

Inner Mongolia's Lost Water

EXPEDITION BRIEFING

January 2004

Dear Volunteers,

Welcome to the Inner Mongolia research project, "Inner Mongolia's Lost Water". We are delighted that you will be joining us. For more understanding of the historic and modern processes of desertification, the possibilities of rehabilitation and raising the hopes of the herdsmen in this area, Earthwatch volunteers will certainly be the key contributors to the success of these purposes.

This area, Ejin (Ejina) Basin, is geomorphologically a fault basin with the vast Gobi desert and degenerating grassland at present. NASA described it as the largest features of such kind in the world. However, this area once had a prosperous history with many cities, residential sites, temples, lakes, grasslands and trading camel teams from the Silk Road, and for a long time, since about 200 B.C., this area was the land of many dynasties of national minorities. Flake tools of the Stone Age in dunes also give evidence about a former scene with rich water. While we cannot prevent past desertification within these high dunes and ruins, we hope that future changes will be minimized in response to an improved understanding of the mechanisms and history of desertification in the region.

This project is the beginning of an exciting long-term monitoring effort with multidisciplinary and international cooperation. However, it would only be a dream without the kind support of Earthwatch volunteers!

This project involves several objectives that necessitate a variety of methods to achieve a solid understanding of the desertification processes in China, to monitor the degeneration of grassland and to evaluate the water resources of this huge arid area. Methods include: examination, surveying, ecohydrological observations, water sampling for hydrochemical and isotopic research. In addition to the general work plan in the field, you are very welcome to utilize your skills to design your own research in the field. You will have the opportunity to undertake a wide range of investigation and to experience a remote Inner Mongolia wilderness deep in the desert with limited access and contact with the outside world.

We feel immense gratitude to 187 volunteers (19,400 person-hours) from 15 countries that have joined our expedition since 1997. They bestowed a great favour by putting this project – a lifelong dream of ours – into practice. They camped at the ruins of ancient cities, wandered over the sand mountains as the nomads did and stayed in Mongolian homes. Sometimes we felt as if we were on another planet, and sometimes we felt as if time were solidified and we had returned to an ancient village of thousand years ago, to the sites of Stone Age. The results of our work are challenging. Some current concepts of arid hydrology and ecology suggest many explanations. However, the more we study this huge wild area, the more questions are raised from the mysterious phenomena found during the expeditions; it stimulates and lures us to get deeper into their surge wildness.

For 2004, we have scheduled five teams to continue to date and explore the puzzling new discoveries of past expeditions. Teams I, II and III will set out from Ejin Qi, the westernmost border city of Inner Mongolia, in the footsteps of Marco Polo within the area of ancient ruins of abandoned cities, rivers and irrigation canals and grassland. We will visit many ancient city ruins and stay there several days, then go to Guai-Zi grassland within the Gobi desert for sites with different coverage and for sand dune area at the edge of Badain Jaran Desert of Stone Age. Team IV and V will set out from Alxa Youqi, the west part of the ancient Mongolian Alxa Qi, go to a

one-family village as our base camp, then within the Stone Age area, our camel caravan will move into the hinterland of Badain Jaran Desert with highest sand mountains of the world. We will camp by the mysterious lake recharged by fresh springs within sand mountains for several days' investigations. In fact, Earthwatch expeditions in the Gobi desert area of Teams I - III are the first foreign teams since the expedition under the leadership of Dr. Sven Hedin during 1927-1935. Those in the Badain Jaran Desert of Team IV and V are the only foreign teams who get across through this huge Desert of 44300 km² (17110 sq mi) up to now.

For your convenience, we will take care of all arrangements as your journey to the field site Ejin Qi from Xi'an, the capital city of Shaanxi Province (Team I, II and III) and, to the field site Alxa Youqi from Yinchuan, the capital city of Ningxia Province (Team IV and V). On the way to and/or from our study area, there will be the opportunities for some sightseeing for world cultural heritage and historic sites as well, e.g., three Great Walls from 214 B.C.

Living and working in Ejin Basin, truly China's last frontier isn't for everyone; the conditions there can be a challenge and require both physical and mental preparation. We welcome you to join us in a taste of the frontier lifestyle in one of the largest Gobi desert areas of China and the world!

A warm welcome awaits you not only from the reserve staff, but also from the Mongolian people whom you will meet either during trips in the remote desert or talking at their homes while enjoying a dinner of Mongolian style with Hada, lamb and songs in your honor.

This is an expedition during which you will have the opportunity to use your energies for raising hopes for the prosperity of this wild area and for the Mongolian people there. I sincerely look forward to meeting and working with all of you!!

Yours very sincerely,



Professor Wei-Zu Gu

Inner Mongolia's Lost Water

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RESEARCH PROPOSAL

PRINCIPAL INVESTIGATOR: Wei-Zu Gu
POSITION / TITLE: Professor
AFFILIATION: Nanjing Institute of Hydrology and Water Resources

PROJECT TITLE: Inner Mongolia's Lost Water
RESEARCH SITE: Alxa (Alashan) plateau, Inner Mongolia, China
TEAM SIZE: Minimum: 6 Maximum: 8

Abstract of Proposal

The area of desertification-prone land in China has increased rapidly during recent decades. The long-term research goals are to understand both the historical and current desertification and recovery processes. Our project area is the arid Alxa Plateau, which covers an area of approximately 23,200 square miles in western Inner Mongolia. This area is the main source of the large-scale sand storm that has occurred during recent years in this country.

For the next few years, our objectives are:

- continue to investigate the Gobi desert area, including its ancient city ruins
- study the Badain Jaran Desert, including several Stone Age sites and ancient lake beds within the sand mountains
- study the degenerated grasslands within the Gobi desert
- identify recharging sources of groundwater
- document features of the ecohydrological system
- investigate the correlation between endemic disease and desertification

Six main methods will be used to attain these objectives, including:

- field surveying
- remote sensing
- hydrological observation
- environmental isotope techniques
- hydrochemical analyses
- ecological observation

Results will improve our understanding of the natural and anthropogenic factors contributing to desertification in arid regions, advance current concepts in hydrology, and inform practical hydro-engineering endeavors in this area.

RESEARCH PLAN

1. THE PROJECT

Background

About 33% of China is arid to semi-arid, and about 27% (2.6 million km²) of the land is prone to desertification. It is also estimated that the desert region is increasing at a rate of 2460 km²/year. This developing crisis is a matter of vital importance to China, as desert land is often uninhabitable for the ever-increasing population. While there has been some effort to manage and prevent desertification, the problem continues to intensify. Effective rehabilitation and management are dependent upon a firm understanding of the ecohydrological processes that cause desertification in the ecosystems of particular regions. Our research is conducted in the western portion of Inner Mongolia, the largest arid region of the country. This region has suffered a long history of desertification, which has led to the demise of ancient cities and prosperous cultures. The western portion of Inner Mongolia is also suffering from modern anthropogenic impacts that accelerate desertification and degeneration of grassland. The end result of this damage is the invasion of dunes, destruction of ecosystem homeostasis, decline of biomass productivity, deterioration of water quality, reduction of available arable land, and spread of endemic diseases. Furthermore, media report that this area is the main source of the frequent sand storms during recent years. These sand storms sometimes extend to Beijing, and even reach across the Yangtze River to Nanjing. The degradation has been made worse by steadily increasing economic demands within this region of China. These demands are the result of a population exceeding the land's carrying capacity and depleting the already limited water resources. The development and exploitation of remaining semi-arid regions seems unavoidable.

We were once asked how Las Vegas could be established in the desert when a Mongolian city could not. The question was best answered by a Chinese saying which responded that a thousand-leg journey starts with a single first step. This project is that first step in understanding the past and future of desertification of this vast area.

Several large-scale projects currently in development require that we gain a more accurate understanding of the hydrological history and future of this semi-arid region of Inner Mongolia. These projects include: water engineering projects in the Ejin, exploitation of the Red Buffalo Desert, and development of the Mu Us Desert. The authorities have asked that we expand our research to include an investigation of practical, applied solutions to the problem of water scarcity. We feel this research necessitates continued multi-disciplinary, basic scientific research in the fundamentals of water resources in an arid region. This research includes studying the mechanisms of desertification and regeneration processes, the evaluation of current water resources, and the sustainable development of semi-arid and desert land.

Research goals

Our research goals are as follows:

(1) Mechanisms of desertification and rehabilitation

Recognizing that desertification and rehabilitation are both natural and social phenomena, this study will investigate many processes including:

- *Historical processes.* What are the natural and anthropogenic factors that historically have contributed to desertification in this region?
- *Modern processes.* What are the natural and anthropogenic factors that have caused an increase in the rate of degradation and degeneration processes of the environment over the last century?
- *Rehabilitation processes.* What methods can be adopted and what policies enacted to foster rehabilitative and regenerative processes in the grasslands and arid land.

(2) Fundamental evaluation of water resources.

For a country with such a large area of arid landscape, we know little regarding its water resources. We can expand our knowledge of these resources by understanding the current hydrological and hydrogeological processes. This study will investigate the following:

- *Hydrogeochemical background.* The project will determine the chemical composition of natural, unpolluted water in the region to serve as a baseline for future water analysis.
- *Identification and evaluation of the recharge sources.* The project will identify the different groundwater systems in the Gobi desert and grassland, including their origins and interconnectivity.
- *Mechanisms of precipitation recharge to groundwater.* The project will study the formation of springs in dune deserts as a result of precipitation.
- *Evapotranspiration / transpiration from ground surface.* The project will determine the amounts and rates of evaporation and transpiration for the Gobi grassland, dune and desert areas. These measurements will provide an index of the recharge rate for groundwater, which plays an important role in water resources evaluation for arid regions. The project will also model the soil-water-plant-atmosphere systems of the desert, transition area, and grassland.
- *The hydrochemical and hydrogeochemical features.* We will analyze the composition of surface water and groundwater and the general ecohydrological features related to climatic, geologic, and ecological environments.

(3) Sustainable development of semi-arid and desert land

The project will analyze the viability and/or sustainability of the following:

- The planned water engineering on the Black River.
- The water resources development of the Red Buffalo Desert.
- The water resources development of the Mu Us Desert.
- Water resources management of the Ejin area problems with endemic diseases arising from the water chemistry in the study area.

Scientific significance

- The project will enhance our understanding of the physical components of an arid region.
- The project will improve our understanding of the degeneration processes of arid environments and of the desertification process.
- The data will help scientists evaluate climate change in the region.
- The data collected in this study will inform policy decisions regarding water management in the Gobi desert

Practical significance

- The results will guide rehabilitation efforts in some regions.
- The research will provide sound scientific suggestions for engineering schemes to develop the water resources in this arid region
- The research will help developers evaluate possibilities for the Gurinai and/or Guai-Zi grasslands, particularly the feasibility of establishing a large, non-polluting beef, mutton and camel industries.

Educational significance

- The research project will provide several Chinese postgraduate and graduate students with theses.
- Via popular publications on the disappearance of ancient lakes and cities, we can increase public consciousness and raise awareness about public responsibility for the environment.

Historical context

Between 1927 and 1935, Dr. Sven Hedin led multiple expeditions of Swedish scientists through our research area. Other expeditions were carried out in the Badain Jaran Desert by Professor D. Jakel, Mebus A. Geyh, and Prof. Wei-Zu Gu between 1988 and 1995. Some hydrological and isotopical research was done in the Gurinai grassland within the research area by Geyh, Gu and Dr. Norman E. Peters of United States Geological Survey (USGS) in 1987-1996. The only comprehensive expeditions in the study area, however, have been made possible by the support of Earthwatch Institute. Since 1997, four Earthwatch teams a year have performed field research in the Gobi, the Gurinai and Guai-Zi grasslands, and the Badain Jaran Desert, which has the Earth's highest sand mountains.

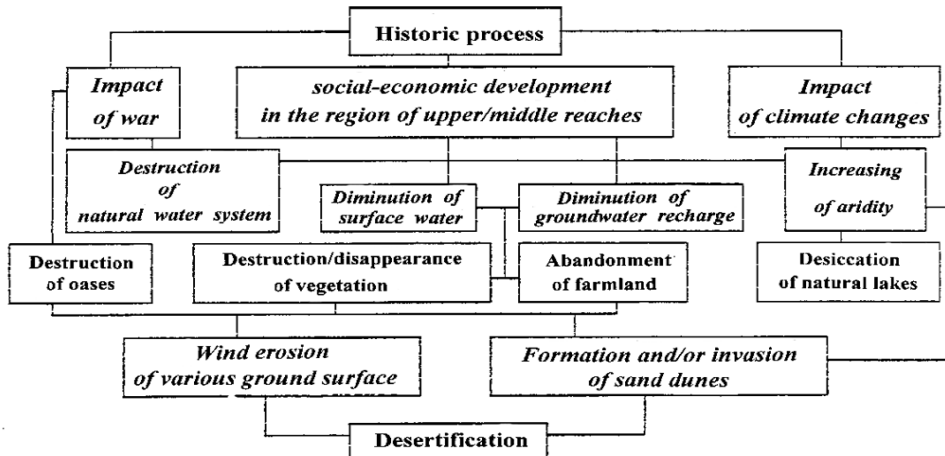
2. RESEARCH OBJECTIVES

Fulfilling the long-term goals mentioned above will require many years of hard work. In the face of impending development projects and current/future water crises, however, the results of this hard work will be well worth the effort.

2.1) The Research Objectives related to the mechanism of desertification and the possibility of rehabilitation.

2.1.1) Historical process research objectives (H)

Factors relating to the historical process of desertification, identified in research performed since 1997, are shown below:



(H1) The hydrography of study area

- a) Map the hydrography of surface watercourses and water bodies. The present maps are incomplete, especially those depicting the Badain Jaran Desert, which contains many lakes.
- b) Use satellite imagery to map the hydrography of subsurface watercourses beneath the Gobi that run toward Gaxun Nur and Sogo Nur lakes, north of Ejin.

(H2) The paleo-hydrography of study area

- a) Use techniques developed on previous expeditions to locate Stone Age sites within the Badain Jaran Desert. Information obtained from studying these sites will reveal long-term changes in the hydrology of the region and climatic changes.
- b) Locate the ancient Ju-Yan Ze lakebed and its dried river system.
 - Locate the ancient large lake, Ju-Yan Ze, and determine the relationships between this lake, the lost Gurinai lake, present lakes, and the Black River. Test several paleo-hydrographic hypotheses.
 - Look for evidence of former waterways by examining layered sediments, shells of aquatic species, etc.
 - Collect historic descriptions related to these lakes and the river system from various historic written accounts to determine the variation of its water environment over time.
 - Locate the more than one hundred sites of the beacon ruins. Their distribution appears to be related to the river system at that time. It will be very helpful to our understanding of climate changes over the last two thousand years.
- c) Investigate the variations in water level of the Gaxun Nur lake, which dried in 1961, and that of the Sogo Nur lake, which has shrunk dramatically. This investigation will help illuminate climate changes over the last hundred years.
- d) Use satellite imagery and field verification to map the dried-up Black River system, especially as it relates to ruins, including many cities and a nearby ancient irrigation system.
- e) Look for ancient wells for groundwater sampling and water environment evaluation.
- f) Look for organic materials for C¹⁴ dating.

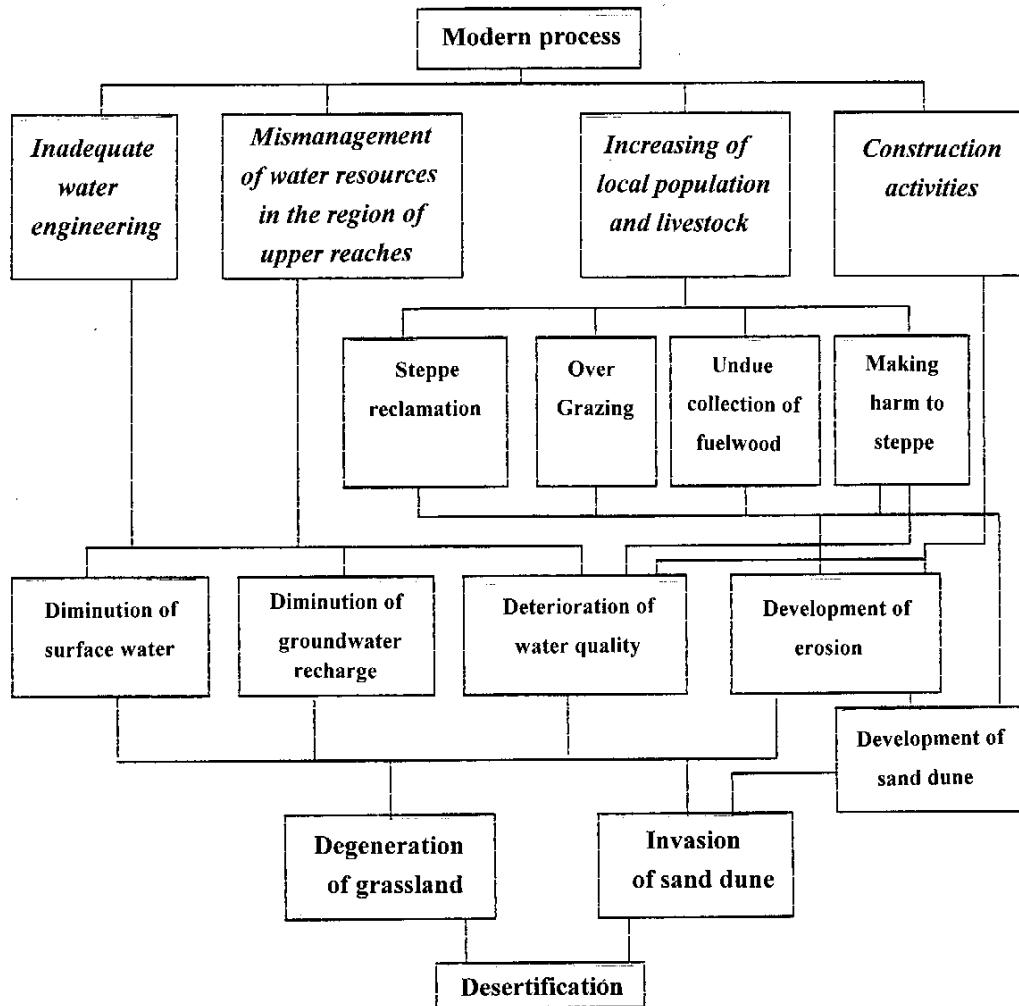
2.1.2) Modern process research objectives (M)

Factors related to the modern process of desertification, identified in research performed since 1997, are shown below.

(M1) Desertification Rates of Gurinai grassland

- a) Determine the advance rate of desertification during recent decades in the Gurinai grassland.
 - Evaluate the overall rate of desertification of Gurinai by comparing the Multispectral Scanner Data (MSS) satellite imagery of 1972 with that of 1980 (and more recent data if it can be found).
 - Use the same imagery to determine the reduction rate of the surrounding saxaule forest (and other desert plants). This saxaule forest was the main production site in this country.
- b) Investigate the change of water bodies, including the lakes and swamps, during this time period.
- c) Identify relationships among indices related to population increase and the reduction in cover rates for different plants.
- d) Estimate the size of the grassland area and the productivity of the main plant communities suitable for livestock; estimate the theoretical livestock carrying capacity.

(M2) Advance of modern desertification of Guai-Zi .
grassland: same as those for M1



2.2) Research Objectives related to the fundamentals of water resources evaluation (F)

(F1) Recharge sources of Gurinai groundwater

Groundwater level appears to be the key factor related to desertification of the grassland. Current methods, however, can only give a general view of the groundwater table and its spatial and temporal variations. For the mechanisms of desertification and for the water resources evaluation, it is necessary to identify various sources of both the phreatic and confined groundwaters. Methods involving the use of environmental isotopes and hydrochemistry can be used to meet this need.

- a) *Fundamental features of environmental isotopes.* Identify spatial and temporal variations in Hydrogen, Oxygen, Carbon, Uranium and Sulfur isotopes in phreatic groundwater and confined groundwater.
- b) *Fundamental features of hydrochemistry in groundwaters.* Record hydrochemical indicators such as Cl⁻, HCO₃⁻, NO₃⁻, SO₄²⁻, Na⁺, K⁺, Ca²⁺ and Mg²⁺.
- c) *Hydrogeochemical background.* Using the neutron activation method, record the presence

- and levels of 33 indicator elements.
- d) *Precipitation recharge.* Identify the recharge rate due to precipitation and determine spatial and temporal variations.
 - e) *Identifying the lateral recharge.* Measure the recharge rates from the percolation of water of the Black River and from Badain Jaran Desert, which we have found during expeditions since 1997.
 - f) *The impact of management on Gurinai groundwater.* Evaluate the correlation between mismanagement of the upper and middle reaches of this river and the diminution of water flow.
 - g) *Paleogroundwater identification.*

(F2) Recharge mechanism of Gurinai groundwater

In our previous work, we demonstrated that a portion of rainfall is involved in the recharge of groundwater. However, it remains a mystery as to how an annual mean precipitation of only about 50 mm could recharge the groundwater through such dry, sandy sediments. We are therefore studying components related to recharge.

- a) *Experimental research on the infiltration characteristics of different plots (of different coverage) using an infiltrometer with a rainfall simulator.*
- b) *Study of the diurnal variation of evaporation rate for ground surface using the energy budget method; the diurnal variation of various components of solar radiation will be measured simultaneously.*
- c) *Study of the characteristics of local precipitation, including the main source of water vapor and its main inflow paths, and the formation and type of precipitation.*
- d) *vapor and its main inflow paths, and the formation and type of precipitation.*
- e) *and the formation and type of precipitation.*
- f) *ipitation.*

(F3) The recharge sources and mechanisms of Guai-Zi grassland

Items included in this objective are the same as that of F2.

(F4) The recharge sources of the groundwaters of Ejin oases

Items included in this objective are the same as that of F2.

(F5) The recharge sources and mechanisms for groundwater in the Gobi and Badain Jaran Deserts

The satellite imagery shows dark black stream-like lines running to the northeast from the east branch of the Black River. They very likely represent groundwater, but such an explanation seems to contradict findings from past field expeditions. During past field work in the Badain Jaran Desert, we found fresh water from precipitation recharge and many springs of good quality. These findings suggest a potential for the development of water resources of unknown origin. Results from recent years reveal the existence of an important recharge source, if it could be identified, the development and disposition of water resources of this area including also the grasslands and Gobi will have dramatic changes. Items to be studied are the same as that of F2.

(F6) The isotopic anomalies of Gurinai groundwater

Conventional isotope analyses have been carried out on precipitation water, river water, and groundwater sampled in the study area during previous expeditions. The relationship between stable isotopes is currently expressed as $\delta^2\text{H} = a \delta^{18}\text{O} + d$. Within the study area, the precipitation fits well with the Global Meteoric Water Line (GMWL) as $a=8$ and $d=+10$. However, for groundwater we found $d = -22 \text{ ‰}$. This is very anomalous within all reported values "a" and

"d" for groundwater in arid regions of the Earth. This aberration is not only scientifically interesting, it also suggests unknown processes are involved in groundwater collection/formation in such arid regions.

2.3) The Research Objectives related to sustainable water resources development and management (W)

(W1) Feasibility of Black River engineering projects

A water engineering project at the upper river of our study area is being planned at a cost of hundreds of millions of Chinese Yuan. However, developers are ignoring the possible impacts on the groundwater of its lower reaches, which encompass an area of many tens of thousands km². Results from our previous research show that the engineering project will have disastrous consequences for the Ejn oases. Further work related to the groundwater recharge of the oases will be conducted.

(W2) Evaluation of water resources in the Red Buffalo (Ulan Buh) Desert

Items included in this objective are the same as that of F2.

(W3) Evaluation of the water resources in the Mu Us Desert

Items included in this objective are the same as that of F2.

(W4) Endemic diseases due to poor water chemistry

Desertification has led to high concentrations of fluoride in the drinking water in this region, which has in turn led to high incidence levels of bone sclerosis. We will investigate the isocline of fluoride concentration in groundwater; the delineation of areas with high incidence levels of disease, and the mechanism of fluoride formation in groundwater, including geochemical and geological factors.

3. METHODS

Six main methods will be used to attain the objectives:

1) *Field surveying and mapping* will be conducted using traditional optical methods

2) *Remote sensing*

- Collect MSS imagery for all possible years for the study area and, if necessary, the Thematic Mapper (TM) on tapes for main study areas from the USGS.
- Collect the multispectral scanner (MSS) imagery from 1972, 1980s, and 1990s for the Gurinai and Guai-Zi grasslands. This imagery will make it possible to estimate the rate of desertification that occurred in recent decades. However, for estimating areas of botanic communities and their productivity in grassland, it seems best to use thematic mapper (TM) imagery if available, as it has higher resolution.
- Selected field sites (i.e., the sample plots) will be used to ground-truth and calibrate image interpretation (Barrett and Curtis, 1976) wherever appropriate for research objectives.

3) *Hydrometry and hydrological experiments*

- Conduct hydrometry and hydrological experiments in selected plots to increase our general understanding of soil-plant-atmosphere continuation system (SPAC). According

to Campbell and Harris (1983), this desert system is extremely difficult to describe in detail, but a reasonably accurate description of the behavior and interactions of its components is possible. In this work, several primary components of the ground's water and energy storage and exchange system will be monitored during July to October. The Chinese colleagues will continue the monitoring at a few plots from November through June while volunteers are not in the field.

- We will use ordinary methods and instruments (Fritschen and Gay, 1979) to collect meteorological and hydrological data.
- We will use current gravimetric methods, including auger-sampling and weighing in the field and oven-drying in the lab (Reynolds 1970), for soil moisture measurements, the main factor in SPAC. We hope to get a Time Domain Reflectometer (TDR), for a quick and nearly non-destructive measurement. We will use a tensiometer for soil moisture potential measurement (Hillel 1980).
- Actual evapotranspiration will be measured with the energy budget method (Gu 1992) to address Evans (1981) concerns about desert systems. An equation of evaporation rate is derived in terms of net surplus of all-wave solar radiation, soil heat flux, differences of air temperature and air humidity at two heights above the evaporating surface and some constants. Then the evapotranspiration rate, with diurnal variations, can be estimated via field measurements of these parameters.

4) *Environmental isotope techniques and neutron activation analysis*

4.1 *Stable isotopes of hydrogen and oxygen*

Natural waters are composed mostly of ^1H and ^{16}O . Deuterium (D) occurs in the form HDO at a concentration of about 320 ppm; ^{18}O occurs in the form $^1\text{H}_2^{18}\text{O}$ at concentrations of about 2000 ppm. Levels can be measured by mass spectrometry. How can it be used for groundwater research? It is important first to know the D- ^{18}O signal of natural meteoric precipitation. Identifying the signal in groundwater then sheds light on the mechanism of recharge. Equal isotope content of groundwater and precipitation provides strong evidence that direct local recharge to the aquifer occurs. On the other hand, incongruous signals reveal the formation mechanisms, recharge sources, and circulation patterns of groundwater and the relationship between aquifers and surface water bodies.

4.2 *Tritium*

Tritium (^3H or T) is the radioactive isotope of hydrogen. Its concentration is measured in tritium units (TU). There are two sources of Tritium in the atmosphere. Tritium can be generated naturally in the upper layer of the atmosphere by the interaction of cosmic rays with nitrogen. However, much more Tritium has been added to the atmosphere by thermonuclear explosions; in 1963 it reached a very high peak value of about 8000 TU in the Northern Hemisphere. So, very low Tritium levels in water shows that the water was formed during the pre-bomb period. Relatively high Tritium levels indicate that the water originates partly or wholly from post-1960 precipitation. This indicator provides a way of roughly determining when groundwater fell in precipitation form. In investigations concerning recharge mechanisms or aquifer delineation, such semiquantitative indicators are often of considerable value. The vertical ages of stratified water in a phreatic aquifer may also be used to estimate groundwater replenishment.

4.2 *CFCs (Chlorofluorocarbons)*

Chlorofluorocarbons are stable, anthropogenic organic compounds which have been produced since the 1930s for both industrial and domestic purposes. Recently, CFCs have been used in hydrological study as a tool for dating very young groundwater. The

amount of CFCs in groundwater reveals a component of modern recharge, which appears valuable for the evaluation of water resources in our study area. This method will be used in our work from 2004 onward; the sampling method we will use is from Switzerland.

4.3 *Radiocarbon ^{14}C*

Radiocarbon dating was developed in 1960. ^{14}C 's long half-life of 5730 years makes it useful for late Quaternary chronology and is now also extensively applied to dating groundwater. Natural ^{14}C is generated in the upper atmosphere by neutron interactions with nitrogen; its production is balanced by decay and burial to maintain a steady-state ratio of about one molecule $^{14}\text{CO}_2$ to 10^{12} molecules of $^{12}\text{CO}_2$. In the 1950s, nuclear explosions added large amounts of ^{14}C to the atmosphere, so that by 1964 the atmospheric concentration in the northern hemisphere had almost doubled. Dating groundwater using ^{14}C cannot be done on the water molecule itself but must rely on dissolved inorganic and organic carbon in the water. Both forms enter groundwater from atmospheric $^{14}\text{CO}_2$ via the soil zone. The decay of ^{14}C atoms makes its specific concentration decrease from the initial ^{14}C ratio to its present ratio over a time span expressed in years. Groundwater can then be dated. However, the factors that influence the observed ^{14}C age of a groundwater sample are complex and incompletely understood. To get an initial ^{14}C measurement is difficult due to the complicated chemical and isotopic systems of carbon cycle. Any interpretation of ^{14}C data is site-specific and requires experience. In our research project, the absolute "age" of groundwater has little significance; we are more interested in comparing the relative ages of groundwater samples and estimating the flow rates from various water sources, especially the transit time of groundwater between two sites.

4.4 *Sulfur 34 and the uranium ratio $^{234}\text{U}/^{238}\text{U}$*

Atmospheric sulfur stems from the decay of organic matter, from airborne salts, and from the combustion of fuel. Sulfur washed down by precipitation may subsequently be augmented by the dissolution of evaporates, by H_2S generated from organic matter and from sulfates contained in rocks. Sulfur has been used, in conjunction with other isotopes, for the delineation of aquifer systems.

^{238}U decays through two short-lived beta emitters to ^{234}U . In a closed system, the ratio of the two isotopes becomes 1:1 after about 1 million years. In most cases of natural waters, it is quite different from 1, ranging from about 0.5 to 20; it is in disequilibrium. This ratio, together with the uranium concentration, is used for the delineation of groundwater systems.

4.5 *Neutron activation analysis*

Neutron activation analysis is another kind of nuclear technique used to determine background values and the elemental composition of natural waters. Water samples are concentrated and prepared through filtration, freeze-drying, and low-temperature evaporation to get dried samples. The water sample is then irradiated in a heavy-water cooled nuclear reactor for about 20 hours with high thermal neutron flux. The radioactivity of activated elements in the sample is then measured by a spectrometer. Concentrations of about 35 elements in every water sample are then found. During the field expedition, various water samples will be taken and/or pre-concentrated for different isotopes to be analyzed in laboratory. Sampling methods are different in volume and in treatments with various chemicals according to demands of individual isotopes.

5) *Hydrochemical method*

The main components of the water, including Cl^- , HCO_3^- , NO_3^- , SO_4^{2-} , Na^+ , K^+ , Ca^{2+} , Mg^{2+} , and fluoride, as well as several physical and chemical parameters, such as temperature and pH level will be measured and/or analyzed in this study. The following methods will be used to interpret the origin, occurrence, recharge, mixing, and circulation of groundwater in different regions (Fetter, C.W., 1980):

- Rank anions and cations separately to identify the dominant ones and the geochemical group to which the surface water and groundwater belong.
- Use various ratios: $\text{Mg}^{2+}/\text{Ca}^{2+}$ for possible admixture of brine water, Na^+/K^+ and $(\text{Ca}^{2+}+\text{Mg}^{2+}) / (\text{Na}^+/\text{K}^+)$ for possible recharge area, $\text{HCO}_3^-/\text{Cl}^-$ and $\text{SO}_4^{2-}/\text{Cl}^-$ for possible groundwater flow direction, etc.
- Make trilinear diagram for grouping various water types, classifying groundwater systems and evaluating mixing.
- Draw isoclines for these components.

6) *Ecological method*

In this study, the ecological methods used by Fautin (1946) in western Utah will be used to describe botanical communities in the desert environment. We will study the botanical communities of individual plots by:

- Identifying major kinds of desert communities, patterns (stratification, zonation, stochastic), population crude density, etc.
- Climax along two profiles through study area: from south to north about 150 km/93 mi and from east to west about 120 km/75 mi. Relate the climax distribution to environmental parameters.

Since 2003, we try to use palaeo-ecological methods, mainly looking at Ostracods. Ostracods are very small aquatic crustaceans characterized by a carapace enclosing the body. We identify the ostracod taxa to the lowest taxa possible, identify the dominating species, isotopes and trace elements of shells, etc. It is aimed at the differentiation of climate changes and the water environment. For this purpose several profiles will be taken for deposit sampling.

4. APPLICATION OF RESULTS

(a) *Results that might benefit scientific understanding*

- *For arid zone ecohydrology:* On a global scale, this research area lies along a belt of arid regions that encircles the globe. The results of this study will benefit world ecohydrology by providing data such as: the climate features, soils, geology, and hydrology of deserts and oases; the recharge sources of groundwater and especially the mechanism of precipitation groundwater recharge in a very arid region with very low annual precipitation; modeling desert ecohydrological systems; the flow of water and energy under arid conditions; the geochemical and isotopic features of waters in arid regions, and the degeneration mechanism in view of ecohydrology.
- *For palaeogeography and palaeolimnology:* Determine the historic variations of the boundaries of many ancient lakes and the inhabitable areas in the desert. Identify the factors responsible for the disappearance of ancient lakes and cities, etc.
- *For environmental science of arid zones:* Identify the mechanisms and factors of desertification and degeneration. Collect data on the hydrochemistry and geochemistry

of desert areas, desertification-prone lands, and degenerative oases. Determine the elemental composition of surface water and groundwater in arid regions.

(b) Results that might contribute to the formulation of public policy

- The prevention of desertification, the rehabilitation of desertification-prone land, the rational carrying capacity of livestock, proper rotation grazing, and the reasonable population growth in an oasis area.
- The rational distribution of water resources from the interior basin and overall consideration for reasonable water planning, including the planned water engineering projects on the Black River.
- The reasonable development of water resources in deserts, which will be an important means toward increasing the fresh water available to a growing population in the forthcoming century.

(c) Results will benefit the education community.

- Postgraduate students from Chinese universities will conduct their theses and will be advised by the PI. Results from this work will enrich college textbooks.

(d) Evaluate local economic development

- With the results, we can better evaluate the possibility of utilizing the natural resources of the Gurinai grassland for industrial purposes, such as livestock, medicinal herbs, etc. The PI would like to help put local residents into direct contact with foreign business units.
- The results will be helpful in developing models for the ecological and economic rehabilitation and development of areas recently lost to desertification.

(e) Publication Plan

- As a result of this project, we hope to publish a book in English for distribution in the US and other countries if all the main objectives are attained. It will tentatively be titled Alxa Plateau: Geography, History, Humanism, Hydrology, Botany.
- We will also submit papers to *Earthwatch Journal*, international and Chinese journals, *Advances in Water Science* (Nanjing, in Chinese with English abstract), as well as to international symposiums. Volunteers may write articles for submission to the *Earthwatch Journal*, other magazines, and local newspapers.

5. FIELD TRAINING

The PI and staff will offer informal lectures, on-site briefings, and discussions, on subjects such as:

- Historical background of the research area
- Descriptions of seasonal research objectives and how they fit into the long-term goals
- Techniques for measuring various meteorological and hydrological parameters
- Sampling methods for different isotopes including the sampling size, pre-treatment procedures, chemicals to be used, cautions, etc.

- Safety (i.e., warnings about staying in wild areas and information on what to do if you get lost)
- Mongolian customs and useful Mongolian words and phrases

6. VOLUNTEER ASSIGNMENTS

Earthwatch volunteers who courageously accept the challenge from the wild desert will contribute greatly to the success of this research and to the science of arid environments. Volunteers will be fully integrated into our studies conducted at a moderate pace. You will spend many hours in transport and viewing places of historic importance.

(a) Volunteers will assist in the following activities:

- Water sampling
- Taking sediment profiles and samples from lost lakes, the Gobi desert, the grasslands
- Meteorological observations
- Limited hydrometry and hydrological experiments
- Examining and locating the lost river courses, irrigation systems, wells, etc.
- Surveying ecohydrological features
- Describing botanical communities using survey plots, occasional
- Describing zoological populations, occasional

(b) Five sequential teams are planned:

- **Teams I, II and III** will follow the footsteps of Marco Polo and go to the Gobi desert, where they will find the ruins of ancient cities and buried rivers. They will then continue to the grasslands for field work within the Gobi desert and on the edge of Badain Jaran Desert.
- **Teams IV-V** will go with a caravan expedition into the Badain Jaran Desert, home to many Stone Age sites and the highest sand mountains in the world.

7. PROJECT STAFF

PRINCIPAL INVESTIGATOR

Professor Wei-Zu Gu, age 64, will be on site for every team and will accompany all volunteers to the field sites from their arrival at the rendezvous. He will serve as their guide and guard; he will be in charge of all field work, data processing, reports and publications. Gu is a research professor at Nanjing Institute of Hydrology and Water Resources, a teaching professor at both the Hohai University of Nanjing and the Xian University of Technology and, an expert of the Institute of Geographic Science and Natural Resources of the Chinese Academy of Sciences.

RESEARCH STAFF MEMBERS

Mr. Jia-Ju Lu (Mr. Lu), age 52, will join several teams and will be in charge of the remote sensing work in Nanjing. Mr. Lu is an Associate Professor, Senior Engineer, and Section Director from Nanjing Institute of Hydrology and Water Resources.

Mr. Jun (Peter) Liu (Mr. Liu), 37, and his wife **Ms. Wei Jiang**, 36, will be in charge of logistical affairs, including transportation, hotel, sightseeing and other needs in Xi'an for all teams. They will serve you upon your arrival in Xi'an until you leave for home. Peter is an engineer and the head of our Project Office in Xi'an.

Mr. Yong Liu (Mr. Liu), age 47, will be in charge of coordinating functions of government agencies of Alxa Prefecture, including the three counties in which our study area is situated: Ejin Qi (Qi literally means "flag" but implies county in Inner Mongolia), Alxa Zuo Qi (or, Alxa Zuoqi) and Alxa You Qi (or, Alxa Youqi). Mr. Liu is a Deputy Director and Senior Engineer at the Bureau of Water Conservancy, Alxa Prefecture, Inner Mongolia.

Mr. Ji-You Deng (Mr. Deng), age 48, will be in charge of Mongolian relations and logistical affairs of Teams I - III. Mr. Deng is a Deputy Head and Senior Engineer at the People's Government of Ejin Qi, Inner Mongolia.

Mr. Mao-Yun Qiao (Mr. Qiao), age 39, will manage logistical operations in Ejin Qi and join several teams for field work. Mr. Qiao is the Director and Chief Engineer at the Water Conservancy Bureau of Ejin Qi, Inner Mongolia.

Mr. Dang-Jun Huang (Mr. Huang), age 45, will be in charge of logistical operations in Alxa Youqi. Mr. Huang is the Director and Engineer at the Water Conservancy Bureau of Alxa Youqi, Inner Mongolia.

Mr. Chao-Yu Zhen (Mr. Zhen), age 25, will join all teams for field work for logistical affairs, field observations and will be ready to wait on you. As a technician he has been working in Gu's laboratory for many years.

Ms. Zao-Hua Qin (Ms. Qin), age 50, will join all teams for logistical affairs, she is in charge of our boiled water supply, foods and cooking, laundering; she has been working in Gu's laboratory for 2 decades.

GRADUATE STUDENTS

Every year one graduate student and one postgraduate student from Xi'an University of Technology join this project. Several graduate/undergraduate students from UK, Australia, and USA have also joined the team.

FIELD LOGISTICS

8. RESEARCH AREA

The People's Republic of China is made up of 23 provinces and 5 autonomous regions. While empires, languages, nations and entire peoples in the rest of the world have risen and blossomed - then disappeared without trace - China has spent the past two millennia largely reinventing itself. The ferocious dragons and lions of Chinese statuary have been produced by Chinese craftsmen, with the same essentially Chinese characteristics, for 25 centuries or more, and the script still used today reached perfection at the time of the Han dynasty, two thousand years ago.

Our research area, the Alxa (Alashan) Plateau, is one of the most arid regions in China. It is part of the Inner Mongolia Plateau, located in the western portion of the Inner Mongolia Autonomous Region. To the west of this Plateau lies the Mazong Shan Mountains. To the south stretches the mountains of Heli Shan, Longshou Shan, etc. To the east rise the famous Helan Shan Range and Lang Shan Mountains. To the north lies a branch of the Mongolian Altayn Nuruu (Gobi Altain Range) mountain range. The altitude of the Plateau (excluding the mountains) ranges from about 1000m - 1500m (3280 - 4900ft) above the mean sea level. There are only a few hilly areas with altitudes higher than 2000 m (6557 ft) above sea level. Teams I, II, and III will travel through Ejin Basin, Gobi Desert, and grasslands. Team IV and V will travel through the Badain Jaran Desert and Ulan Buh Desert.

Teams I, II, and II will travel through the *Ejin Basin* that is a large alluvial fan that began forming over 1.8 million years ago. In the lowermost part, this has formed the Ejin oases. Throughout this region are a series of locations that mark the location of dried up lakes (Gaxun Nur and Ju-Yan Ze) and ones that are substantially reduced in size (Sogo Nur). We will also study the large number of ruins that represent former habited area that would indicated the presense of historical water resources. By mid-team, we will be in the famous *Gobi desert* whose Mongolian translation is "the place without water." Gobi specifically refers to an area distributed over central Asia in Mongolia and Inner Mongolia. It extends about 1600 km (994 mi) east to west and 500 - 1000 km (300 - 600 mi) north to south. We study the regions of both Gaxun Gobi and Outer Altay Gobi. The area is hilly to the west of the Black River and contains a vast plain to the east. The black color and the stream-like lines toward the northeast are shown in the satellite imagery, but it remains to be seen if the area contains surface water.

Teams I, II and III will also research the *Gurinaï grassland* situated to the southeast of the Black River alluvial fan and covers an area of about 3000 km² (1158 sq. mi). The Badain Jaran Desert lies to the east and south, while the Gobi is to its west and north. About 1000 inhabitants, including nomads and their livestock, live in Gurinaï. It is a dried lake-basin whose area has been significantly reduced over geologic time. Presently, there are several small lakes joined by saline-alkaline soil resembling a playa. On the lake terrace surrounding the Gurinaï, playa reeds (*Phragmites communis*) are widely distributed. Beyond the playa reeds are the famous saxaule desert plants (*Haloxylon ammodendron*) and the White-Needles (*Nitreria tangutorum*) on small dunes. This grassland has suffered degeneration during recent decades. It is said that in 1930 a person riding a camel could hardly be seen above the tall reeds, so the reeds must have been in excess of 3 m (10 ft) tall at that time. At present, the reeds are only 1 - 2 m (3-6 ft) tall. A large area of saxaule forest was weathered, while other areas degenerated due to factories.

Team IV and V will travel and research in the Badain Jaran Desert and Ulan Buh desert. The *Badain Jaran Desert* is a famous sandy desert in this country, with an area of 44300 km² (17100 square miles). About 83% of its area is moving dunes. High sand mountains with heights of about 200 – 400 m (656 - 1310 ft) are distributed over its hinterland. The highest ones reach about 500 m (1640 ft), making them the highest sand mountains (megadunes) on Earth. Chain-like sand dunes with height of about 20 – 30 m (66 –98 ft) are situated at the periphery of the desert. Small lakes exist in the southeast of the desert within the sand mountains. Fresh springs are also found in many areas. Our preliminary study used ¹⁴C dating techniques to age the water and discovered relatively “young” water in the springs. The mechanisms of the spring formation and its occurrence are still unknown. The *Red Buffalo (Ulan Buh) Desert* in Alxa Zuoqi covers an area of 5850 km². There are three city ruins (established around 127 BC) and the traces of a large lake, Tu-Shen-Ze, located in its northern area. Part of the area became farmland circa 1968, reclaimed by thousands of student deserters during the “Mao Revolution.” Land was irrigated by water introduced from the Yellow River, and also tragically, by their blood, tears and lives. It is now planned to be further developed for irrigation agriculture in the new century as a “Second Hao-Te.”

Travelling in China, particularly in the less inhabited regions of this study, requires a sense of adventure and willingness to adapt to a different culture. You will be spend most of your time far away from tourist sites, so certain behaviors may be new to you and you should read some guidebooks about the proper behavior for greetings, accepting and giving of gifts, and physically interacting with individuals that will represent a blend of Chinese, Mongolian and many other ethnicities.

What are the downsides to traveling to this area? The climate is hot and dry, and can be oppressive and challenging to individuals not used to these conditions. The sun is very strong and sunburn can occur quickly. UV-blocking clothes, hats and sunscreen are a must. Air conditioning is rarely, if ever available. We will work mostly in the beginning and end of the day avoiding the worst of the heat. Road and traffic safety are concerns to anyone traveling overseas. The roads are often under construction, in poor repair, used as livestock transport paths, and can become quite congested at times. Other times we will be driving in a virtually uninhabited desert between habitated portions. Our drivers exert the utmost care, but you must be prepared for a different perspective on vehicle and road safety.

A change in diet and eating in local homes and small restaurants can be troublesome to some people, and illness while traveling can be unpleasant. It is likely that some traveller’s diarrhea and other gastrointestinal distress will be experienced by some of the staff or team, even with the most careful screening of food. Please do not consume anything, food or water, that the PI has not approved for you. This includes purchasing food at stalls or stores. Water will often be boiled and although safe, can have an unpleasant odor and taste (powdered drink mix goes far to fix this). Vaccines are available for the most common diseases and medical advice should be sought well in advance of travel. High quality medical attention will be hours to days away.

It is sensible to adhere to precautions and bring medications for treating minor problems. Any prescription medications brought into China must be accompanied by a letter from your doctor for Customs purposes. Please make sure that the letter or official prescription matches your name exactly as it appears in your passport and the exact drug name as it appears on the bottle.

Most people who travel to China come away with an unforgettable experience and greater appreciate for the history and culture of the people. As well, you will have a very unique opportunity to see the blending of modern and ancient with persons of varying cultural heriatage in this vast region.

9. TRAVEL PLANNING

FOR ALL TEAMS

Visa Information

All volunteers must obtain a *tourist* visa to enter The People's Republic of China. The processing time varies, depending on country of origin, so volunteers should begin the paperwork immediately. One is not allowed to board a plane to China if one does not have a valid tourist visa. And, it is important be sure your passport is up-to-date and valid for 6 months beyond staying in China and has at least one blank page.

Most volunteers will apply for a tourist visa, type "L," which is issued for travel during a 90 day time-frame (termed the duration), but only for 30 days of actual travel within China. Processing time for a visa can vary between 1 and 6 months, so volunteers have to apply early. A useful website for visa requirements is: <http://www.embassyworld.com>

Within your home country - If one wishes to stay in China longer than 30 days, the local Chinese Consulate may consider extending your visa for longer periods. However, these are determined on an individual basis. People have to contact them for instructions to properly fill-out the visa application.

Once in China - If one wishes to stay longer than the original visa allows, visa extensions are handled by the Foreign Affairs Section of the local Public Security Bureaus (the police). In general, an agreeable Public Security Bureau may issue one 30 day extension of your original visa by payment.

Volunteers must send their passport number, full legal name as it appears on your passport, and date of birth to Earthwatch Expedition Coordinator and PI as soon as possible for the travel permit in study area, which is a special border area.

Address and local contact person

If necessary for your tourist visa and when you are on the plane to China, you will be asked to fill out an immigration form.

Here are some Frequently Asked Questions about visas:

What kind of visa do I need?

Earthwatch volunteers, who require a visa for entrance, will need a tourist visa. The Principal Investigator/researcher will have the research permit or permission for the project.

How do I obtain a visa?

You can obtain a tourist visa by contacting the Embassy or Consulate of the country to which you are traveling. If you choose to obtain a tourist visa by directly contacting the country's embassy, please be sure to leave plenty of time, at least 6 weeks. If you have less than 6 weeks or wish to save yourself trouble, we strongly recommend using a visa agency, which can both expedite and simplify the process. The average cost of a visa is approximately US\$40--\$100 but varies country to country and can potentially cost up to US\$180. A visa agency will charge an additional fee

(depending on the amount of time it takes to process the application), which you can inquire about directly.

What information do I need to provide?

You will need to send your passport, an application form, 2 to 4 passport-size photos plus payment to the embassy or visa agency (if applicable) at least 6 weeks in advance of departure. Please be sure that your passport is valid for at least 6 months beyond your stay.

What do I write on the visa application form as the “purpose of my visit?”

The purpose of your visit is for vacation, holiday, or travel. Foreign immigration officials do not always understand the concept of a “working vacation” or even “volunteering.” Words such as “working/volunteering,” “research” or a “scientific expedition” can raise questions concerning the country’s foreign labor laws and/or prompt questions about official scientific research permits and credentials, etc. to which volunteers on their own will not be equipped to respond. All required research permits for the project are in place and have been approved by the proper authorities.

What do I write on the immigration form as the “purpose of my visit?”

The purpose of your visit is vacation, holiday, or travel.

What should I write for the place where I will be residing?

List the address of the hotel or project accommodations where you will be staying.

Where can I find more information on visas?

Please see “Helpful Resources” for several web site links related to the visa process.

Visa Agencies

IN THE UNITED STATES

Passport Visa Express.com
1911 North Fort Myer Drive, Suite 503
Arlington, VA 22209
Tel: 888 596-6028, +1 703 351-0992
Fax: +1 703 351-0995
Email: info@passportvisaexpress.com
Website: <http://www.passportvisaexpress.com/>

IN EUROPE

The Visaservice
Tel: +44 (0) 20 7833 2709
Fax: +44 (0) 20 7833 1857
Website: <http://www.visaservice.co.uk>

Thames Consular Services Ltd
Tel: +44 (0)20 8995 2492
Fax: +44 (0)20 8742 1285
Website: <http://www.visapassport.com>

Travel Agencies

The following agency is familiar with Earthwatch projects and can assist you in making travel arrangements and booking hotels:

FOR US VOLUNTEERS

Imperial Pacific Travel
Min Turner
1215 Worthington Hills Dr.
Roswell, GA1215
Tel: +1 770 518-5535
Toll free: +800 298-5535
Fax: +1 770 640-1817

FOR EUROPEAN VOLUNTEERS

Wexas International
London, UK
Tel: +44 (0) 20 7581 8761
Fax: +44 (0) 20 7581 7679
Email: southern@wexas.com
Quote code: EWE01/02

STA Travel
Oxford, UK
Tel: +44 (0) 1865 792800
Fax: +44 (0) 1865 792911
Email: manager.oxford@statravel.co.uk
Quote code: EWE01/02

For discounted student and youth fares, we recommend the following agencies which specialize in student discounts:

STA Travel
U.S.: 800 781-4040
U.K.: +44 (0) 1865 792800
Website: <http://www.statravel.com>

FOR AUSTRALIAN VOLUNTEERS

The recommended travel agent is familiar with Earthwatch projects, is in contact with the Australian Earthwatch coordinators and gives a discount where possible to Earthwatch volunteers. She is able to organise travel and travel insurance for volunteers Australia-wide.

Carlene Harlock
Shop 2, 250 Flinders Street

Melbourne, Vic 3000
Tel: +03 9663 6266
Fax: +03 9663 5100
Email: carlene_harlock.vic@flightcentre.com

If you notify your Earthwatch Coordinator prior to contacting this travel agent, your rendezvous information will be forwarded.

Cancellation Insurance

We highly recommend trip cancellation insurance which will help cover your airfare if you are unable to travel, or the expedition is cancelled. Earthwatch does not reimburse airfare or costs associated with cancelled flights. Contact your nearest Earthwatch office for details on cancellation insurance.

Other Advice / Information

- *Local Currency:* the Chinese Yuan Renminbi (RMB) or “People’s money.” The Yuan is the basic unit of Chinese currency. One Yuan equals approximately US\$0.12.

Money can be exchanged at the Bank of China, some of the large hotels, and at the airport. All teams will have the opportunity to exchange money *en route*, but it is wise to exchange some in the airport before you leave for the field.

- *Credit Cards and travel cheques:* VISA cards and travel cheques **can only be cashed** in Xi’an, Dunhuang and Yinchuan, the VISA cards appears not as easy to use. A small amount of US bank notes sometimes seems useful (clean, crisp – not old or used looking.) If you intend to use a credit card within China, you should make sure that the name on the credit card matches the name on your passport/identity card exactly (no nicknames, shortened names, or alternate spellings). Please note the working time of the bank, it is never open on the weekend or vacation days, e.g., Team IV will meet during a 7-day long bank vacation.
- *Purchasing:* Please purchase important field supplies prior to your arrival in China. Common items can be purchased in cities on the way to field sites, but you should not rely on this.
- *Electricity:* 220 V, 50 Hz
- *Time Zone:* GMT/UTC +8

Cautionary Notes:

- Please be very careful of your baggage, camera, money and passport. When you buy something NEVER show your purse or a lot of bills with large amount and, always to have your purse or handbag with you.
- NEVER ask for help from a stranger. You can ask for help from police. At the airport ask the information desk or police.
- Don’t forget to make sure you have your small bags while you leave a taxi.
- Don’t eat on the street or in small restaurants even for ice cream. Eat at large restaurants or, locations suggested by Gu or his assistants.
- In case of emergency dial 110.

Please see the Appendix section for a list of helpful information written by several of Professor Gu’s past team members.

Volunteers Under 18 Years of Age

In an effort to prevent international child abduction, many governments have initiated procedures at entry/exit points. These often include requiring documentary evidence of relationship and permission for the child's travel from the parent(s) or legal guardian if not present. Having such documentation on hand, even if not required, may facilitate entry/departure.

In addition, airlines may also have documentation requirements for unaccompanied minors. Parents of minors are responsible for checking with each airline that their child will utilize to insure sufficient documentation. This could include a copy of a birth certificate or a notarized letter stating that the minor has his or her parent's permission to travel alone.

10. ITINERARY

Travel plans and daily itineraries may change subject to weather, field conditions, or schedule changes. Flexibility, an open mind will make for the best experience.

Teams I, II, and III

	Train		bus		bus		bus		bus	
	And bus									
Xi'an	⇒	Dunhuang	⇒	Jiayuguan	⇒	Ejin Qi and field sites in Gobi desert	⇒	Alxa Zuoqi	⇒	Yinchuan

Our rendezvous is in Xi'an. We will then go to Jiayuguan via Dunhuang by train. The famous Dunhuang Grottoes including the Mogao Grottoes (Caves of Thousand Buddhas, 366 - 1372 AD), a World Cultural Heritage, is not too far from Jiayuguan. It brings a continuous stream of foreign visitors attracted by its mystery. From our experience in past years, most volunteers wish to take this opportunity to see it. It is, of course, our pleasure to make such arrangements. The following itinerary is based on this suggestion. If most volunteers do not wish to see it, adjustments to the itinerary can be made. This decision can be made once the team meets in Xi'an and train tickets will be booked accordingly.

DAY 1: All volunteers arrive by 2:00 pm in Xi'an. We will leave Xi'an on the evening before Day 1. In the meantime, the exact departure time of train from Xi'an is still unknown because it was informed that the time table will have big changes since 2004. Please arrive no later than 3:00 pm in Xi'an. We will take the soft sleeping berth with 4 persons in an individual room, 2 upper beds and 2 lower.

DAY 2: Spend the entire day on the train. Pass through the geographic Gansu Corridor (or Hexi Corridor, Hexi means the west of the Yellow River) following the ancient Silk Road. The green becomes less and less on our way west. You can see the huge loess plateau with caves for living, the mountains with glaciers at your left side. You can have a walk on the platform of large stations but careful when buying food! We will have breakfast in our own room with foods purchased from Xi'an, have lunch in the dinning car with Chinese dishes, and have supper in our room again with instant noodles. Hot boiled water is available in our car. We strongly suggest not using bottle water bought from the platform/within the train. We will discuss your schedule

for leaving the project, confirm whatever you need help including domestic air/train tickets from Yinchuan/Xi'an, etc. and, the schedule of following days.

DAY 3: After traveling by train 1743 km (1083 mi) from Xi'an (2 nights and 1 whole day), we will arrive at the Dunhuang regional railway station on the early morning. Then, we take the bus 130 km (81 mi) to Dunhuang City (about 3 hours of bus travel). On the way to Dunhuang city, we will see the ruin of Great Wall of Han Dynasty (since 206 B.C.). We will have a discussion for our field work in the afternoon. In the evening we will try to go see and take samples from the famous crescent moon lake by sand dunes. Don't be surprised if we have our dinner round 9:00 or 9:30 pm.

DAY 4: Stay in Dunhuang. In the morning starting at 8:00 am we will see the World Cultural Heritage, museum, and night market in evening. These will have entrance fees for volunteers. Once in Dunhuang, we have arrived at the outskirts of the Gobi Desert.

DAY 5 - Gobi Desert: Travel from Dunhuang to Jiayuguan by van about 400 km (250 mi). We will leave in the early morning. On the way we will see the so-called Ya-dan geomorphological landscape and a museum with a drum made of human skin (usually serfs) who owed a debt to venal officials from about 300 years ago. In the afternoon, we will have a visit to the Jiayu Pass, the terminal west gate of the Great Wall of the Ming Dynasty (the same Great Wall of Beijing) in existence since 1372 AD.

DAY 6 - Gobi Desert: Travel 370 km (230 mi) from Jiayuguan to Ejin Qi by van. We will pass through the famous ancient city of Jiuquan (Suzhou), Jinta county and an irrigation area. The road mostly passes through an uninhabited area within the Gobi. We will arrive in Ejin Qi in the evening. It is in general very hot on the way (air temperature higher than 35° C/95° F); an exception happened in 1999 when it became very cold (about 10° C/50° F). We will have a dinner party to meet the local officials, but it's not necessary to dress up. Note you have to be careful as the Chinese liquor has alcohol up to 50% in volume or more. A small dancing party after dinner will be given if you still have energy.

DAY 7 - Gobi Desert: The morning is free for the team to sightsee in this small border city, send postcards and buy something you need. In the afternoon we will have an examination for the Ejin Oasis with living poplars and its water environment including groundwater sampling. We leave Ejin Qi after dinner and travel about 50 km (31 mi) by jeep to the Gobi desert area with lost river courses and many ruins of ancient cities, arrive at our "Base camp," a village with only one Mongolian family. We will stay overnight outside the ruin of Khara-Khoto (described by Marco Polo as the Ejin City, which means the Black River City or, the Black City); if sand storm occasioned, we will stay at our "Base camp."

DAYS 8-11 - Gobi Desert: On these days we will work in the vicinity of our base camp, within the Black City and other city ruins. We will try to find lost river courses using satellite imagery as references. It is believed that the water depletion was responsible for the abandonment of cities. We will try to find ancient wells in these cities and ancient organic material for ¹⁴C dating. We will sample groundwater for isotopic and hydrochemical study from dug wells and springs which may be found and sample rainwater if we fortunately encounter any. Research is also scheduled in several dunes to investigate water source for the thick Red Willows (*Tanarix Junipeina Bge*). After dinner at base camp every day, we will go to the Black City and overnight in tents by a deep well, work there in the next morning until noon time of high air temperature we will return back to our "base camp" and, go to other sites for work in the afternoon. However, sometimes, we have experienced very strong sand or rain storms that made setting-up tents

impossible in the Black City; in this case we have to cancel staying overnight one day or several days there and just go to there for work. We may drive to the lost Ju-Yan city. We will hydrometrically and isotopically monitor the confined groundwater from another important borehole found by Earthwatch volunteers, examine the water environment of the dried forest of poplars (*Populus euphratica*) including sampling of phreatic groundwater there.

Note: The itinerary of DAYS 9-11 is subject to change according to the weather conditions.

DAY 12: We will leave the Black City in the early morning for the Guai-Zi grassland by jeep. We will have our breakfast in Ejin, get fresh vegetables there, arrive at Wendu-Gaolei (Ongt Gol) *Sumo* first, about 250 km (155 mi) from Ejin. Within the Inner Mongolian government system, *Sumo* is one below *Qi* (County); it manages several natural villages.

DAYS 13-17 - Grasslands: We will conduct field examinations, which include: basic surveying, meteorological, hydrological and ecological observations, sampling for surface water, groundwater and rainfall, hydrological experiments, and cultural investigations. We will record readings continuously every two hours. We will have one day to visit the Alxa Aobao. This is a traditional holy site of the Mongols, where we will take groundwater samples and pray for good luck for your families and ourselves according to Mongolian custom. We will have one or two days to make examinations at the northern edge of the Badain Jaran Desert within its sand dune area where we were surprised to find during our expedition of 2001 a site of Stone Age; it is believed that the water environment changes here resulted from mainly climate changes. Another day we will visit the area with a living Saxaule forest for examination of its living condition of vadose water. Within these days we will try to dig a profile with soil samples every 5 to 10 cm (2 to 4 in) aimed at the climate changes by using of the method of fossils and isotopes.

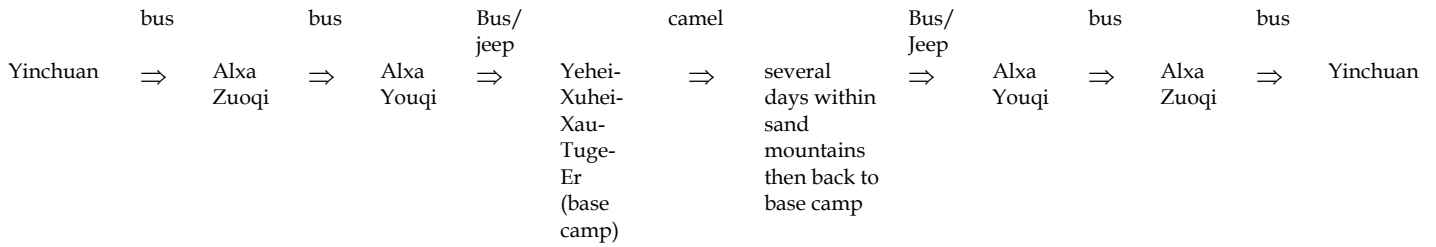
DAY 18: We will travel from Wendu-Gaolei to Alxa Zuoqi via Bayan Mod (Wu-Li-Ji) by van, about 580 km (360 mi). We will have our lunch on the way. We may stay in the motel of Bayan Mod depending on road conditions. Today will be a long day if the road is good and we travel all the way to Alxa Zuoqi.

DAY 19 (FREE DAY): Stay in Alxa Zuoqi, the famous ancient Mongolian city. If something happened on the way from Wendu to Zuoqi, then we will arrive in Zuoqi today and overnight at Bayan Mod. In general we can arrive on Day 18 around 10:00 pm. After a good rest this morning, today is free and, if you like you can visit several famous sites in the city or in the mountains near Alxa. For Team III, it will occasion the famous Mongolian traditional fair, Nadam, held in Alxa.

DAY 20: We will travel by van from Alxa Zuoqi to Yinchuan in the morning with 110 km (68 mi). On the way to Yinchuan, we will visit the ruin of the earliest Great Wall of the Chin (Qin) Dynasty (221-207 BC), which is earlier than those we saw near Dunhuang and at Jiayuguan (you know the Great Wall in Beijing is the youngest). You can walk on it or climb up to its beacon. Also we will see the Royal Tombs of the Xi-Xia Dynasty.

The project officially ends when we arrive in Yinchuan, so all transportation or hotel costs beyond this point will be at your own expense. The train to Xi'an leaves at 3:42 pm and will arrive at Xi'an at about 6:13 am *the next day* (Team I: July 21, Team II: August 14, Team III: September 8). In Xi'an, Peter will meet you at the railway station and arrange everything for you until your leave from Xi'an. Also you can leave for Beijing directly by air/train or for other cities, in this case as mentioned above Gu can arrange tickets for you but please make your decision during your arrival at the project, i.e., no later than Day 4.

TEAMS IV & V



DAY 1: All volunteers arrive by 2:00 pm in Yinchuan. Gu and his assistants will meet you at the airport and/or the railway station. We then take our van to Alxa Zuoqi. Travel from Yinchuan to Alxa Zuoqi by van (110 km/68 mi). Stay overnight in Alxa Zuoqi. On the way we will see the Royal Tombs of Xi-Xia Dynasty.

DAY 2: The day will be spent in Alxa Zuoqi to prepare for departure. The PI will provide training and advice regarding the caravan expedition, will check your clothes to see if they are acceptable enough or not. You will need to bring a down-filled jacket plus thermal clothes to layer and a sleeping bag and overbag, or a four-season bag, rated to -10°C/20°F it will be extremely difficult to find extra clothes and covers once we get into the megadune area. We will spend a second night in Alxa Zuoqi. In order to have more time to work at the destination site, we will leave for the field site today in stead of taking a one-day stay here.

DAY 3: Travel from Alxa Zuoqi to Yabulai Saltern township by van, 430 km (267 mi). We will have our lunch on the way at Alateng Aobao (Altan Obo) or another place. We will stay overnight in a “motel” in Yabulai, the guest house of the saltern.

DAY 4: Travel from Yabulai to Alxa Youqi by van 154 km (96 mi). We will have a lunch party of Mongolian style in Alxa Youqi. We will take jeeps about 60 km (37 mi) to our base camp in Yehei-Xuhei-Xau-Tuge-Er (means the large green depression) at the edge of Badain Jaran Desert. On the way we will take groundwater samples. Stay overnight in tents (tents provided).

DAY 5: Stay in base camp, organize, and check everything for the caravan with the Mongolian guides. Guides and volunteers will check the loading of materials and belongings, and discuss our schedule. Again, we will have camel riding training. Stay overnight in tents.

DAYS 6-8: Our caravan begins to march into the hinterland of the Badain Jaran Desert within the sand mountains. We have to travel a distance of about 70 km (43.5 mi), while zigzagging both laterally and perpendicularly about 140 km (87 mi). We will ride on the camels about 6 to 8 hours a day, climbing over sand mountains with heights of up to 400 - 600 m (1300 to 1970 ft). In the evening of Day 8, we will arrive at our destination site by a lake with many springs within the sand mountains. The destination site is different every year and will depend on weather conditions and the physical condition of volunteers. On the way we will travel through Stone Age ruins (about 4000 to 10,000 or more BC) and pass several lakes, springs, and dug wells. We will mark their locations with GPS, make examinations, and take water samples. We will stay overnight in tents. We will get up very early everyday because our camel drivers have to load our luggage on the back of camels, and this often takes several hours.

DAYS 9-12: Stay in destination site, a “village” where only one Mongolian nomadic family lives, though sometimes the host is absent. Our work will include field examinations, basic surveying, meteorological observations, hydrological and ecological measurements, and observations in the lake using an inflatable small boat. We will sample lake water, spring water, groundwater, and rain water (if we encounter it). We will perform hydrological experiments and humanism

investigations. We record observations every two hours continuously over these 3 days. On Days 10 and 11, we will have a day-trip to another lake and climb over sand mountains for groundwater and lake water sampling. We will stay overnight in tents. If we left Alxa Zuoqi on DAY 2, then we will stay and work here during DAYS 8-12.

DAYS 13-15: Our caravan will take another route back to base camp. We will conduct similar work as DAYS 6-8. Arrive at our base camp in the afternoon/evening of DAY 15. Many Mongolian nomads will gather there to welcome you as their respected foreign guests. In the evening, the Mongolian camel drivers and guides will have a liquor party with their relatives to celebrate a smooth return. We will most likely have our own private dinner to avoid the drunkenness that normally occurs at these parties.

DAY 16: Travel in van from base camp to Meng-Gen Bu-lu-ge, a Mongolian township via Alxa Youqi, have our lunch on the way. In the afternoon before dinner we will have a visit to a mountain with very ancient *rockpainting*. Stay overnight in a motel of Meng-Gen.

DAY 17: Travel in van from Meng-Gen, return back to Alxa Zuoqi in the evening.

DAY 18: Stay in Alxa Zuoqi. This day is also planned as a contingency day in case there is an earlier delay e.g., something happened including special weather on the way from base camp to the destination and *vice-versa*. In case everything goes smoothly, then we will have this day for rest, sightseeing.

DAY 19: Leave Alxa Zuoqi for Yinchuan. On the way to Yinchuan, we will visit the ruin of the earliest Great Wall of the Chin (Qin) Dynasty (221-207 BC), which is earlier than that in Beijing. At the Great Wall of China of the Qin Dynasty (221-207 BC), we can walk on it or climb up to its beacon. After our arrival in Yinchuan, volunteers will be transported to the airport, train station, or hotel, depending on their respective schedules.

Volunteers should consult a travel guidebook for information on local attractions. See "Helpful Resources."

11. DAILY SCHEDULE

Volunteers should be aware that schedules will fluctuate. Weather and work conditions can affect the daily schedule. The time listed below is in Beijing Time which is used in most of China, however, for the field site of our study area, the local time will have about a negative one+ hour difference.

For Teams I, II and III

In the Gobi Desert with ancient city ruins

7:00 am	rise
7:30 - 8:30 am	breakfast in our dining room in case we stay overnight in base camp, but picnic while we stay overnight in the Black City; read maps, prepare everything
8:30 - 11:30 am	field work in the vicinity of Black City; in case we stay overnight there, we will return back to our base camp for lunch
12:00 - 1:30 pm	lunch in base camp

1:30 - 3:00/4:00 pm	have a rest or have a nap in room and/or in yurt to avoid the high temperatures
4:30 - 7:00 pm	work in our base village and/or go to other sites for field work
8:00 - 9:00 pm	supper at base camp; after supper go to black city and stay overnight there except during sand storms/rain storm, in this case we have to stay overnight in base camp
10:00 pm	after supper, perhaps a walk in the ancient city under moonlight, retire

In grassland

6:30 - 7:00 am	rise
7:00 - 8:30 am	breakfast prepared by staff members, read maps, prepare everything
8:30 - 11:30 am	field work
12:00 - 2:30 pm	lunch at home, prepared by staff member
4:00 - 7:00 pm	field work
7:30 - 9:00 pm	supper
10:00 pm	retire, meteorological observations will be continued every two hours

For Team IV

On the way to the desert

6:00 am	rise
6:30 - 7:30 am	take up tents, gathering everything
7:30 - 8:00 am	breakfast, hot tea in Mongolian style
8:00 - 9:00 am	gathering camels by Mongolians; camels are out to feed in very early morning and sometimes on grass far from our camp. During camel loading, we can do nothing but wait. The ground in general is cold for sitting in the morning, sometimes a small inflatable pillow appears useful. It was experienced that it seems best to have a walk in advance of riding.
9:00 am - 7:00 pm	traveling in the desert, on camel in general; do our research work; we will have a picnic lunch in desert; arrive at a new camp site, set up tents, washing with very limited water carried by camels
8:00 - 9:00	supper then retire

At the destination camp

7:00 - 8:30 am	rise; breakfast prepared by staff members, read maps, prepare everything
8:30 - 11:30 am	field work
12:00 - 2:30 pm	lunch at home, prepared by staff member
3:00 - 6:00 pm	field work
7:00 - 9:00 pm	supper
10:00 pm	retire, meteorological observations will be continued every two/three hours

12. TEAM DEVELOPMENT

Meals in the desert and in the Mongolian homes will be prepared by staff members. We will try to prepare meals the volunteers will enjoy.

When the evening in the desert has brilliant moonlight, we will walk together in the ancient cities or along the dunes to experience a feeling of wonderful silence as on a planet other than our own Earth. Sometimes in the evening, we will play the Chinese game, “mahjong” with tiles.

Volunteers who are less physically fit will be well taken care of. They can stay in camp for meteorological observations, etc.

Volunteers are requested to teach English to their Chinese colleagues, and together we will learn some Mongolian.

Every team will be like a family; we will do our “homework” together, including drawing water from wells, cleaning up tableware, loading and unloading luggage, collect firewood on the way of camel trip at the destination camp of Team IV, etc.

13. ACCOMMODATIONS

(a) Sleeping facilities

In grassland: We will stay in tents.

In Gobi area: We will stay in tents or yurts with 5–8 people together. Often, these are within the property of herders or other friends.

In cities and townships: We will stay in local hotels/rural motels with standard room, i.e., two beds in a room.

(b) Bathing facilities

In Mongolian homes including at the destination of Team IV: Enough cold/hot water can be expected for bathing, using a plastic washbasin with upper diameter of about 0.3 m (1 ft) and 0.4 m (1.3 ft) in depth; such new washbasins are prepared for everyone. There is no bathroom in the field site but everywhere you can go behind sand dunes. For face washing, we strongly recommend that all volunteers bring a small plastic folding washbowl for personal use or purchase a plastic one in Ejin Qi (Teams I, II, and III) or Alxa Youqi (Team IV) for about US\$1.

On the way in Desert of Teams IV-V: Only limited water carried by camels is planned, not for bathing unless we encounter springs or wells.

In cities and townships: Showers with hot water are available in city hotels. Hot water is available in motel of townships, but no showering facilities.

(c) Provisions for couples

In Gobi desert: Use one’s own tents, brought by volunteer.

In grassland: Separate room(s) may be arranged (additional cost may be incurred by volunteer.)

In cities and townships: Separate room(s) can be prepared (additional cost may be incurred by volunteer.)

(d) Toilet

Flush toilets are available only in cities. In most places, bathroom facilities consist of pit latrines. There are no toilets in Mongolian homes. Generally, it is preferable to find a private place behind the dunes.

(e) Electricity

In townships, Mongolian homes and in desert: No electricity. Chinese candles are used. It is ideal if volunteers bring a small-sized flashlight/torch. It can be hung for reading in tent/room and is very useful for our supper, which will often be outdoors.

In cities: Electricity is available, but sometimes power failures will happen. The voltage in China is 220 V. Refrigerators are available only in cities.

(f) Conventional sanitation in and around research area

Situation:

No infectious diseases are reported in this area; the general sanitation conditions of townships and cities in this area are not so good; mosquitoes and sometimes the biting midges/mites might make trouble in this season.

Measures: New tableware has been purchased for your use: a teacup, bowl, one set of chopsticks per person, plates, teapots and other cooking utensils. We are cautious about sterilization, but there are no good health guarantees for local products.

14. FOOD

As is the custom expected by the local people, Professor Gu will often eat with dignitaries, guides, and staff. He will rarely sit with the volunteers during meals.

(a) Cooking arrangements

In cities and townships, we will have our meals in restaurants and pubs. We usually do not share meals with Mongolian guides for breakfast and lunch, but sometimes do for dinner. We will, in most cases, share meals with Mongolians when we stay in their homes. In general, during meals, we will separate into two groups with one for Chinese and one for Mongolian. Project staff will be in charge of cooking in Chinese style. We welcome volunteers to make suggestions on the menu and sometimes even make meals in the Western style. We request that volunteers help project staff with cleaning up tableware, getting water from dug wells, and collecting firewood, especially on the way in the Desert and at the destination of Team IV and V. Foods used in the field are purchased in the nearest cities; some special foods will be prepared in Xi'an and/or Yinchuan.

(b) Typical diet

Here is a sampling of the foods you might expect in the field. Please bear in mind that variety depends on availability. This list is intended to provide a general idea of food types. It is very important that volunteers be flexible.

In Gobi Desert and grasslands (Teams I - III), and at the base camp and at the destination camp in Badain Jaran Desert(Teams IV-V)

water: boiled water, green tea, black tea and chrysanthemum tea are always available; it will be put in large containers to stay cool so that everyone can fill up his/her own water containers anytime. It is important for

Teams I-III to have personal containers with total volume never less than 1 liter (0.26 gal) always full, even at night! And, no less than 2 liters for Teams IV and V.

breakfast	hot water, green tea, black tea, milk from milk powder, instant oats or oatmeal, biscuits, hard boiled egg, pancake or steam bread, water melon, etc.
lunch & supper (<i>Teams I-III</i>)	boiled water, tea, bottled beer chilled in the groundwater, Chinese 'beijiu,' dishes (strong liquor if one like at supper), Chinese-style dishes with vegetables (e.g., tomatoes, potatoes, carrots, cabbage, onions, green beans, eggplant, radish, cucumber, black edible fungus, and dried mushrooms), eggs and meats (e.g., packed ham, pork, beef), melon, etc.
supper	(<i>Teams IV-V</i>) Instant beef stew noodles (in case of late arrival at camp site), vegetables (potatoes, carrots, cabbage, onions, green beans, eggplant, etc.); meat (packed ham, pork and beef, canned fish, etc.) in Chinese dishes, Chinese beijiu, or more rice, noodles with soup, sweet biscuits, and hard candy.

On the way in Badain Jaran Desert (*Teams IV-V only*)
ert (*Teams IV-V only*)
only)

water	every morning we will prepare boiled water for a one day supply. Everybody must have all their water containers filled up; we will not boil water after breakfast because all the cooking utensils have to be packed for camel loading in morning.
breakfast	hot water, Mongolian brick tea, milk by milk powder, instant oat cereal or oatmeal, instant noodles, Mongolian dry ready food, apple, and dried raisins.
lunch	for picnic lunch on the way in the Desert, we will have water or tea, sausage, apples, peanuts, dried fruits, biscuits, Chinese type sweet pancakes, etc. It will be distributed during breakfast time, 'ziploc' bags are so suggested for this purpose.
supper	Instant beef stew noodles (in case of late arrival at camp site), vegetables (e.g., tomatoes, potatoes, carrots, cabbage, onions, green beans, eggplant, radish, cucumber, black edible fungus, dried mushrooms, etc.); meat (packed ham, pork and beef, canned fish, etc.) in Chinese dishes; Chinese strong liquor, or more, rice, noodles with soup, sweet biscuits, hard candy.

At the destination site in Badain Jaran Desert (*Teams IV-V only*) Water, breakfast, lunch & supper will as same as that for Teams I-III as mentioned above except no eggs.

In cities We will have our meals at a local Chinese restaurant.

water	boiled water will be brought to your hotel room in a thermos
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breakfast	tea, soy bean milk, fresh milk if any, rice porridge, pancake, dumplings stuffed with pork/red bean paste, deep-fried twisted dough sticks, eggs, salted vegetables, fruits, etc.
lunch	beer, soup, rice, noodles with soup or fried, various Chinese dishes in different cooking styles with bean curd, chicken, pork, beef, fish, etc.
supper	Beer or strong Chinese liquor and dessert in addition to lunch meals.

In townships

We will have meals similar to that in cities without certain foods that are not available in townships.

(c) Special diets

We can try to accommodate special diets according to volunteers' habits and customs, but we should be notified of any special dietary requirements in advance. We will pay special attention to special diets for volunteers who suffer from diabetes, hypertension, heart trouble, gastric ulcer, etc. It would be very difficult to provide kosher or halal meals. Vegetarians or vegans will find it difficult to avoid animal products.

15. PHYSICAL CONDITIONING

Please show this section to your physician when he/she is completing your health statement.

To the examining physician:

Your patient has volunteered to join the field research team which has specific physical demands of which you and your patient should be aware. **We need your accurate evaluation of your patient's ability to meet the conditions detailed below in order to safeguard his/her health and safety, and ensure that s/he can participate fully and effectively.**

Overview

The expedition demands bravery! Brave the serious environment including the arid weather in order to explore the secrets, probe into the essence of desertification and degeneration of this area, and contribute to earth science research. On the other hand, we will do our best to minimize the difficulties or discomforts to volunteers.

Hepatitis A may be present. No cases of AIDS have been reported. No poisonous weeds or insects or harmful animals are in this area, in general there are no snakes but sometimes they are in small swamps distributed in grassland and near the lakes. However, Chinese dogs might have rabies as they are not vaccinated against it.

Health hazards that might be encountered are as follows:

- Losing one's way in the desert, very dangerous!
- Being bitten by Chinese dogs, very dangerous!
- Falling from the back of camel, very uncomfortable!

- Catching cold due to the highly changeable weather, happened frequently.
- Catching an illness due to contaminated foods and “cold drinks” purchased on the street. In this remote area, most such “cold drinks” are made with unclean tap water. The foods on the street are not guaranteed even in Xi’an, and volunteers have suffered from diarrhea several times.
- Volunteers should be wary of food and beverages purchased on the way to field site, because you don’t know where such kind of food comes from. Foods from staff should be guaranteed.
- Heat-related illnesses; dehydration; cold-related illnesses.

The ways to deal with the above situations are as follows:

- Never take walks in the desert by yourself, especially in the evening (even though the moonlight seems so attractive). Volunteers are requested to inform other people when they want to have a walk in the desert and must learn the correct procedures to follow if they get lost. If people become lost, stop and if possible blow your whistle and/or make a fire. Wait until someone finds you, rather than keep guessing which is the correct direction.
- Stay away from dogs in China (there are no dogs in camping sites of all teams but there are few dogs in cities and in Mongolian village). Dogs are not vaccinated against rabies in this area. Most dogs are kept on leashes; however, volunteers must refrain from approaching or surprising them.
- When riding camels, we should keep in a group of 4 to 5 camels connected to each other and led by a Mongolian guide. Never lead a camel by yourself! It seems best not to carry hard things on your shoulder (eg, hard water bottle). And, kindly follow the directions on how to handle the particular temper of a camel.
- People should bring enough clothes (layering is best) to keep warm. The temperature can suddenly drop down to 12.5°C (54.5°F) in July, 5°C (41°F) in September or less at night or during rain storms, March 0°C (32°F) or lower in October . The temperature in day time is high, up to 40°C (104°F) or more in July, August, 30°C (86°F) could be more even in September of Team IV. For the camel teams please remember the Chinese saying that “cotton cloth in the morning but gauze in the noon.”
- As mentioned above, our tableware is kept separate, and food and cooking are prepared by us. Our water and food sources are kept clean. We always use boiled water for drinking because even bottled water is not guaranteed in this remote area. Volunteers should never eat ice or drink water from unknown sources.

General Conditions

Humidity	10%	to	60%
Temperature Range:	July: 43.4°C/110°F	to	12.5°C/54.5°F
	August: 41.2°C/106°F		12.9°C/55.2°F
	September : 34.6°C/94°F		5.0°C/41.0°F
	October: 25°C/77°F		-5°C/23°F
Altitude	980 m/3,200 ft	to	1300 m/4,300 ft
Rainfall	50 mm/2 in	per	year
			2 hours in the

sometimes 12 mm per sand sea

Climate and terrain of the research site

Intermittent, brief rain showers are possible, during which the temperature can drop quickly. The temperatures for Teams I-II can reach 43.4°C/110°F and that of Team III to 41.2°C/106°F, though we will stay inside during the hottest part of the day. During observation and sampling, people have to take precautions to minimize sunburn (sunscreen, long sleeved shirts, hats, light-colored clothing). However, it is important to note that at the lowermost temperatures at night, some people have caught colds easily. Teams IV-V will be much cooler than the first three teams (see data shown above), so bringing sufficient clothing and warm sleeping gear is very important.

Physical Demands

	Workload/Intensity	Time (hours per day)/#of days per team
Sitting	Traveling to and from field sites on jeeps/bus and on camel with distance as mentioned above	<p><i>For Teams I, II and III:</i> up to 12 hours a day in jeep/bus for 4 days in total per team</p> <p><i>For Teams IV-V:</i> 6 to 8 hours per day on the back of a camel for 6 days in total; up to 12 hours a day on a bus for 4 days total</p>
Walking	<p><i>For Teams I, II, III:</i> 1 to 2 miles per day of several days</p> <p><i>For Teams IV-V:</i> 1 to 2 miles per day of several days special tour once for energetic people up to 10 miles</p>	<p><i>For Teams I, II, III:</i> 1 to 2 hours</p> <p><i>For Teams IV-V:</i> 1 to 2 hours</p>
Carrying	0 to several pounds (personal items)	
Climbing	<i>For Teams IV-V:</i> Mostly on camel, sometimes climbing up to 30 to 60 ft/9 to 18 m slope	Few days with 1 to 2 hours

Medical Conditions of Special Concern

The environment is hot and dry with very high exposure to sun with little cover. Any condition or medication that decreases heat tolerance, increases sun-sensitivity, affects water retention, or blood flow to extremities should be carefully considered with a physician’s advice (this may include those taking common medication like oral antibiotics, diuretics, and tetracyclines). If you have diabetes and do not have previous experience of how physical exertion in a hot climate with a new diet will affect your level of control, please consult a physician. The roads are rough and those with back problems may find this difficult, although manageable.

There will be a very high amount of dust in the air. Those with any respiratory challenges or allergies to dust should be prepared for this and consult with a physician. In addition to acting as a lung irritant, the dust will also irritate eyes and is especially problematic if you wear contact lenses.

“Yurts” and many other items are made from camel hair, wool, and hides. This may pose a challenge to those with allergies. Come prepared to minimize your discomfort if you react to these materials.

Volunteers on Teams IV-V will climb steep dunes. Sand dunes provide little resistance, like beach sand, and can pose a challenge to those with physical limitation. If you have any difficulty walking unassisted, you should consider joining Teams I-III instead of Teams IV-V. Camels are temperamental and occasionally nasty; they spit and occasionally nip.

Potential Hazards

- The environment alone places one at risk of sunburn, dehydration, heat exhaustion and heat stroke. Additional hazards include, but are not limited to: catching cold due to changeable weather in the desert, injury from a fall from a camel’s back, and bumping or jostling in vehicles on rough roads. Sandstorms are known to occur and can cause eye irritation and harm. Water quality throughout the region is not safe and you may only drink from sources identified by the PI or bottled water.
- If you approach stray dogs, you place yourself at risk being bitten and acquiring rabies. Stomach upset and intestinal distress are common among those that travel to this region and may increase your risks of heat-related illnesses.
- Respiratory or eye irritation from dust. Contact lens wearers are at risk of corneal ulcers, so eye glasses are recommended. For all teams, it could take at least 8 hours for assistance to arrive.
- Low water consumption can place one at risk of dehydration. In combination with poor sanitary conditions, one may be at risk for urinary infections (you are advised to come prepared to deal with these.)

Proximity to medical care

Teams I, II and III: A hospital is available in Ejin. The distance from field to Ejin is about 30 km (19 mi) in Gobi and 250 km/155 mi in Guai-Zi. There is a small clinic in Guai-Zi.

A good military hospital could be requested by the Ejin Government under serious situations, and we will maintain close ties with the government while we are in the field.

Teams IV-V: The only hospital is in Alxa Youqi. First aid will be available for minor emergencies. Serious emergencies will be difficult to deal with. The nearest hospital will be approximately 80 km/50 mi away (8 hours).

Is there a physician, nurse, or EMT on staff? No

Staff certified in CPR (Cardiopulmonary Resuscitation), First Aid, or other safety training (i.e. Wilderness First Response, Water Safety, etc.)?

The PI knows traditional Chinese herbal medicine. During the black Mao-time he became a peasant of a very poor area without a physician, he tried to learn to help people there from diseases using herbs. Neither he nor the field staff have standard western first aid training.

What is nearest hospital location?

for Teams I, II and III: hospital is available in Ejin, the distance from field to Ejin is about 30 km/19 mi in Gobi and 250 km/155 mi in Guai-Zi. There is a small clinic in Guai-Zi.

for Teams IV-V: the only hospital is in Alxa Youqi. The nearest hospital will be approximately 80 km/50 mi away.

Time to reach?

for Teams I, II and III: 2 hours from Gobi near Black City, 8 hours from Guai-Zi.

for Teams IV-V: 8 hours

16. MEDICAL ADVICE

Inoculations

The following are recommendations only. Health conditions around the world are constantly changing, so keep informed and consult your local travel health clinic, the U. S. Center for Disease Control (www.cdc.gov) or the World Health Organization (www.who.org) websites. Medical decisions are the responsibility of each volunteer. Please consult your physician, your local Public Health Department, or the resources listed below for the latest health information for travelers.

	Required for Entry	Recommended for Health Reasons
Polio		
Tetanus		X
Typhoid		
Yellow Fever		
Hepatitis A		X

Is Malaria present at the research site? No

Tuberculosis (TB): The World Health Organization (WHO) estimates that one third of the world's population is infected with the bacterium (*M.tuberculosis*) that causes tuberculosis (TB). Incidence of tuberculosis is higher in developing countries, particularly in Asia, Africa, the Caribbean and Latin America. In general, approximately 10% of persons infected with *M. tuberculosis* are at risk for developing active TB during their lifetimes. TB is considered highly treatable with medications that are of relatively low toxicity and cost. Volunteers returning from developing countries are encouraged to have a (PPD)-tuberculin skin-test to screen for potential infection.

These recommendations are for this project site only. Please consult your physician for guidance on inoculations if you intend to travel to other parts of the country.

Resources

Earthwatch recommends that you consult your local public health department or one of the following resources for the latest health information for travelers.

US ONLY

Centers for Disease Control
Atlanta, GA, U.S.A.
Phone: 800 311-3435 or 888 232-3228
Website: <http://www.cdc.gov>

UK ONLY

Hospital for Tropical Diseases Healthline
Phone: 0906 1 337733 (within UK)
(calls are charged at 50p per minute)

MASTA Travelers' Healthline
Phone: 0906 8 224100 (within UK)

AUSTRALIA ONLY

The Travel Doctor – clinics Australia wide
Travel Doctor Hotline: 1300 658 844 (within AU)
Website: <http://www.tmvc.com.au>

GENERAL INFORMATION

Disease Outbreaks:
<http://www.who.int/disease-outbreak-news/>
or
<http://www.istm.org/news.html>

17. EMERGENCIES IN THE FIELD

For Teams I-III, we have always a vehicle stay with us in the Gobi and in the grasslands. Minor injuries can be treated in the field, major ones will be sent to hospital of Ejin. If any life-threatening injury occurs which can't be treated by the hospital, we can contact the local government via our staff member (who himself is a Section Head of the government). They will ask a military hospital with better equipment and physicians near there for help. They even can use their special airport to send patient by air to e.g., Beijing.

For Team IV, only camels can be used unless we are near the base camp. In the dune desert, one has to very careful not to catch cold and to be sure to drink/eat only safe water/foods. In fact, once we get into the hinterland with highest megadune, we and the Mongolians are fated to be in same boat to help each other.

Emergency contact number at Earthwatch headquarters in the U.S.: +1 978 461-0081.

After business hours, leave your message with our answering service. State that you have an emergency communication and leave a clear message with the name of the expedition, your name, location you are calling from, and if possible, a phone number where you can be reached. An Earthwatch staff person will be paged and will respond to your call.

International Evacuation Insurance

UNITED STATES OFFICE:

The travel medical and evacuation insurance, coordinated by ISIS Assistance, is mandatory for all Earthwatch volunteers while they are on an Earthwatch expedition anywhere in the world. The insurance covers volunteer travel medical risk, including medical expenses and medical evacuation, while you are traveling with Earthwatch overseas or on an expedition within your home country. ISIS Assistance will also facilitate evacuation from the project site in the event of an emergency. Without insurance, the costs of such measures can be on the order of US\$20,000 to \$50,000.

A detailed description of the Earthwatch Volunteer Travel Medical Insurance Program policy will be sent with this briefing. The policy is summarized in a user-friendly questions answer format. Please contact your Expedition Coordinator if you have further questions.

Earthwatch Institute's insurance provider, ISIS Assistance, provides a 24-hour emergency hotline for the use of insured persons under the Earthwatch program. ISIS Assistance can help with medical emergencies, doctor and hospital selection, obtaining additional medical options, or medical translation problems. ISIS Assistance is backed by International SOS and Global Medical Management, who provide emergency medical evacuation and rescue services. The Earthwatch policy certificate number is US 011300. In addition, each individual policy is identified by the volunteer's Earthwatch ID number, shown above your name on your team list.

In an emergency - If you are calling from **outside of the US**, the number to call is: +44 (20) 8762 8015. You may call this number collect.

In an emergency - If you are calling from **inside the US**, the toll-free number to call is: 888 422-4747.

Basic coverage is valid in the country of your Earthwatch expedition, and during international travel to and from your expedition. For volunteers on Earthwatch expeditions in their own country, coverage begins when your group forms for the expedition, and ends when the group disbands. Options are available for volunteers who would like to extend the period of coverage, increase insurance amounts or purchase additional cancellation or baggage insurance.

EUROPEAN OFFICE:

Earthwatch Europe offers travel and medical insurance provided by Royal & SunAlliance. In the event of medical assistance or an evacuation being necessary, ISIS Assistance will be notified. ISIS Assistance will coordinate the evacuation in conjunction with International SOS.

FOR ALL OTHER VOLUNTEERS:

In addition, our affiliate offices in the Australia and Japan have recommendations for their volunteers. Please contact your nearest Earthwatch office for more information. You may also try the following website which lists several travel insurance providers. Click on the "Travel

Insurance" link, which is located on the right in a box called "Healthy Travel Store" (just under the Visa sign). Website: <http://www.travelhealth.com/home/>

18. WHAT TO BRING

General Considerations

Limitations for baggage

In general, do not bring more luggage than necessary in the field than you can carry and handle on your own. However, Gu and his assistants of course are ready do their best to help elder/younger volunteers.

- **For Team I-III**, there is no formal limit for baggage, but you will need to personally carry what you bring.
- **For Teams IV-V**, baggage should be as minimal as possible since everything must be carried by camel and handled often, on the way (about 6 days) within the Badain Jaran Desert, you have to pack up everything in early morning every day. All baggage should be sturdy, yet soft enough to be bound tightly with rope onto the backs of camels. If it is necessary to bring crushable items, they should be well padded in the interior of your baggage or protected by a hard plastic box (e.g. pelican box) however this will limit your available space.

Gear and Clothing Guidance - All Teams

On a general note, clothing and sleeping bags will need to accommodate wide variations in temperature encountered in the desert. There are rarely clouds to keep it warm at night and temperatures can plunge. Three-season sleeping bags rated to 0°C/ 30°F will be adequate, though for Teams IV-V, an overbag or a four-season bag rated to -10°C/20°F would be better. Your tent need only be of a three-season design and you need to be familiar with how to put it up and guy it out in strong winds (ask for advice if unsure from the store where you bought it). Extra guy ropes to secure your tent in case of high winds is also important, as are extra tent metal pegs or sand hogs.

Layering your clothing will be best. A base layer of a sweat-wicking material or merino wool is a good all-round choice. Synthetic "fleece", down or primaloft jackets* or sweaters and leggings are highly compressible and well worth their weight. Gloves and a winter hat are likely to be needed by Teams IV-V at night. A "bug-shirt" with a hood or at least a gauze mosquito head net is also a must against the midges you'll likely encounter at base camp. While some additional clothing can be obtained locally, selection, materials and sizes are likely to be limited, particularly of larger sizes.

Since personal hygiene is a challenge due to limited water supplies, carrying sufficient underclothes and socks is as important as outerwear. "Moist" towelettes or baby wipes are handy for between wash-basin-bath hygiene. Women should pack a compression-type sports bra in anticipation of the long jeep (Teams I, II, and III) or camel (Team IV, V) rides. Women should come prepared with all personal feminine products as such items will be impossible to locate in the field.

Cultural Considerations – All Teams

In fact we will meet only a few nomadic Mongolians during the expeditions; we will stay in Mongolian homes for Teams I-III and we will have about 5 Mongolian camel drivers with us during the 2 week expedition of Teams IV-V. During our field work we will visit several Mongolian families. No special cultural considerations are needed except some Mongolian customs. Mongolians are friendly and enjoy entertainment of foreign and American guests, especially in their own home; they will feel unhappy if you don't visit their house when you are invited. While in their yurt it seems best to wait for words from your host/hostess before taking a seat, in general the center part and/or somewhere with shrine in the yurt is not the place for sitting. If you can say a few Mongolian words to your host/hostess [e.g., hello! (*sain bainuu!*), thank you! (*tand bayarlaa!*)] he/she will be very happy. No problem if it is impossible for you to drink so much as the host/hostess invites but you have to have take even a drop before a polite and clever refuse. Please avoid anything with a picture of Genghis Khan on it. His picture should be respected as like the Mongolian God. Be careful though, as in any location there are a few bad persons who cheat.

Water – All Teams

Expect to drink at least 4-6 liters of water a day. Start preparing by increasing water intake a couple of days before entering the desert and, once there, remember to "drink little, lots." It is better to drink small amounts of water constantly than to drink to excess only when thirsty. Flexible water bladders are more convenient and can be carried in hydration packs or in camel saddle bags available locally. Hard water bottles, such as Nalgene, hurt if you fall on them. Also, remember to prepare water for the following day before going to bed otherwise it will remain hot for most of the day after having been boiled at breakfast and won't be thirst-quenching."

We have enough water for drinking with quality guaranteed, however the following items must draw your attention:

- (a) the best drinking water is the boiled water
- (b) never get bottled water from street, railway station, tourist sites but from big shops/supermarkets only
- (c) prepare water containers with enough volume for your own use, keep it full anytime even in the night

For Teams I-III:

Plastic containers are OK, but it seems better to have 2 containers with about 500 ml (about 1 pint) each and another one with about 1 liter (1 and 3/4 pints) for your own use. In the field we will prepare enough boiled water for your use, enough quantity at anytime.

For Teams IV and V:

Flexible water bladders carrying on your back with plastic feeding pipe are more convenient for drinking anytime while you are on camel back, it may have about 5 litres (about 4 quarts or 1.3 gallons) or more in volume even it is not necessary to full fill it everyday. Never have hard water bottles, such as Nalgene, carrying on your back during riding on camel. We will have enough drinking water at base camp, at the destination but we are limited on the way to the destination but will be guaranteed for drinking. Every morning on the way riding camel, boiled water will be prepared for your container. You need 2 to 3 litres per day. During your stay at our destination, somebody will go to other lakes by walking. In this case more water is necessary. Expect to drink 4 - 6 liters of water a day by walking. Remember to "drink little, lots." It is better to drink small amounts of water constantly than to drink to excess only when thirsty. Also, remember to

prepare water for the following day before going to bed otherwise it will remain hot for most of the day after having been boiled at breakfast and won't be thirst-quenching.

The Project Provides the Following Supplies for Volunteers

- Camp stove and cooking pots
- A new, unused set of chop-sticks for each person when they arrive

Teams I, II and III

Extreme weather

The weather could be very hot during the day for Teams I and II, a bit more comfortable during Team III. But for all these teams, solar radiation is strong/very strong due to the clean and dry air mass.

- The sun is intense and unrelenting. Bring high SPF sunscreen and a wide brim hat.
- Bring several additional warm layers to compensate for cool evenings or just before sandstorms.

Bedding and Bathing – Teams I, II, III

- A **folding vinyl washbasin** for washing your self. In the field for all teams, a clean plastic bucket is prepared for everyone to shower behind the sand dune but it seems poor for face washing. Detergent and soap can be bought in Ejin/Alxa Zyoqi or, you can ask staff workers to help for laundry. You may also purchase a small plastic washbasin in Alxa with costs of about US\$50.
- A **sturdy three-season tent**. Most teams have experienced sandstorms or rainstorms in the Gobi Desert that caused the destruction of some of the tents. Tents must be roped with ropes fixed tautly. There are special plastic stakes that are recommended for affixing a tent in sand called “sand hogs,” or you can use rigid metal bars that are longer and thicker. Extra guy ropes to secure your tent in case of high winds is also important. You need to be familiar with how to put it up and guy it out in strong winds (ask for advice from the store where you bought it if unsure).
- **Sleeping bags** will need to accommodate wide variations in temperatures encountered in the desert. There are rarely clouds to keep it warm at night and temperatures can plunge. Three-season sleeping bags rated to 0°C/30°F will be adequate for Teams I, II and III.
- **Sleeping bag pad**
- **Sleeping bag cover sack** (if you will use a down bag)

Clothing and Footwear for Fieldwork – Teams I, II, III

- Warm, packable jacket/jumper for cooler nights. Temperature are variable [43.4°C(110°F in 2001) to 12.5°C (54.5°F, midnight, in 2001) for July; 41.2°C(106°F in 2001) to 12.9°C (55.2°F, midnight, in 2001) for August]
- Packable rain jacket
- Any simple, light, comfortable style is okay in the Gobi area. You can buy shoes in Ejin made by cloth commonly used by Mongolians; it costs about US\$1.5 USD. Boots are not necessary.

Teams IV and V

Extreme weather

For Teams IV and V: There are three problems that we have experienced due to special areas in the dune desert.

(a) In the dune desert, the weather is most changeable. There is a Chinese saying about *Eating water melon with a stove in arms for warm*. It is common in the dune desert for the air temperature to turn cold in the evenings even if it is hot during the day. In our case even in the later half of September (autumn) temperatures had been known to reach up to about 40°C (104°F) while in the evening it may down to as low as 5°C (41°F). For Team V in October, at night time the air temperature may drop to -5°C (23°F) even in the noon time it may raise to about 25°C (77°F). You may wish to bring a sleeping bag liner and warm, packable jacket to compensate for temperature shifts.

(b) The solar radiation is still very strong during expedition time, more serious than Teams I-III and one has to ride on the camel with many hours exposure continuously within several days. But, when you ride on the camel the wind is always blowing which is in general cold. So, you must protect yourself from the sun and wind.

(c) During 2003, we met two rainstorms during Team IV. Tents were broken, sleeping bags and covers were soaked, foods were covered with sand and things were blown away.

Bedding and Bathing – Teams IV and V

- A **folding vinyl washbasin** for washing yourself. In the field for all teams, a clean plastic bucket is prepared for everyone to shower behind the sand dune but it seems poor for face washing. Detergent and soap can be bought in Ejin/Alxa Zyoqi or, you can ask staff workers to help for laundry. You may also purchase a small plastic washbasin in Alxa with costs of about US\$50.
- A **sturdy three-season tent**. Most teams have experienced sandstorms or rainstorms in the Gobi Desert that caused the destruction of some of the tents. Tents must be roped with ropes fixed tautly. There are special plastic stakes that are recommended for affixing a tent in sand called “sand hogs,” or you can use rigid metal bars that are longer and thicker. Extra guy ropes to secure your tent in case of high winds is also important. You need to be familiar with how to put it up and guy it out in strong winds (ask for advice from the store where you bought it if unsure).
- **Sleeping bags** will need to accommodate wide variations in temperatures encountered in the desert. There are rarely clouds to keep it warm at night and temperatures can plunge. For Teams IV-V a four-season bag rated to -10°C/20°F or a lesser rated bag with an overbag. You can purchase a military green cover in Alxa Youqi for about US\$6 or, a military green cotton overcoat for cover and cloth with costs about US\$14.
- **Sleeping bag pad**
- **Waterproof Sleeping bag cover sack** (if you will use a down bag)

Clothing/Footwear for Fieldwork – Teams IV and V

- Warm winter jacket or sweater/jumper using synthetics (fleece) or wool. Bringing several layers is preferable to bringing one thick jacket. Temperatures are variable.

[34.6°C (94°F in 2000) to 5.0°C (41.0°F, midnight, in 1997) for September; 25°C (estimated) to - 5.0°C (midnight, estimated) for October]

- Warm, packable hat
- Gloves (lightweight, synthetic)
- Socks appropriate for the variable weather
- Sneakers or light boots will be okay if they are warm enough while you are on the back of camel.

Additional Gear for All Teams

Clothing and Footwear for Fieldwork – All Teams

- Lightweight, loose-fitting clothes made of natural materials covering the body are the most breathable. Synthetic materials are best for sun protection, while natural fibers may be more breathable.
- Short pants/trousers.
- Long-sleeved shirt(s) to minimize sun exposure.
- Lightweight shirts.

Field Supplies – All Teams

- Water holder – we STRONGLY recommend that you bring two water bladders with a drinking tube (like those used by bicyclists) that will carry 4-6 L of water. Do NOT bring plastic bottles. Plastic bottles are likely to break if they or cause harm to you, if you fall off.
- Small, highly absorbent towel for personal use
- Sunglasses with retaining strap
- Hat with wide brim for sun protection
- Bandanna: good for sun protection, filtering dusty air, towel, pot holders, flag, etc.
- Whistle - For safety reasons, it is required to bring a *loud, safety* whistle with a string attached. For Team I-III, we request you carry this on while in the dune desert. For Teams IV-V, carry it at all times in the field even at the base camp. Please kindly never treat it lightly, it was experienced many times to get lost even at the base camp; there was a joke then, instead of a whistle, bring a ball of string while go to “toilet” behind sand dune in the night but hold one end in tent.
- Socks appropriate for the variable weather
- Underwear/compression-sports bra (synthetic fabrics; avoid cotton) – opportunities to wash these may be limited at times, so bring sufficient quantities

Personal Supplies – All Teams

- Plenty of Sunscreen lotion with SPF 30 or higher, lip balm with high SPF
- Insect repellent
- Several packs of pocket packed wet tissues for sterilization (toilet paper can be purchased in Xi’an, Yinchuan, Jiaquan, Ejin, Alxa Zuoqi).
- Personal cup (you can buy it in Ejin/Alxa Zuoqi)
- A flashlight or headlamp with extra batteries. Headlamps are particularly useful for setting-up camp at night.
- A small daypack for field use. For camel teams it is best to have two such bags connected to fit on the camel back, so you will have nothing with you except a soft plastic water bag on your shoulder while you are riding on the camel.
- Several Ziploc bags, especially for Teams IV-V. It will be used for different kinds of picnic foods that are distributed every morning

- Personal first aid kit (anti-diarrhea pills, antibiotics, antiseptic, itch-relief, pain reliever, bandages, moleskin, etc.). In addition, intestinal distress is not uncommon. You may wish to speak to your doctor about a prescription for a wide spectrum antibiotic in case this happens in the field. Please Note: All medications (non-prescription, health supplements, vitamins, and prescription) are best transported in their original packaging. For prescriptions, you should have a signed letter from your doctor. You will not be able to acquire these items easily, so come prepared.
- Footcare – blister care pads and foot fungus treatment may be necessary
- Contact lens with spare pair and all items for sanitation. However, with the high amount of sand, wearing contact lenses places one at great risk of eye injury. Eye glasses are more suitable for this environment. If you elect to wear contacts, bring highly protective eyewear (wrap-around, close fitting sun glasses or “glacier” type goggles)
- Women should come prepared with all personal feminine products, as such items will be impossible to locate in the field

Recommended – All Teams

- A small, packable candle lantern.
- A battery operated travel alarm clock
- A calculator
- A “Swiss Army Knife” or other multi-tool (pack this in your checked luggage when traveling through the airports).
- Multi-vitamin tablets; Tang, Gatorade or other powdered drink powder to make the water taste better.
- Ear plugs
- It is customary to give small gifts to the Mongolian hosts (Teams I-III) and guides (Teams IV-V) and, other Chinese people that served you while along the way. The PI will prepare most of these according to Mongolian custom, but it would be appreciated if the volunteers brought some items from their homelands to show your friendship and sometimes to express thanks for their help. Chinese and Mongolians both enjoy T-shirts with foreign words/pictures on it, also any foreign articles of daily, inexpensive items, (e.g., cigarette, cigarette-lighter, handkerchiefs, simple toys for children, inexpensive jewelry, knife, etc.). These should be presented as a personal item of yours that you are giving to them, not as a special item you bought for them.

19. HELPFUL RESOURCES

- Useful Visa Information website: <http://www.embassyworld.com>
- Airport Codes Worldwide: <http://www.logisticsworld.com/airports.asp>
- Lonely Planet travel guidebooks and online travel site: <http://www.lonelyplanet.com>. Their guidebooks can be purchased from their website.
- The Rough Guide travel guidebooks and online travel site: <http://travel.roughguides.com/>
- Cheap Flights: <http://www.travelix.com/> or <http://www.discountair.com/> (worldwide)

- Country Reports. Country information from around the world. Website: <http://www.countryreports.org>
- National Geographic Map Machine. Website: <http://plasma.nationalgeographic.com/mapmachine>
- U.S. Travel Clinic Directory: <http://www.astmh.org/scripts/clinindex.asp>
- Travel Health website: <http://www.mdtravelhealth.com> is a resource for healthy travel. Covers country-specific risks and diseases, suggested immunizations, and health recommendation, and locating a travel clinic near you.
- U.S. State Department: <http://www.state.gov/>
- UK Foreign Office travel advice: <http://www.fco.gov.uk/travel>
- World Time Server: <http://www.worldtimeserver.com/> [time worldwide with GMT/UTC] or <http://worldbuddy.com/> or <http://www.hilink.com.au/times/>
- Currency Converter: <http://www.xe.com/ucc/>
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- Online Unit Conversions: <http://www.onlineconversion.com/>
- Worldwide Weather: <http://www.worldweather.com/> or <http://www.wunderground.com>
- ATM Locator: http://visaatm.infonow.net/bin/findNow?CLIENT_ID=VISA
<http://www.mastercard.com/atmlocator/index.jsp>
- Heat Index (temperature, dewpoint and relative humidity): <http://www.weatherimages.org/data/heatindex.html>
- Exhaustive List of Weather Resources: <http://cirrus.sprl.umich.edu/wxnet/servers.html>
- Third World Traveler – offers many links for useful travel information: http://www.thirdworldtraveler.com/Travel/Travel_Links.html

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