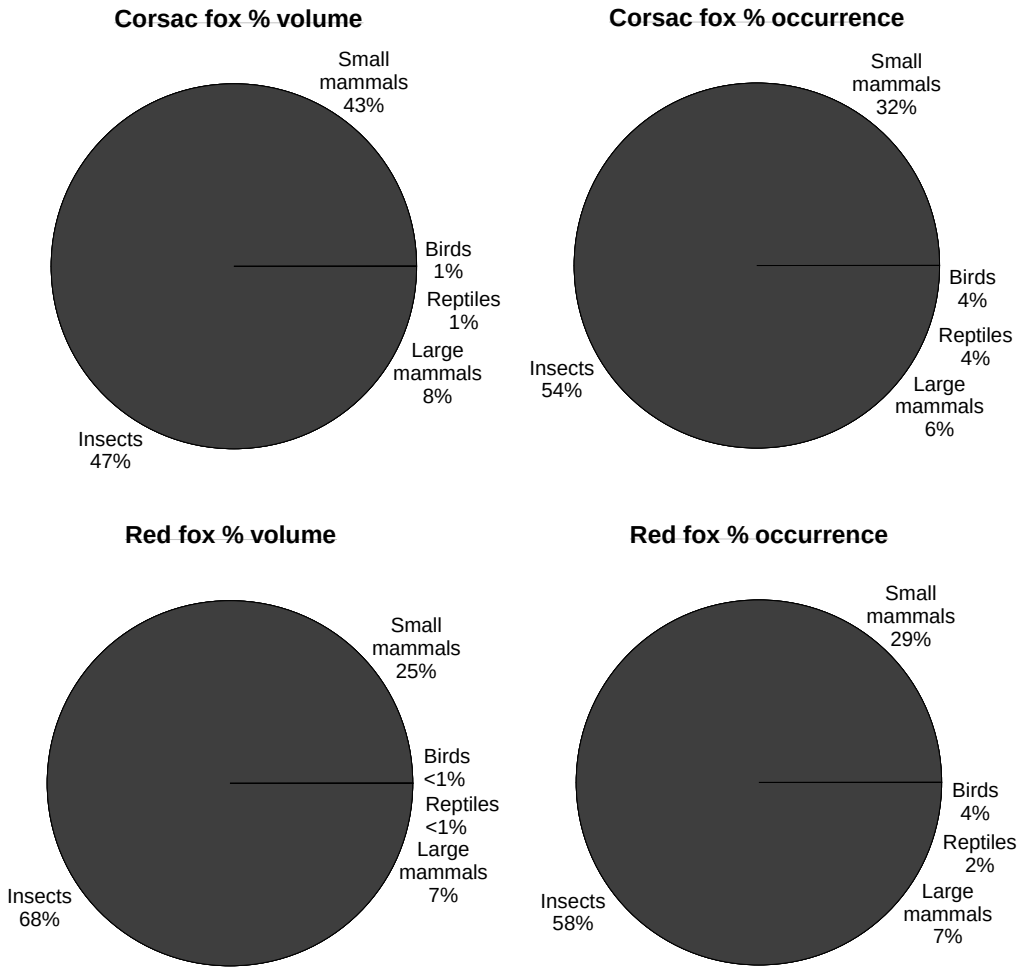

Figure 4. Composition of corsac fox (*Vulpes corsac*) and red fox (*V. vulpes*) diet in Dornogobi, Mongolia. Composition estimated by percent volume and percent occurrence in scats. Percent occurrence plot is derived by expressing the number of occurrences of each prey group as a percent of all occurrences of all prey groups.

Project Budget

Below is budget for the project that indicates the amounts granted by the Rufford Foundation Small Grants for Nature Conservation and the amounts spent by the project. All amounts estimated in GBP £ - Sterling.

Item	***Funding Granted by RSGNC[1]***	***Funding spent by project***
Equipment		
Scent station lures – (6 x misc. scent lures)	17	*15*
Shovels – (4 x FS round-point)	31	30
Sifting boards – (4 x Shaker Sieve)	33	25
GPS receivers – (4 x Garmin eTrex)	236	245
Small mammal box traps – (210 x Sherman 13")	2310	2310
Trap bait and insulation – (20 kg millet, wool)	55	30
Headlamps – (4 x BD Hybrid LED/Xenon)	110	120
Scales – (4 x Pesola Medioline 300g)	90	95
Marking supplies – (20 x non-toxic marker)	14	8
Transport boxes – (4 x Action Packer 8-gal.)	40	40
Spotlights – (4 x Q-Beam rechargeable)	134	134
Rangefinder – (2 x Nikon Laser 440)	297	300
Graduated cylinders – (4 x Nalgene 500ml)	22	22
Scat bags – (1000 x paper bags 0.5l)	11	5
Dissecting kits – (2 x Vari-case kit)	18	18
Notebooks (15 x FS Field Book)	45	35
Training manual (20 for conservation programme)	90	80
Personnel		
Mongolian park ranger field assistant – (12 months x £80/month)	240	240
Mongolian participants in training course per diem – (4 courses x £150/course)	600	600
Transportation		
Survey vehicle costs – (1,800 km x £0.10/km)	180	230
Camp supplies/maintenance/equipment		
Solar panel – (~100 watt monocrystalline PV)	138	130
Charge controller – (Morningstar 20-amp)	41	40
12VDC battery – (100-amp capacity)	28	28
Winter heating fuel – (4 months x £50/month)	200	200
TOTAL	**£4,980**	**£4,980**

[1] Funding granted to the project in June 2005. Additional funds for the project granted by the Denver Zoological Foundation, Trust for Mutual Understanding, and the Small Cat Conservation Alliance. This funding covered additional equipment, field assistant per diem costs, and airfares.

Budgetary notes – our project spent within budget for most expenses. We were over budget on survey vehicles costs, which is partly due to an increase in petrol costs over the winter. We accounted for this by reducing some costs including trap bait, small mammal marking supplies, and scat bags.

Project Photographs

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Photograph captions

1) Core research team that implemented the project. James D. Murdoch (left), Tserendorj Munkhzul (middle), and Maikhant Otgonbayar (right). Photo © Ingrid Barcelo.
2) Grassland steppe ecosystem in the Ikh Nartiin Chuluu Nature Reserve. The grassland steppes of Asia represent one of the largest intact grasslands in the world and harbor a wide diversity of carnivore species. Photo © James Murdoch.
3) Eurasian lynx (*Lynx lynx*) near the Ikh Nartiin Chuluu Nature Reserve. Lynx occur throughout the arid grasslands of Mongolia and face heavy persecuted by livestock herders. Photo © Steve Cain.
4) Striped dwarf hamster (*Phodopus sungorus*) in the reserve. Several small mammal species live in the reserve, including 3 species of dwarf hamster. Photo © Richard P. Reading.
5) Corsac fox (*Vulpes corsac*). Corsac foxes range widely across Mongolia. Intense hunting pressure in recent years resulted in an upgrade in its IUCN listing in Mongolia from Least Concern to Near Threatened. Photo © Xavier Eichaker.
6) Tserendorj Munkhzul shows a dwarf hamster captured during surveys for small mammals in the reserve. Photo © James Murdoch.
7) Maikhant Otgonbayar apprehended this red fox (*Vulpes vulpes*) killed by poachers inside the reserve. Illegal hunting represents the most serious threat to wildlife in Mongolia. Photo © James Murdoch.
8) Pallas' cat (*Otocolobus manul*). Pallas' cats (or manul) occur throughout the reserve and are hunting for their skins and body parts. Live animals are also sold to international markets. Photo © Richard P. Reading.
9) J. Murdoch explains how we surveyed small mammal abundance in the reserve to a school group in Dornogobi aimag. Photo © Matt Becker.
10) Red fox (*Vulpes vulpes*). Red foxes, often called 'yellow foxes' in Mongolia, occupy nearly every habitat in the reserve and are intensively hunted during winter months. Photo © Richard P. Reading.
11) Jargalsaikhan helped collect data for the project as a field assistant. His efforts included obtaining carnivore and small mammal data as well as interview data. Photo © James Murdoch.
12) Release of a corsac fox in the reserve. With the generous support of the Rufford Foundation, we received additional funding to launch a pilot study that aims to understand the biological requirements of carnivores in the reserve. We radio-tagged several carnivores in 2005, including this corsac fox, and followed their movements on a weekly basis. Photo © James Murdoch.

Literature Cited

Heptner, V. G., N. P. Naumov, editors. 1992. Mammals of the Soviet Union. Part 1A ed. New York: E.J. Brill.

Mallon, D. P. 1985. The mammals of the Mongolian People's Republic. Mammal Review 15:71-102.

Pratt, D. G., D. C. Macmillan, I. J. Gordon. 2004. Local community attitudes to wildlife utilisation in the changing economic and social context of Mongolia. Biodiversity and Conservation 13:591-613.

Reading, R., D. Kenny, G. Wingard, B. Mandakh, B. Steinhauer-Burkart. 2006. Ikh Nart nature reserve. Ulaanbaatar, Mongolia: ECO Nature Edition.

Reading, R. P., H. Mix, B. Lhagvasuren, N. Tseveenmyadag. 1998. The commercial harvest of wildlife in Dornod Aimag, Mongolia. Journal of Wildlife Management 62:59-71.

United Nations Environment Programme. 2001. Mongolia: State of the Environment 2002. Ulaanbaatar, Mongolia. 79 p.

World Bank Group. 2001. Mongolia Environment Monitor. Ulaanbaatar, Mongolia. 38 p.