EARTHWATCH INSTITUTE FIELD REPORT

Earthwatch Institute Mission: *Earthwatch engages people worldwide in scientific field research and education to promote the understanding and action necessary for a sustainable environment.*

Earthwatch Institute uses the UNESCO Definition of a Sustainable Environment*:*
A sustainable environment is one in which the natural environment, economic development and social life are seen as mutually dependent - and the interaction between them contributes to the sustainability and enhancement of the quality of people's lives and the natural environment.

SECTION I: UNEP- WCMC WEBLINK INFORMATION

Project Title: Ecology & Conservation of Argali Sheep (*Ovis ammon*) in Mongolia

Principal Investigator (s): Richard P. Reading & Ganchimeg Wingard

Position/Affiliations: Director of Conservation Biology & Research Associate, respectively, with Denver Zoological Foundation

Research Site(s) (geographic location, include coordinates if known, e.g. Lat/Long):
Ikh Nartiin Chuluu Nature Reserve, Dornogobi Aimag, Mongolia (research camp = Lat: N45.72323° and Long: E108.64525°

Local Management Status of the Research Site(s) (e.g. National Park, RAMSAR Site, World Heritage Site, IBA etc.): Nature Reserve (Mongolia) & Important Breeding Bird Area (BirdLife International)

Scientific names of primary species being studied:
Argali Sheep (*Ovis ammon*); Cinereous vulture (*Aegypius monachus*)

Key Research Objectives:

Overall Objective:
Understand argali sheep ecology well enough to develop a long-term conservation management plan for the species.

1) Capture 5 – 10 adult and 8 – 10 lamb argali sheep/year and fit them with radio collars;
2) Determine sources of argali mortality.
3) Understand argali movement patterns and habitat use.
4) Compare habitat use and forage plants of argali sheep and domestic sheep and goats.
5) Better understand argali behavior.
6) Determine cinereous vulture nesting success rates and sources of nest failure.
7) Use the data collected from our research to develop a conservation management plan for argali sheep and cinereous vulture in Ikh Nart.
8) Train Mongolian biologists and conservationists.

Data Collection and Results

a) Give a concise account of the data you have collected during the past field season.

Argali Sheep

Our research expeditions are divided into 2 autumn and 2 spring teams (4 teams total). All teams participate in radio telemetry tracking, behavioral observations, and vegetation sampling. The autumn teams also assist in animal capture and collaring using drive nets and the spring teams help us hand capture and collar argali lambs and Siberian ibex (*Capra ibex sibirica*) kids with expandable, drop-off collars. Altogether, we obtained 232 locations of our radio collared argali (primarily) and ibex, including 55 locations during the autumn and 177 locations during the spring. The difference was primarily related to the fact that drive netting requires that researchers spend a large proportion of their time near the nets, while lamb captures are opportunistic and occur while researchers are conducting other activities. We also gathered 18 hours and 19 minutes of behavioral data on argali, including 9 hours and 9 minutes during the autumn and 9 hours and 10 minutes during the spring. Unfortunately, much of these data are unusable, as researchers did not use established protocols or complete their data collection forms. We sampled 160 vegetation plots during both autumn and spring, for a total of 320 plots.

We captured and collared more animals than ever before over the 2 field seasons. In the autumn we captured 14 argali and 2 ibex in drive nets; however, we only had 15 radio collars, so we released one of the last 2 argali rams we captured with ear tags only. Of these, 10 argali were ewes and 4 were rams, while we captured 1 billy and 1 nanny ibex. In spring we captured 20 argali lambs and 3 Siberian ibex kids, comprised of 10 female and 10 male argali and 2 male and 1 female ibex. One of the primary goals of collaring young animals is determining causes of mortality. We lost 14 of our 20 collared argali lambs during the fieldwork, including 7 males and 7 females. Unfortunately, for 5 animals we could not determine the cause of death (often because we only found a collar). Of the rest, 2 were definite and 3 probable victims of predation, 2 appeared to die from unknown illnesses, and 3 died of maternal neglect (one of these had a very low body temperature, suggesting an illness as well).

Cinereous Vultures

In autumn 2004, we measured, weighed, and banded 3 vulture chicks on 7 different occasions (i.e., 2 chicks twice). These were the last 3 chicks in our study to fledge, with one fledging on about September 7, 2004, another on about September 27, 2004, and the last on about September 29, 2004.

In spring 2005, we located 175 vulture nests, of which 61 were actively used for nesting by a pair of vultures. By May 5, 2005, 34 of these nests remained active. We collected some data on all nests, including nest length, width, depth, and cup size; nesting substrate (rock or tree); nest height; tree species and diameter at breast height for tree nests; slope, aspect, and viewshed for rock nests; latitude, longitude, and elevation; and any other comments of note. We delayed collecting comprehensive data on active nests to avoid disturbing nesting pairs (we will collect these data later) and for a few nests data collection remained incomplete by the end of the Earthwatch expeditions. We periodically (every 2-5 days) examined active nests to determine if they remained active and investigated nests that were no longer active to try to determine the reason (e.g., nest predation, infertile eggs, nest lost due to strong winds, etc.). The first eggs hatched on May 1 or 2, 2005.

Other

Earthwatch volunteers also assisted with a project on small carnivores and their small mammal prey. In autumn 2004, that project captured and radio collared 4 corsac foxes (*Vulpes corsac*), 2 red foxes (*V. Vulpes*), and 2 badgers (*Meles meles*), and volunteers assisted in a couple of these captures. Non-target captures included long-eared (*Hemiechinus auritus*) and Daurian hedghogs (*H. dauricus*). We also established 2 100 m x 100 m grids and 2 1-km transects for trapping small mammal trap. The grids and transects each included 100 traps and we trapped each for 4 consecutive nights (1,600 trap nights total). Volunteers assisted in checking traps and processing captured animals, which included Mongolian jirds (or gerbils) (*Meriones unguiculatus*), midday jirds (or gerbils) (*M. meridianus*), Roborovskii's dwarf hamsters (*Phodopus roborovskii*), dwarf hamsters (*P. sungorus*), striped hamsters (*Cricetulus barabensis*), house mice (*Mus musculus*), Royle's mountain voles (*Alticola argentatus*), and a Daurian hedgehog. In spring 2005 we set up an additional small mammal grid, but 400 trap nights yielded only a few of the *P. sungorus* dwarf hamsters and midday jirds so we discontinued that work. Volunteers again assisted in checking traps and processing animals.

b) What progress have you made towards achieving your original objectives?

Overall Objective:

Understand argali sheep ecology well enough to develop a long-term conservation management plan for the species.

We have made substantial progress toward this overall objective, learning much about sources of mortality, habitat use, dietary overlap with livestock, genetic considerations, behavior, and more. We are using the knowledge gleaned from our work to assist the Mongolian Ministry for Nature and Environment in developing a conservation management plan for the species. While that plan will undoubtedly be completed in the next year or two, our knowledge of the species' ecology remains incomplete. We hope to continue our work for several more years and revise the management plan accordingly.

1) Capture 5 – 10 adult and 8 – 10 lamb argali sheep/year and fit them with radio collars;

We greatly exceeded our objectives in terms of animal captures. We captured 14 adult argali and 2 adult ibex, of which we collared 15 animals (we ran out of collars and thus could not collar one of the last 2 rams we captured). At this point, we will dramatically reduce our targets each year unless a large proportion of our collared animals die, as we are simply unable to track many more animals. We captured 21 argali lambs and 3 ibex kids and collared them. Again, this was our best year for lamb captures and the first year we collared ibex kids. Part of the reason for this large number was that a large proportion of collared animals died (14 lambs and 1 kid) due to a variety of causes.

2) Determine sources of argali mortality.

We continually monitor collared animals and immediately work to locate animals that die (our collars include mortality switches). For the majority of animals this is possible, but even getting to a dead animal quickly does not guarantee that we will be able to determine the cause of death (in some cases we only find collars) and a large proportion of animals that die are not easily diagnosed. Still, our project has determined that domestic guard dogs represent an important (perhaps most important) cause of mortality and this factor was previously unrecorded.

3) Understand argali movement patterns and habitat use.

We have been tracking radio collared animals daily (365 days/year), although we do not get locations on all animals each day (usually only once every several days) and some animals go several days with locations being recorded. We have not had the time to rigorously analyze all of the movement data collected (see above for details on the data collected during Earthwatch team expeditions). We have collected a substantial amount of vegetation data as well that will permit us to examine habitat use in the future.

4) Compare habitat use and forage plants of argali sheep and domestic sheep and goats.

Our analyses of dietary overlap between argali sheep and domestic sheep and goats are almost complete and will be presented as part of one PI's (Ganchimeg Wingard) M.S. thesis. Basically, we found substantial overlap in the diets of these ungulates, which has serious management implications for the reserve.

5) Better understand argali behavior.

Although we have collected behavioral data, much of these data are not usable because researchers (usually students) and volunteers (some) did follow our protocols. In addition, observing argali without them noticing the researcher or moving out of view is often difficult. As such, we have only collected limited data to date, and not enough to begin analyses. We will work more diligently in the next year to try to address this situation.

6) Determine cinereous vulture nesting success rates and sources of nest failure.

Our cinereous vulture nesting ecology study is progressing well. Our first 2 years served as a pilot study for our more rigorous research in 2005 (teams III and IV). Results from the pilot study have been accepted for publication and are appended to this report. In 2004 we were able to band 3 nestlings with the assistance of Earthwatch volunteers (one of whom discovered the nest that contained one of these nestlings). In 2005, researchers and volunteers identified some 175 nests of which 61 contained eggs or nestlings. We will track these nests through the first half our second year with Earthwatch. Determining causes of nest failures has proven more difficult (often because the eggs often simply disappear), although we are performing far better than in past years.

7) Use the data collected from our research to develop a conservation management plan for argali sheep and cinereous vulture in Ikh Nart.

We have worked with the Mongolian federal government to develop a national management plan for argali and a draft is now in review. On the local level, we have met with the Soum (like a county) governor and he is very interested in developing more active management of Ikh Nart. We hope to develop a sister park relationship with Anza-Borrego State Park in California, USA to help realize this objective.

8) Train Mongolian biologists and conservationists.

Training has progressed well on our project. Over the past year, we worked with and trained 9 Mongolian undergraduate students, 3 researchers with the Mongolian Academy of Sciences, and 1 Mongolian graduate student in the U.S. One of the Mongolian researchers at the Academy is also pursuing his Ph.D. at the Mongolia National University. In addition, we had over 25 students from the Mongolian Pedagogical University, 6 students from the University of Ulaanbaatar, and 1 student from the Mongolian International University visit and train on our project for shorter periods of time. This training continues.

c) Please provide a summary of your results.

d) Argali Sheep

Our results remain preliminary, but we are obtaining an ever-improving picture of the ecology of argali sheep in Ikh Nart. The extent to which we can generalize these results to other areas inhabited by argali remains unknown, but certain aspects of their ecology undoubtedly hold across the species range. Most of the results we discuss here are presented in Reading *et al.* (In press a). More recently collected data remain to be analyzed.

Movement Patterns. We have not noted any seasonality in argali movement patterns. This may be due to the fact that our argali do not inhabit a mountain range, but a relatively level area with rocky outcrops. Home ranges were an average of 57 ±3.7 SE km^2 using the 100% minimum convex polygon method. Core use areas averaged 76 ±5.3 SE km^2 for 95% kernel ranges; 32 ± 3.7 SE km^2 for 75% kernel; 11 ±1.6 km^2 for 50% kernel; and 3.8 ±0.5 km^2 for 25% kernel home ranges. These ranges are mostly larger than ranges for desert bighorn sheep (*Ovis canadensis*), but this is not surprising, as argali are more of a cursorial animal, built for running.

Mortality. Predation accounts for over 70% of the mortality of radio collared argali, and domestic dogs are responsible for 30-50% of all predations (it is often difficult to differentiate between wolves and dogs). We have also directly observed domestic guard dogs killing argali on 5 different occasions, the only predations we have witnessed. Thus, guard dogs represent an important source of mortality, and one that was previously unrecorded. Other sources of mortality include maternal neglect, disease, starvation and exposure, and unknown causes. Over the past year we have had an unknown disease run through the argali population that causes blindness prior to killing the animals. None of our adult, collared animals have yet died from this disease, but we have found at least 5 uncollared adults suffering from this ailment and 2 lambs may have succumbed to it. We are currently working to identify the disease, but our efforts are hampered by the lack of an appropriate diagnostic facility in Mongolia. The disease is also occurring in domestic livestock (the likely source, especially as large numbers of herders from outside the region moved into Ikh Nart just prior to the disease outbreak).

Dietary Overlap with Livestock. Our preliminary results show a high degree of dietary overlap between argali sheep and domestic sheep and goats, especially in the winter. These results will be part of Ganchimeg Wingard's Master's thesis and so we will not report on them in detail here. We will provide a copy of Ganaa's thesis to Earthwatch when it is completed. These results are not surprising, as the species are closely related and inhabit the same parts of Ikh Nart.

Habitat Use. Argali sheep from the northern part of Ikh Nart utilize 2 main areas of the reserve: an area just north of our research camp with some large, rocky outcrops and an area even further north, with less rocks and more rolling terrain (see figures in Reading *et al.* in press a). Now that we have these telemetry data we can analyze the habitat characteristics that draw argali to these regions. We are currently analyzing vegetation within and outside of these heavy use areas for future comparisons. We will also use a geographic information system (GIS) to analyze other variables, such as proximity to water, roads, people, and rocky areas.

Behavior. Our understanding of argali behavior remains rudimentary and we have not collected sufficient data to begin our analyses. This is particularly unfortunate because argali appear to becoming more habituated to humans in the reserve. Although we do not have rigorous data to support this assertion, we appear able to approach much closer to argali than in past years, as our continually improving photos suggest. Such habituation should prove highly

beneficial if we help the reserve develop ecotourism as an income generating initiative to help fund park management.

Side Ecology & Conservation Projects

Cinereous Vultures. The results of our cinereous vulture work through the end of 2004 are published in Reading *et al.* (in press b). We just began collecting data for 2005 in April. Our results indicate that most vulture nests fail during the incubation period. Pairs that successfully incubate their eggs through to hatching are far more likely to successfully fledge young. Contrary to expectations, we also found that nests on rocks were more likely to succeed than nests in trees. This was surprising because most nests on rock substrates were easily approachable by ground predators. This year we are keeping better track of causes of nest failures and found that infertile eggs, eggs cracked during incubation, nest blow-overs during wind storms, and egg predation by ravens all play a role in nesting failures. We are collecting more variables on nest sites in 2005 that will hopefully allow us to compare successful with non-successful nests.

Small Carnivores & Small Mammals. Our small carnivore and associated small mammal project began in autumn of 2004. Data remain too preliminary to draw any conclusions, but with the few animals of each carnivore species we collared, we are beginning to see distinctions in habitat use. Future analyses of feces may allow us to better understand how these carnivores partition resources. Similarly, our small mammal trapping results suggest that different species prefer different habitats (more rocky areas as opposed to more sandy areas and more vegetated areas as opposed to less vegetated areas). We also trapped a new species of small mammal for Mongolia and are working to try to determine if it is new to science (we released the animal, thinking we could identify it later, so we really need to capture another specimen to make the identification certain).

Significance/Benefits of Research

a) What is/are the significance/benefits of your research at the following levels? (see below)

b) How do your findings contribute to issues of sustainability?

Our research and conservation efforts promise to provide benefits locally, nationally, and internationally. Overall, our work will improve our understanding of several globally significant species about which very little is currently known. As such, our work should contribute to conservation efforts in our area, but also throughout the range of the species. For example, we are the first and only long-term research project that extensively studies argali sheep using radio telemetry. The insight gleaned through this work is already significant, as we have identified an important and previously unrecognized source of mortality – domestic guard dogs. We are also elucidating movement patterns and home range sizes, the degree of dietary overlap with domestic livestock, and argali behaviors. All of this information should help wildlife managers in Ikh Nart, in Mongolia, and throughout the range of the species in Central Asia to better manage the species (for example, by better estimating the potential impacts of pastoralism and the size of protected areas required).

Similarly, little is understood about cinereous vultures, a species of global conservation concern, and the small carnivores inhabiting Ikh Nart. Our research into vulture nesting ecology will help managers understand the factors influencing nesting success, while many of the small carnivores we are studying have either not been previously studied intensively or have been only little studied, especially in Mongolia. Yet, the pressure on these species to supply pelts

and body parts for traditional Chinese medicine continues to grow. This increases the importance of management, which should be based on sound science.

We conduct our work as if it is one large training program for our Mongolian colleagues. As such, the project also promises to benefit the local area and Mongolia by training Mongolian ecologists and conservation biologists who will be better able to take these skills and use them to advance wildlife management and conservation in the area and nationally (if not internationally). Our the past year, we have trained 9 Mongolian undergraduate students, 3 researchers with the Mongolian Academy of Sciences, and 1 Mongolian graduate student in the U.S. One of the researchers at the Academy of Sciences is also pursuing a Ph.D. in Mongolia based on the work we are doing in Ikh Nart. Several of our colleagues are already involved in conservation management planning on the national level for some of the species with which we work and 1 will likely consult overseas later in 2005. All of this bodes well for the sustainability of our work, because it is our Mongolian colleagues who will continue our research and conservation initiatives into the future. It is they who are in the best positions to meld our research results with the local culture to develop sounder, more sustainable management plans.

Hopefully, the benefits of a better managed nature reserve will extend beyond the animals and plants inhabiting the reserve to the people living in and around Ikh Nart. Our work is already demonstrating benefits in terms of growing wildlife populations that are more habituated to humans. This increases the opportunities for nature-based tourism and increased job opportunities. Our project already employs 2 local people full time and 10 local people part time and, as such, enjoys the full support of the county governor. Finally, and perhaps most importantly, the local people benefit from being able to enjoy a more healthy ecological community. Luckily, we work in a region where the local people strongly value a healthy environment and support our efforts to ensure a sustainable future for them, their families, and the myriad of plants and animals that co-inhabit Ikh Nart with them.

Dissemination of Results

a) Have you provided details of results from your research to or within:

- **Scientific papers (indicate status; e.g., peer reviewed or in progress/press)**

Zahler, P., B. Lhagasuren, R.P. Reading, J.R. Wingard, S. Amgalanbaatar, S. Gombobaatar, N.W.H. Barton, and Y. Onon. 2004. Illegal and unsustainable wildlife hunting and trade in Mongolia. Mongolian Journal of Biological Sciences 2:23-32. (peer reviewed)

Reading, R. P., S. Amgalanbaatar, G. J. Wingard, D. Kenny, and A. DeNicola. In press a. Ecology of argali in Ikh Nartiin Chuluu, Dornogobi Aimag. Erforsch Biol. Ress. Mongolei, Halle (Saale) 9: ##-##. (peer reviewed)

Reading, R. P., S. Amgalanbaatar, D. Kenny, and B. Dashdemberel. In press b. Cinereous vulture nesting ecology in Ikh Nartiin Chuluu Nature Reserve, Mongolia. Mongolian Journal of Biological Sciences. (peer reviewed).

- **Management plans and reports (in progress or completed)**
  - **By who, for whom, and used by which agencies**

CO-PI Amgalanbaatar has been working with the Mongolian Ministry for Nature & Environment in drafting a national management plan for argali sheep. A draft of that plan is now being circulated for review within Mongolia.

- **Presentations (given or planned)**

Reading, R.P., S. Amgalanbaatar, G. Wingard, D. E. Kenny, and A. DeNicola. 2004. Ecology of Argali in Ikh Nartiin Chuluu, Dornogobi Aimag. International workshop on Ecosystem research in the arid environments of Central Asia: Results, challenges and perspectives, June 23-25. National University of Mongolia, Ulaanbaatar, Mongolia. (attended by about 50 students, researchers, and faculty members)

Wingard, G., R. P. Reading, S. Amgalanbaatar, and B. Mandakh. 2004. Seasonal food habits of argali (*Ovis ammon*) and dietary overlap with domestic livestock in Mongolia. Rangelands in Transition, 57th Annual Meeting of the Society for Range Management, January 24 – 30, Salt Lake City, Utah. (Poster). (attended by about 35 international researchers)

- **Popular articles or films (in progress or completed)**

Our co-PI, Sukh Amgalanbaatar has 2 conducted radio interviews in Mongolian about our work over the past year.

Sukh Amgalanbaatar also assisted in the production of a Mongolian popular nature film that partially covered our work during the past year and which aired on Mongolian television.

S. Amgalanbaatar also responded to several requests for newspaper interviews and the press in Mongolia has written at least 3 newspaper stories about our work over the past year.

- **Books, chapters, illustrations**

None

We would appreciate copies of any relevant materials you can make available to us.