

PLANT GERMPLASM COLLECTION REPORT
USDA-ARS
FORAGE AND RANGE RESEARCH LABORATORY
LOGAN, UTAH

Foreign Travel to:
Mongolia (with additional travel in China)
August 21 - September 22, 1998

Title: Germplasm Collection in the Hovsgol and Hentii Mountain Regions of Mongolia to Collect Cool-Season Grass and Legume Germplasm for Crop Improvement

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Objectives: The objective of our trip was to make joint seed collections of important forage grass, legume, and forb germplasm in northern Mongolia for improving deteriorated rangelands in the western U.S. and Mongolia.

Accomplishments: Our 1998 plant exploration trip to Mongolia was jointly conducted with scientists from the Research Institute of Animal Husbandry in Ulaanbaatar. Two collection teams (four Mongolians and three Americans on each team) traveled to the Hovsgol and Hentii Mountain Regions of northern Mongolia. Because of their isolation, the Hovsgol and Hentii Mountain regions of northern Mongolia have a unique flora that is unlike other regions of Mongolia. One team focused its efforts mainly in the western Hentii Mountains and Hovsgol areas, while the other team concentrated on the central and eastern Hentii Mountains. The two teams traveled about 5,000 km (3,000 miles) and made a total of 574 collections, which represented 132 genera and 253 species. The rangelands of Mongolia are some of the most diverse and productive of any rangelands in the world. The collected seed was shared equally with the Mongolians, and the U.S. portion was brought back to the U.S.

and processed according to quarantine regulations. The seed was cleaned and cataloged at Logan, UT. The cleaned seed and accompanying passport data were sent to the particular curator or to the Regional Plant Introduction Station at Pullman, WA for entry into the National Plant Germplasm System where the seed will be made available to scientists in the U.S. and throughout the world. The most promising forage germplasm accessions will be used in ongoing forage breeding and selection programs at Logan and other locations to provide improved forage species for western U.S. rangelands.

General Information on Mongolia

Mongolia is a climatic analog of the Intermountain, Northern Rocky Mountain, and Great Plains Regions of the western U.S.A. Variations in temperature and precipitation in Mongolia create seasonally harsh conditions. Winters are generally long, cold, and dry, whereas the spring season is cold, dry, and windy. Most of the precipitation in Mongolia is received between mid-June and the end of August. Extended drought periods and winter snow storms are common features in the Mongolian environment. These dry and temperate climatic conditions have favored the development of extensive grass and shrub steppe grazing lands.

The topography of Mongolia is also similar to that in the western U.S. Mongolia has deserts, high mountains, saline soils and lakes, fertile valleys, forests, and vast expanses of steppe. These lands have supported grazing animals for thousands of years, cover an area of 1.26 million km², and have the capacity to support large numbers of grazing animals. These natural pastures are grazed yearlong by pastoral livestock and wild herbivores. Higher-yielding natural pastures are harvested as hay for winter supplemental feed. Mongolian grasses and legumes evolved under sustained grazing pressure and are well adapted to grazing.

Because of their adaptation to grazing and the climatic and topographic similarities between Mongolia and western North America, many of the grasses and legumes found in Mongolia hold potential for use as valuable forage species in pastures and rangelands of the Intermountain, Northern Rocky Mountain, and Northern Great Plains Regions of the western United States. However, germplasm from northern Mongolia is poorly represented in the current collections of the National Plant Germplasm System in the U.S. In addition, because of changing economic and social conditions in Mongolia, these unique rangeland areas could be threatened by intensive agricultural development and overgrazing. As a result, it is important that this unique forage grass and legume germplasm be collected while the natural grazing lands in northern Mongolia remain in relatively high ecological condition.

Mongolia has six major vegetation zones, each having different topography, elevation, temperature, rainfall distribution, soils, and vegetation. Mongolia's major vegetation zones and the percentages of land area occupied by each are: alpine tundra (4.5%), mountain

taiga (3.8%), mountain steppe and forest (23.3%), grass steppe (25.9%), desert steppe (21.5%), and desert (15.4%).

High mountain grazing land (alpine tundra) has an annual standing crop yield (dry weight) that ranges between 100 to 850 kg/ha. Lichen grazing land at the highest altitude is used for summer grazing of reindeer. Lichen-*Carex* grazing land is used for summer grazing of yak. *Caligonum* shrub and *Kobresia* meadows are used for summer and autumn grazing of yak and cattle. Alpine shrub and meadow grazing land is used for summer and autumn grazing of yak and cattle; swamp grazing land is used for summer grazing of cattle. *Poa* grazing land is used yearlong by all livestock.

Forest steppe, swamp steppe, and grass steppe grazing land predominate in Mongolia and exhibit the highest forage yields. Forest grazing land has annual standing crop yields ranging from 400 to 600 kg/ha. *Betula-Pinus* forest, *Larix* forest, and *Betula-Populus* forest grazing lands are used primarily for summer grazing by horses, cattle, and large wild herbivores. Forest with an extensive shrub understory is grazed during the summer by all livestock except camels. Swamp steppe grazing land is dominated by grasses (*Koeleria*, *Carex*, *Poa*, *Agropyron*, and *Puccinellia*) and *Carex* species in association with forbs, and have annual standing crop yields ranging from 180 to 800 kg/ha. Swamp steppe grazing land is used yearlong and is generally most suited for horses and cattle.

Forest and grass steppe regions have the highest number of livestock and have annual standing crop yields ranging from 250 to 800 kg/ha. These regions are dominated by grasses including *Cleistogenes*, *Stipa*, *Aneurolepidium*, *Elytrigia*, *Festuca*, *Helictotrichon*, and *Koeleria*; various *Carex* species; and forbs including *Artemisia*, *Filifolium*, and *Allium*. The shrub *Caragana* is often present in the community as a co-dominant. Plant morphological characteristics such as awns on *Stipa* species may limit use of some grazing land by livestock to certain seasons. Most forest steppe and grass steppe grazing land is grazed yearlong by all livestock except camels. Red deer is the major wild herbivore grazing in forest steppe areas, while gazelles are the most common wild herbivore grazers in grass steppe areas.

Desert steppe and desert grazing lands generally exhibit low standing crop yields, but provide the highest diversity of vegetation communities, soils, and land form. The effect of these specialized communities is to create "patch" grazing for livestock and wild herbivores. Desert steppe grazing land is dominated by grasses, herbs, and shrubs with annual standing crop yields ranging from 170 to 400 kg/ha. Desert steppe formerly was the habitat of the Mongolian wild horse (*Equus ferus*). Annual standing crop yield ranges from 100 to 330 kg/ha. Desert grazing lands are especially suited to grazing by camels, sheep, and goats and provide habitat for a number of wild herbivores.

Collection Areas

The 1998 germplasm collection in Mongolia was centered in north-central Mongolia, primarily in the Hovsgol and Hentii Aimags, with additional collections made in the

Selenge and Bulgan Aimags. These areas are representative of two major ecological regions: the Hovsgol-Hangai Ecological Region and the Selenge-Onon Ecological Region.

Hovsgol-Hangai Ecological Region: The Hovsgol-Hangai Ecological Region is located in northwest-central Mongolia. As a mountainous region of high elevation and deep valleys with forest steppe, agricultural production is primarily limited to harvesting forage with grazing animals including yaks, cattle, sheep, and reindeer. Agricultural activities other than pastoral grazing include some forage harvesting for winter feed from natural meadows and very limited grain production in some valleys of the region. Aimags forming the region include Hovsgol, Arhangai, Bulgan, and Zavhan.

Climatic and physical factors are severely limiting to agricultural production in this region. The native plants that have evolved in this region are hardy and adapted to climatic extremes. Average elevation is between 2000 and 3000 meters. Mean annual temperature is between -2.5°C and 7.5°C with a low temperature of -24°C in January and a high temperature of 19°C in July. The region has, on the average, between 60 and 100 frost free days and an annual precipitation between 200 and >400 mm. Wind speed averages between 2-4 m/sec, and snow cover is often >15 cm in depth, except in mountainous areas, which receive considerably more.

Selenge-Onon Ecological Region: The Selenge-Onon Ecological Region is located in north-central Mongolia and includes the principle cropping area for Mongolia as well as the extensive Hentii Mountains located in Selenge, Tov, and Hentii Aimags. Although considerable cropping is done in this region, livestock grazing is still the main agricultural activity. Native or hybrid cattle and sheep are the primary grazing animals as well as large wild herbivores such as elk, deer, and moose. The mountain portion of this ecological region is comprised of relatively low mountain ranges with *Larix* forest typically on north aspects. The Onon River Basin, which enters Mongolia from Siberia and loops back to Siberia in the eastern portion of Hentii Aimag, drains the northwestern portion of Hentii Aimag.

Although climatic and physical factors are limiting to crop and livestock production, conditions are less severe than those in the Hovsgol-Hangai Ecological Region. Average elevation in this region is between 1500 and 2000 m. Mean annual temperature is between 0.0°C and 2.5°C with cold temperature in January to -20°C and warm temperature in July to 19°C . The region averages between 70 and 120 frost-free days and has annual precipitation between 250 and 400 mm. Snow cover averages between 5 to 10 cm in depth, except in the Hentii Mountains, which receive considerably more. Average wind speed is between 4 to 6 m/sec.

Both the Hentii Mountains and Hovsgol areas are protected as National Parks because of the unique composition of their flora and fauna and their scenic beauty. Both collection areas can be generally categorized as cold temperate. The area of major vegetation types in each aimag visited during the 1998 germplasm collection trip with the extent of their respective major vegetation types is as follows:

Aimag	Area (ha x 000)	High Mountain	Forest-Steppe	Steppe	Desert-Steppe	Desert
Hovsgol	5906	28	70	1	-	-
Bulgan	3059	2	75	23	-	-
Selenge	1967	2	85	13	-	-
Tov	6003	5	36	59	-	-
Hentii	6110	3	60	36	1	-

As expected from their distribution percentages, the most common vegetation type encountered during collection travel was forest steppe. Many of the forests appeared to have been burned by wildfire during the previous one to three years, creating many early successional communities. High mountain and swamp steppe were encountered in the upper reaches of streams and passes both in the Hovsgol and Hentii Mountain areas. Other communities encountered were birch, river and stream riparian, and pine forest. The steppe vegetation type was also present in these areas as ecotonal communities intergrading with forest steppe vegetation. Because most vegetation in Mongolia is grazed in the pastoral livestock production system, Mongolian plant ecologists typically classify vegetation by pasture group, which are composed of the following vegetation types/associations:

High Mountain Pasture: *Lichen*, *Lichen-Carex*, *Calligonum* Shrub, *Kobresia* Meadow, *Carex* Swampy Meadow, *Poa*

Forest Pasture Birch-Pine Forest: *Betula-Populus* Forest, *Larix* Forest, Forest Shrub

Swamp Meadow Pasture: *Koeleria*/Forb, *Carex*/Forb, *Koeleria*/ Forb/Other, *Poa*/Forb, *Agropyron*/Forb, *Puccinellia*/Forb

Forest/Grass Pasture: *Cleistogenes*/*Stipa*, *Potentilla*/*Stipa*, *Stipa*/Forb, *Carex*/*Aneurolepidium* *Elytrigia*/*Artemisia*, *Festuca*/*Stipa*/*Koeleria*, *Allium*/*Carex*, *Helictotrichon*/Forb, *Filifolium*, Shrub/Forb, *Caragana*/*Stipa*

Overall, human population in both the Hentii Mountain and Hovsgol collection areas was low. The northern boundary of Hentii Aimag with Siberia of Russia has mainly Buriat Mongols, who are few in number and primarily live in log cabins rather than the Mongolian ger. Because the human population is low, livestock numbers are also low, creating large areas of almost unused vegetation. Except for areas adjacent to towns (Sums) and along main roads, most plant communities appear to be in almost pristine ecological condition, except where disturbed by fire or other natural factors.

Specific Collection Information

On August 21, U.S. participants flew from their respective locations to Beijing and arrived in Ulaanbaatar on August 24. One day was spent in Ulaanbaatar finalizing trip arrangements, supplies, and equipment for the exploration. Because of the extensiveness of the remote, relatively inaccessible collection areas, two teams were assembled. A four-wheel drive Russian jeep and four-wheel drive van were rented for each team. The two teams left Ulaanbaatar on August 26 (see attached map).

Hovsgol Team: Members of the Hovsgol Team included S. Jigjidsuren (leader, agronomist), C. Sanchir (taxonomist), A. Erdenechimeg (seed specialist), B. Erdenebaatar (interpreter, animal scientist), Douglas Johnson (co-leader, plant physiologist), Mark Majerus (plant materials specialist), Thomas Johnson (field assistant), and the drivers, G. Byamsogt and B. Enkhbaatar. The Hovsgol Team collected in Selenge, Bulgan, and Hovsgol Aimags, and took a route that began in Ulaanbaatar and traversed north to Darkhan in Selenge Aimag; northeast to Bayankharaat, Yoroo, and Huder in the western reaches of the Hentii Mountains; west-northwest to Altenbulag, Tsagaanuur, and Tushig near the Russian border; then west through Bulgan Aimag to Hovsgol Aimag through Tarailan, Eguur, Chandmanundur, Hovsgol, Ulaanuul, and Tosontsengel; and southeast back to Ulaanbaatar.

Hentii Team: Members of the Hentii Team included D. Tsogoo (co-leader, taxonomist), S. Batsukh (agronomist), D. Namkhai (seed specialist), B. Amarsanaa (interpreter), Dennis Sheehy (co-leader, range scientist), Susan Winslow (plant materials specialist), Hugh Sheehy (field assistant), and the drivers, S. Monkhoos and S. Nasantogtokh. The Hentii Team traversed a route that began in Ulaanbaatar and went east-northeast along the southern and eastern portions of the Hentii Mountains in northern Tov Aimag and western Hentii Aimag and the Onon Basin in northern Hentii Aimag. Although a portion of Hentii Aimag is located in the Central and Eastern Steppe Ecological Region, collection was primarily focused in the Selenge-Onon Ecological Region.

The travel route followed by the Hentii Team was generally along the ecotonal boundary between forest steppe and grass steppe ecological zones. The first segment of the trip was to the northwest and concentrated on small river valleys formed by the eastward extension of the Hentii Mountains. The second segment of the collection route was in the basin formed by the Onon River. The third, return segment of the collection trip was parallel to the first segment of the trip, but was along the eastward terminus of the Hentii mountains where vegetation transitions to steppe vegetation.

During the first segment of the Hentii Team's trip, the typical landform was relatively narrow stream and small river valleys. Vegetation types encountered in a cross section of each river valley and mountain range were: (1) *Larix* forest dominated on north aspects of low mountain ranges, (2) dry grass steppe dominated on south aspects of the low mountain ranges and along fringes of the valley floor on north aspects, (3) meadow steppe dominated the better drained portions of the valley floor, and (4) swamp steppe dominated the wetter portions of the valley floor. Rock outcrops were associated with distinctive plant communities that often contained important plant species. Each valley had a riparian zone dominated by birch and willow at higher elevations and willow and poplar at lower elevations. Moist but well-drained zones in the valley floor were often dominated by several species of legumes which, if herders were present, were usually used as winter hay meadows. Open areas on the passes often contained numerous species of legumes and grasses. A pine-dominated forest community was encountered during the first trip segment. Often the head of narrow valleys in the mountains were characteristic of high mountain vegetation, being dominated by *Carex* and *Kobresia* meadows. Areas burned by wildfire were usually dominated by early successional communities that had low plant

diversity. The second segment of the trip had land form and species very similar to the first trip segment. However, most germplasm collection was confined to valley floors because of access problems to the higher elevations of forest-dominated mountains and numerous, larger rivers. The third, return segment of the Hentii Team trip was in typical grass steppe with forest steppe on northern aspects.

Weather during the 1998 growing season had considerable impact on the availability of plant germplasm. During the early part of the growing season, northern Mongolia was exposed to drought conditions. These conditions limited plant growth and development until the delayed rainy season began in mid-July. Although conditions became optimal for vegetation growth after mid-July, the delay in plant growth and development affected seed development and maturity in many localized plant communities. With the onset of cold nights by early September, the seeds of many plants did not mature into viable seeds suitable for collection. Nevertheless, seed of many potentially important forage germplasm accessions was collected, including a total of 574 collections, which represented 132 genera and 253 species. Seed was collected for each accession, and accompanying passport data were obtained for each collection. Voucher herbarium specimens were also obtained.

The Hentii Team returned to Ulaanbaatar on September 12, and the Hovsgol Team returned on September 15. The two teams traveled a combined total of 5,000 km over very difficult terrain on mainly unimproved dirt tracks through the countryside. In Ulaanbaatar, herbarium specimens were taxonomically verified, the collections were cataloged, species lists prepared, the seed was equally divided, and necessary seed export approvals were obtained. All necessary procedures and requirements for collection documentation and seed inspection required by Mongolian Government officials were followed.

Both Mongolian and U.S. members of the various collection teams in 1994, 1996, and 1998 expended considerable efforts to ensure the success of all three germplasm collection expeditions. Although germplasm collection is challenging in any overseas country, collection in Mongolia is particularly demanding. Mongolia is extremely remote and relatively inaccessible, requires camping, has a limited road system with mainly dirt tracks in the countryside, is a country where even basic supplies are difficult or impossible to find, experiences regular fuel shortages, has essentially no system for distribution of vehicle spare parts, and is subject to quarantine for several deadly diseases. Our Mongolian colleagues went to great lengths to surmount these challenges and make our three collecting trips successful. Driving and collection typically occupied all daylight hours with setting up camp and dinner preparation usually occurring after dark. Collection itself in 1998 was particularly difficult because of the late-season rains and heavy mosquito infestations. Our Mongolian hosts deserve special recognition for their efforts in making all three collection trips extremely successful.

General discussions were held with our Mongolian counterparts and with administrators at the Research Institute of Animal Husbandry to develop a possible Work Plan funded through the Food for Progress Program (similar to the PL-480 Program). The USDA-

NRCS had initiated establishment of a natural resource conservation project in the early 1990s. It was decided to use this document as the basis for establishing a 3-5 year project for evaluating the forage germplasm collections made during 1994, 1996, and 1998. A meat sheep project through the Research Institute of Animal Husbandry is also being established through the Food for Progress Program. Dr. David Kincaid with the USDA's Foreign Agricultural/International Cooperation and Development/Research and Scientific Exchanges Division is working through Mr. Edward Birgells, AID Director at the U.S. Embassy in Ulaanbaatar, to establish these two projects.

Dennis Sheehy and Hugh Sheehy departed Ulaanbaatar on September 15 to return to the U.S. to assist in wedding preparations for Dennis' daughter in Oregon. Susan Winslow, Mark Majerus, Thomas Johnson, and Douglas Johnson departed Ulaanbaatar for Beijing with the U.S. portion of the seed collections on September 19.

Additional Travel in China: On September 19, the group was met in Beijing by Dr. Gu Anlin, a scientist with the Grassland Research Institute in Huhehot, Inner Mongolia, who had been a visiting scientist at the USDA-NRCS Plant Materials Center at Bridger, MT. In the afternoon of September 19, they were hosted for a visit to the Chinese Academy of Agricultural Sciences by Drs. Xu Liu and Xueyong Zhang who had previously been visiting scientists at the USDA-ARS Forage and Range Research Laboratory in Logan, UT. Susan Winslow and Mark Majerus returned to Bridger, MT on September 20.

On September 20, Douglas and Thomas Johnson flew from Beijing to Chongqing in Sichuan Province of China where they were met by Dr. Detian Cai, who had previously been a visiting scientist at the USDA-ARS Forage and Range Research Laboratory in Logan, UT. Dr. Cai hosted Douglas and Thomas Johnson on a three-day boat trip on the Yangtze River to view erosional damage from the extensive flooding that occurred during August-September, 1998. A major challenge for the Chinese Government is devising effective farm management practices to minimize soil erosion losses and extend the functional life of dams and reservoir projects along the Yangtze River. Our boat traversed through the Three Gorges section of the Yangtze River, site of the largest dam project in the world. Whole cities including apartments, manufacturing plants, and businesses are being relocated and rebuilt at higher elevations above the river. Total project cost is estimated to be about five billion dollars, and work on the Three Gorges Dam is continuing 24 hours a day. This dam is being built for power generation and flood control with an expected completion date in 2007.

The Johnsons then participated in a two-day visit to Wuhan in Hubei Province where they had discussions with faculty and administrators at Huazhong Agricultural University (Key Laboratory of Crop Genetic Improvement for the Chinese Government) and Hubei University. Dr. Johnson was presented an Honorary Professor Award by the President of Hubei University on September 24. Douglas and Thomas Johnson flew from Wuhan to Beijing on September 25 and returned to the U.S. on September 26.

1998 Germplasm Collections from the Hentii and Hovsgol Areas of Northern Mongolia

Achillea alpina
Achnatherum splendens (3)
Aconitum baicalense
Aconitum barbatum
Aconitum septentrionale (2)
Acorus calamus
Adenophora stenanthina (2)
Agrimonia pilosa
Agropyron cristatum (21)
Agropyron geniculatum
Agropyron michnoi (2)
Agropyron pectinatum
Agrostis clavata (2)
Agrostis mongolica (2)
Agrostis trinii (4)
Allium anisopodium
Allium bidentatum (5)
Allium leucocephalum (2)
Allium lineare
Allium maximowiczii
Allium odorum (4)
Allium schoenoprasum (6)
Allium senescens (11)
Allium splendens
Allium vodopjanovae
Alopecurus alpinus
Alopecurus arundinaceus
Alopecurus brachystachyus
Alopecurus pratensis (3)
Amblynotus rupestris
Amethystea caerulea
Androsace incana
Androsace septentrionalis
Anemone crinita
Arabis pendula
Arenaria capillaris
Artemisia commutata
Artemisia gmelinii
Artemisia laciniata
Artemisia scoparia
Aster alpinus
Aster tataricus (2)
Astragalus adsurgens (9)
Astragalus austrosibiricus (3)
Astragalus dahuricus
Astragalus frigidus (2)
Astragalus inopinatus (3)
Astragalus melilotoides (2) *Astragalus mongholicus* (3) *Astragalus oroboides* (2)
Astragalus propinquus (5)
Atriplex fera
Beckmannia syzigachne
Betula fusca (2)
Bromus inermis (5)
Bromus pumpellianus (3)
Bupleurum bicaule (2)

Bupleurum sibiricum
Cacalia hastata
Calamagrostis epigea
Calamagrostis langsdorffi
Caragana jubata
Caragana microphylla (2)
Carex enervis
Carex karoï
Carex korshinskii
Carex spp.
Carex stenocarpa (3)
Carum buriaticum
Chamaenerion angustifolium (2)
Chenopodium aristatum
Cirsium esculentum
Cleistogenes squarrosa
Clematis hexapetala
Corispermum declinatum
Cotoneaster melanocarpa
Dasiphora fruticosa
Delphinium grandiflorum (2)
Deschampsia sukatschewii
Dianthus versicolor
Dontostemon integrifolius
Draba nemorosa
Echinops dahuricus
Eleocharis intersita
Elymus brachypodioides (3)
Elymus chinensis (2)
Elymus confusus
Elymus dahuricus (7)
Elymus excelsus (3)
Elymus gmelinii (10)
Elymus komarovii
Elymus ovatus
Elymus sibiricus (12)
Elymus transbaicalensis
Elytrigia aegilopoides
Eragrostis minor
Erigeron acer
Erysimum flavum
Festuca altaica
Festuca dahurica
Festuca komarovii
Festuca lenensis (7)
Festuca ovina (5)
Festuca rubra
Festuca sibirica (2)
Filifolium sibiricum (2)
Galium verum
Gentiana barbata (2)
Gentiana decumbens
Geranium pseudosibiricum
Geranium vlassovianum
Geum aleppicum
Goniolimon speciosum

Gypsophyla dahurica
Halenia corniculata
Haplophyllum dauricum
Hedysarum alpinum (10)
Hedysarum collinum
Hedysarum inundatum
Hedysarum sangilense
Helictotrichon mongolicum
Helictotrichon schellianum (6)
Hemerocallis minor (2)
Heracleum dissectum (3)
Heteropappus hispidus
Hierochloe glabra (2)
Hordeum brevisubulatum
Iris lactea (2)
Iris ruthenica
Iris tigridia
Juncus leucochlamus
Juncus salsuginosus
Jungia fleuxosa (2)
Kobresia bellardii
Kobresia sibirica
Kochia scoparia
Koeleria alpina
Koeleria altaica
Koeleria macrantha (5)
Koeleria mukdenensis (2)
Larix sibiric
Lathyrus pratensis
Lathyrus quinquenervius
Leibnitzia anandria
Leontopodium leontopodium
Lepidium apetalum
Lespedeza daurica (3)
Leymus chinensis (4)
Leymus secalinus
Lilium martagon (3)
Lilium tenuifolium (4)
Linaria buriatica
Linum baicalense (3)
Medicago falcata (17)
Medicago lupulina
Medicago platycarpus (4)
Medicago ruthenica (2)
Medicago varia
Melandrium brachypetalum (2)
Melica turczaninowiana
Melica virgata (2)
Melilotus dentata (2)
Onobrychis sibirica (2)
Oxytropis ambigua
Oxytropis ampullata
Oxytropis deflexa (2)
Oxytropis microphylla (3)
Oxytropis nitens
Oxytropis oxyphylla

Oxytropis pseudoglandulosa
Oxytropis spp. (1)
Oxytropis strobilacea (2)
Oxytropis tragacanthoides
Papaver nudicaule (3)
Parnassia palustris
Patrinia dahurica
Patrinia rupestris (4)
Pedicularis flava (2)
Pedicularis resupinata
Pedicularis uliginosa (2)
Peucedanum baicalense
Phleum phleoides (6)
Phlomis tuberosa (2)
Plantago depressa
Plantago major
Pleurospermum uralense
Poa argunensis (2)
Poa attenuata (2)
Poa botryoides (4)
Poa pratensis (12)
Poa sibirica
Poa stepposa (3)
Poa subfastigiata
Polygonatum odratum (2) *Polygonum divricatum* (3)
Polygonum lapathifolium
Polygonum viviparum (2)
Potentilla multifida
Potentilla strigosa
Potentilla tanacetifolia (2)
Potentilla viscosa
Ptilagrostis mongholica (3)
Puccinellia tenuiflora (4)
Pulsatilla bungeana (2)
Pulsatilla dahurica
Rhaponicum uniflorum (2)
Rhinanthus songaricus (2)
Rhodiola rosea
Ribes pulchellum (3)
Rosa acicularis (2)
Rosa dahurica (2)
Rubia cordifolia (2)
Rumex acetosella
Rumex gmelinii
Rumex thyrsiflorus (3)
Sanguisorba officinalis (7)
Saposhnikovia divaricata (2)
Saussurea salicifolia (2)
Scabiosa comosa
Schizonepeta multifida
Scirpus orientalis (2)
Scutellaria baicalensis
Sedum aizoon (2)
Serratula centauroides
Serratula marginata
Setaria viridis

Spiraea flexuosa
Spiraea salicifolia
Stipa baicalensis (2)
Stipa grandis
Stipa krylovii (3)
Stipa sibirica (8)
Stipa spp.
Taraxacum collinum
Taraxacum officinale (2)
Thalictrum minus
Thalictrum petaloideum (2)
Thalictrum simplex (3)
Thermopsis dahurica
Thermopsis lanceolata
Thymus mongolicus
Trifolium lupinaster (11)
Trifolium repens (2)
Triglochin maritima
Triglochin palustris
Trisetum sibircum (7)
Trisetum spicatum
Veronica incana
Veronica longifolia (2)
Vicia amoena (12)
Vicia baicalensis
Vicia cracca (14)
Vicia nervata (2)
Vicia unijuga (4)

TOTAL = 57 Addresses and Contacts

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Daily Log for Hovsgol Germplasm Collection Team - 1998

(From report prepared by Mark Majerus)8/21-22/98: U.S. participants met in Vancouver, B.C. including Susan Winslow, Mark Majerus, Doug Johnson, Tom Johnson, Dennis Sheehy, and Hugh Sheehy. A Canadian Airline flight was taken directly to Beijing. We were met at the airport by Dan Miller, a private consultant presently working in Tibet and other regions of China. Dan had previously worked on the Padlock Ranch in north-central Wyoming and south-central Montana.

8/23: A day layover in Beijing was scheduled to give everyone a chance to adjust to the 14-hour time change.

8/24: We flew out of Beijing on Miat Mongolian Airlines arriving in Ulaanbaatar at 1730. We were met at the airport by Dr. S. Jigjidsuren, Project Leader from the Research Institute of Animal Husbandry (RIAH), and J. Byambadorj, a colleague and friend of Drs. Sheehy and Johnson who works as a private agricultural consultant in Ulaanbaatar. The Johnsons and the Sheehys stayed in the apartment of J. Byambadorj, while Susan Winslow and Mark Majerus rented an apartment from husband/wife scientists at RIAH, S. Batsukh and D. Tsogoo for \$25/night each.

8/25: At RIAH we met with all the scientists who were to be involved with the two germplasm collection teams. It was estimated that each team would travel about 2,600 kilometers with the fee for vehicle and driver being 200 Tugriks/km (\$613), and gas was estimated at 200 Tugriks/liter with mileage of 5 km/liter (\$125). The salary and per diem for Mongolian scientists was \$24/day for 21 days (\$504).

8/26: Most of the day was spent getting ready to leave, and purchasing food and supplies for the expedition. We left Ulaanbaatar at 1730 proceeding north out of Ulaanbaatar and made our first camp near a ger

belonging to the brother of our jeep driver. We purchased a sheep and shared in the first meal, which consisted of internal organs and blood sausage encased in small intestines and the stomach.

8/27: Our Russian jeep encountered transmission problems in Banuukharaa. After repairs were made, we proceeded to Darkhan and then headed northeast for the Yoroo River Valley. Our first seven collections were made in strips of native prairie between blocks of abandoned crop land. We camped on a hill overlooking Yoroo River Valley.

8/28: We headed southeast into an area of extensive abandoned crop land with many junked Russian combines and other farm equipment. As we turned east, we entered into foothills dominated by Scotch pine and birch. By afternoon we were collecting in the Yoroo River Valley (some wet saline areas). A total of 38 collections were made today. By nightfall we were approaching Huder, camping on a hilltop just north of town.

8/29: In the morning we went into Huder and stopped at the house of a cattle crossbreeding researcher (Zorigtbaatar) who was to accompany us into a large valley to the southeast. His family accompanied us to the ger of his wife's family where they stayed while we proceeded up the Uyalga River Valley to within 7 miles of the Russian border. In the distance was a mountain peak that was considered sacred to the Buriat people. After returning the cattle researcher and his family to their home, we headed west into the mountains, camping on a pass in a Scotch pine savanna. Twenty-three collections were made today.

8/30: After collecting in a dense fog we headed down into a mountain valley. We stopped at the Khazai Brigade Headquarters where they were preparing harvesting equipment for the spring wheat harvest. We dropped in elevation to the Tsokh River Valley, the river being the border between Mongolia and Russia. We ran into the Russian border and had to backtrack until we found the Ikh Dugeree Border Station. We were accompanied by the Major of the Border Station and his two children to Altenbulgan, where the Major was going to enroll his children in school. From Altenbulgan we traveled to Sukhbaatar where we picked up Erdenechimeg, an agronomist on our expedition who had prior commitments. Fifteen collections were made today.

8/31: We broke camp without breakfast and headed south to Shaamar. We stopped to make a phone call concerning Doug Johnson's visa problems. We then stopped at the house of a former county leader (a friend of Dr. Jigjidsuren) to have breakfast. We made a lunch camp on a hillside between Tsagaanuur and Tushig where extensive collecting was done. When we got gas in Tushig, we inquired about the roads, finding out that the road we planned on taking was impassable because of higher than normal precipitation. We inquired at a local ger about sites in the immediate area that were not extensively grazed and were directed to a spot near the river, where we made camp for the night. Seventeen collections were made today.

9/1: The drivers were having trouble with the carburetor of the jeep, and needed most of the day to make repairs. We collected extensively in the area of our camp. This also gave us a chance to dry the seed that we had collected to date. We finally got out of the area about 1500 and began to backtrack to Tsagaanuur. With the overnight rains, the roads were literally torn to pieces by big trucks hauling supplies to Tushig. Eighteen collections were made today.

9/2: We awoke in a dense fog and decided it was too wet to collect in the area of our camp. After traveling for only a few kilometers, the jeep once again had carburetor problems. After switching to another carburetor and cleaning all the jets during a three-hour repair, we were off again. We stopped at a State Farm Brigade and bought a front shoulder of mutton and later stopped at another Brigade and bought some bread. We visited a ger that was supposed to have excellent airag (fermented mares milk), the national drink of Mongolia. We proceeded to Khyelgnet where we bought potatoes, onions, and carrots. We camped on a ridge just outside of Erdenet. Because of some backtracking and going into the Selenge River Valley where collecting had been done in 1996, only six collections were made.

9/3: We went into the central market of Erdenet, which is a major copper-mining town, and bought some beef and a beef tongue. We were not able to start collecting until we got a distance out of Bulgan, as most of the areas around major cities were extensively grazed. We purchased gas in Hutag and then went west of town to establish camp. Eleven collections were made today.

9/4: We stopped in Tarailin to purchase gas again, as amounts were limited at each location. Most of the collections today were made between Tarailin and Erdenbulgan, areas that have severe winters. We saw numerous small stacks of hay made by ground squirrels, which take grass into their burrows and stack the forbs and shrub material at the burrow entrance. We stopped at a herder's cabin late in the day to buy a sheep. They slaughtered the sheep and prepared the internal organs to share with us for supper. They had just finished making felt that day and had large squares laying out to dry. We made 19 collections today.

9/5: We woke up to major frost on our tents. We went into Erdenbulgan, bought some bread, and headed down to the Egiyn River to set up camp. We took the day off to lay out all the seed packets to dry, inventory the seed collections and herbarium voucher specimens, wash clothes and bodies in the river, and celebrate Tom Johnson's 71st birthday. The Mongolians created quite a culinary treat by cooking up mutton shishkabobs, beef tongue, rice, boiled potatoes, potato salad, and cole slaw. Although no collections were made today, the area was surveyed for collections to be made the next day.

9/6: We stopped at a large garden plot to inquire about purchasing vegetables. The garden was a community project directed by David Megit of Canada through the Bahai Faith. We collected along the Egiyn River Valley among abandoned crop land and then headed into the mountains. We camped along the Erigyn River. Twenty-three collections were made today.

9/7: We headed through the mountains towards Hovsgol Lake. This area has mainly yak, the preferred grazing animal for higher elevations. We stopped in Hohov to purchase gas and sugar; not much else available to buy. In late afternoon we drove through a torrential downpour. We finally made camp on a hill overlooking Hatgal at the lower end of Hovsgol Lake. Twenty-three collections were made today.

9/8: We drove into Hatgal to inquire about the roads on the west side of Hovsgol Lake and over the mountain to Renchinkhumbe. The road was impassable so we had to travel to Darhan Valley from the south. We bought potatoes, turnips, and bread and headed south to the entrance station of Hovsgol National Park. The park ranger suggested a short cut through an area that was lightly if ever grazed, which would reduce our trip by about 100 km. This road was not on the map, but with a few stops at gers to ask directions and by using our GPS, we were able to find our way through the mountains. We camped near tree line in a subalpine area. Sixteen collections were made today.

9/9: We spent most of the day collecting on open ridge tops near our camp at about 7,000 feet elevation, collecting several new species. We left the mountain top about 1600. Along the way we saw a father and daughter collecting onions, presumably *Allium altaica*, which has the largest bulb of the native *Allium* species in this area. After only an hour on the road, the jeep developed transmission problems again. The two drivers finally had to remove the transmission from the vehicle to repair it; the jeep was finally fixed at 2030. After getting both vehicles stuck in a boggy area, we made camp in the dark. Fourteen collections were made today.

9/10: We worked our way through a large, boggy area and got to the Beltes River and headed to higher elevations and rockier soil. We skirted the southern boundary of the Argali Sheep Preserve in the rugged Horidal Soridag Mountains. We entered Darhan Valley, a broad valley from which the mountains to the east rose abruptly from the valley floor similar to the Grand Tetons in Wyoming. We made a lunch camp along a river and caught several arctic grayling. While eating lunch, a local herder on a bicycle stopped by to visit-- we eventually hired him as our local guide for the next two days. We picked him up at his ger a little later in the day and stopped at a neighboring ger to buy a sheep. We drove up a dry river bed for several kilometers before finding a campsite that had a small log A-frame structure (similar to a wickiup) and fire pit. After dinner, our guide who was a four-time Gold Medalist singer at the Mongolian National Music Festival performed for us. Only six collections were made today.

9/11: We continued up the dry river bed, stopping occasionally to explore the banks and adjacent forest. We found camel-tail caragana (*Caragana robota*), a species that the Mongolians had only seen as herbarium specimens. As we approached the mountains, the terrain became extremely boggy so we turned around and tried to approach the mountains a few kilometers further north, which was again futile. As we tried to get back to Ulaanuul, the jeep got stuck. Efforts to get it out failed. We went back to the ger where we bought the sheep earlier and set up camp. Some of the Mongolians returned to the jeep and worked at getting it out of the bog.

9/12: We woke up to a light rain and the Mongolians coming back with both vehicles. They had built pads out of pine and lifted the vehicle up with long pine poles. As we approached Ulaanuul to purchase gas, we met a family on a tractor who was returning from picking blueberries in the mountains. The Mongolians met the pickers in Ulaanuul and spent about two hours getting about 10 gallons of blueberries. It was snowing hard by the time we left Ulaanuul, and about 5-6 inches of snow had accumulated by the time we got to the top of the pass. As we got over the two mountain passes, the weather began to clear, but it was still very cold. We stopped in the town of Sumber at the ger of a young lady who was the local doctor. Four people stayed in her ger, and the rest of the Mongolians stayed in the local hospital.

9/13: We were sent off with our hosts splashing milk on our vehicles for a safe trip. We proceeded to Moron, a major city, where we went to the local market and bought coffee and bread. As we continued down the Selenge River Valley, we found the ger belonging to the uncle of Byamsogt, our van driver. His cousin had been killed in a traffic accident, and Byamsogt had not seen the family since the accident. We camped next to his uncle's ger. We made eight collections today.

9/14: We are almost to the area where we will be back tracking on previously traveled roads. We stopped in an area of abandoned crop land and adjacent native hay harvesting area, where we made our final four collections. We collected *Lathyrus quinquinervus*, which the Mongolians had only previously seen as an herbarium specimen. We now headed straight for Ulaanbaatar. We stopped late, made our camp, cooked dinner, and enjoyed our last evening in the Mongolian countryside with singing and Arkhi toasts.

9/15: Last night's late-night toasting took its toll on some members of the team. We had lunch near the Tuul River near Zaamar and eventually reached Ulaanbaatar about 1900.

9/16: We went to RIAH and met with Dr. Jigjidsuren to finalize the additional expenses related to traveling an extra 400 kilometers and having to pay higher than anticipated prices for gasoline. Doug Johnson was also finally able to obtain a visa extension and necessary approvals for his passport. We purchased extra envelopes at the Ulaanbaatar Post Office to use for packaging the split seed.

9/17: Most of the day was spent splitting seed lots, cataloging the collections, verifying the voucher specimens, and obtaining the necessary permits for exporting our seed.

9/18: All receipts for the collection trip were finalized, and splitting the seed was completed. A farewell dinner for the Hovsgol Team was hosted at Erdenechimeg's apartment.

9/19: We congregated at Byambadorj's apartment to consolidate luggage and went to the airport at 0900. Those accompanying us to the airport were Byambadorj, Jigjidsuren, Erdenebaatar, Sanchir, and Erdenechimeg. We were met at the Beijing Airport by Gu Anlin, a researcher from the Grassland Research Institute in Huhehot, Inner Mongolia who worked at the Bridger Plant Materials Center in 1990-91. Doug Johnson discussed with her the possibility of participating in a forage germplasm collection trip in 2000 to Tibet, an area Anlin is quite familiar with. At 1730 we were picked up by Dr. Liu Xu (Deputy-Director/Associate Professor) and Dr. Xueyong Zhang (Associate Professor) from the Chinese Academy of Agricultural Science (CAAS), who had worked previously at the USDA-ARS Forage and Range Research Laboratory at Logan, UT. We toured CAAS and then ate a delicious Chinese dinner.

9/20: Mark Majerus, Susan Winslow, Doug Johnson, and Tom Johnson left for the airport at 0815. Mark and Susan returned to Bridger, MT at 1930 via Narita, Japan; Seattle, WA; and Billings, MT. Doug and Tom Johnson continued their travels through China.

Daily Log for Hentii Germplasm Collection Team - 1998
(From report prepared by Susan Winslow)

8/21-22/98: U.S. participants met in Vancouver, B.C. This included Mark Majerus (USDA-NRCS), Susan Winslow (USDA-NRCS), Doug Johnson (USDA-ARS), Tom Johnson, Dennis Sheehy, and Hugh Sheehy. Our trip continued to Beijing, People's Republic of China. We were met at the airport by Dan Miller, a private consultant living in Beijing who works in the Tibetan Region of China and other countries in Asia.

8/23: This day was set aside as a layover day to adjust to crossing the International Date Line and gaining 14 hours.

8/24: We departed for the airport at 1145 and flew on Miat Mongolian Airlines to Ulaanbaatar, arriving at 1730. We were met at the airport by Dr. S. Jigjidsuren, Head of Pasture and Fodder Department at the Research Institute of Animal Husbandry (RIAH), and J. Byambadorj, a friend and colleague of the Sheehys and Johnsons. Mark Majerus and Susan Winslow stayed at the apartment of husband/wife scientists at RIAH, Drs. Batsukht and Tsogoo, and the Sheehys and Johnsons stayed at Byambadorj's apartment.

8/25: U.S. participants went to RIAH and discussed details of the collection trip with the Mongolian scientists. Team compositions were determined, and payments were made for estimated trip expenses. Mongolian scientists received \$24/day, and the fee for vehicles with driver was 200 Tugriks/km. Petrol was estimated at 200 Tugriks/liter (5 km/liter @ 2000 km). We attempted to contact Mr. Ed Birgells, US AID Director for Mongolia about a possible project with the Food for Progress (FFP) Program and left a message concerning the possibility of scheduling a meeting when we return from the countryside.

8/26: The two teams spent the majority of the day securing supplies, petrol, foodstuffs, and miscellaneous items for their trips. The Hentii Team left Ulaanbaatar at 1800 and proceeded northeast for approximately 60 km. We made a late camp in the dark, ate mutton soup for supper, and called it a day.

8/27: After breaking camp, we proceeded along the Kherlen River and made one seed collection in Mongolmort Sum in Tov Aimag. Nine additional collections (10 total) were made, and the day ended in rain.

8/28: Progress continued with 19 more collections. Travel was mostly in valley bottoms, with short traverses through mountain passes. Camp was made at Huhknuur (Blue Lake) in Sinkormondel Sum in Hentii Aimag, a site made famous by Chiingis Khan, the revered Mongolian leader.

8/29: The countryside is very similar to western Montana, and the forest steppe communities contain vegetative life forms that are very similar, and in many cases identical, to those found in the Intermountain Region of the western U.S. We made 14 collections at various locations in Omnogelger Sum; purchased, slaughtered, and processed a sheep; and made camp near a former (abandoned) socialist tourist camp on Hangalnuur (called Moose Lake).

8/30: Travel continued, and collections now total 75. The weather has been mostly warm, but there has been rain nearly every day. Mosquitos are everywhere.

8/31: It was decided to get Dr. Namkhi to a dentist, as he had developed an extremely infected tooth and was suffering great pain. We collected along the way and stopped at the former Horha State Farm, where we secured vegetables and also collected an *Eragrostis*. We finally made it to Gurvanbayan Sum Center, where we purchased petrol and other supplies, while Dr. Namkhi's bad tooth was extracted. We then forded the large Khork River, proceeded up a side valley, and made camp at a place known as Red Rocks in Batshireet Sum. We heard our first wolves howling at a distance of about 200 yards.

9/1: We collected within a large, ancient walled area with a tall, imposing natural pillar of red sandstone in the compound. History places Chiingis Khan here. This was one of our most productive collecting sites, and we made 22 collections (total now 104). There is evidence of large tracts of burned forest, similar to what has been observed along the entire collecting route. Camp was broke at about 1600, and travel was extremely difficult and slow going until camp was made along the Barh River at 2000, with dinner following in a heavy rain.

9/2: We made 19 collections (now 130 in total) and also took advantage of the river and washed clothes. We then forded the river, drove to the Batshireet Sum Center and purchased supplies, and made camp near the village. It was decided during dinner that we would try the following day to reach and cross the Onon River, a formidable river.

9/3: We reached the Onon River in early afternoon, making collections along the way. Because of the wet weather, we made camp and spread our seed collections on the bank to dry in the sun. Recent rains and high water in the rivers continued to impede our travel.

9/4: We back tracked to Batshireet Sum Center, where we bought petrol (supplies were low and getting expensive due to ongoing problems in Russia) and made our way east to the grass steppe. Collections now total 185, and we made camp on a wind swept ridge to minimize mosquitos.

9/5: Collection continued as we made our way to the east side of the Onon River and made camp in Binder Sum. After a dinner made by the Americans and eaten under a clear sky illuminated by a full moon, we listened to wolves on the other side of the river.

9/6: We collected 17 accessions in the morning (224 total) and then drove to a barge (2,000 Tugriks per vehicle fee, ~ \$2.35) and crossed the river. One vehicle got stuck in a wet meadow, but eventually made it back to camp.

9/7: After making quite extensive repairs to the brake master cylinder of one of the vehicles, we made our way to the next river crossing and encountered an entourage of vehicles traveling with the Governor of Hentii Aimag (the equivalent of a state governor in the U.S.). At this point we were about five miles from the Russian border. In this group were several famous Mongolian poets and writers and a world-renowned opera singer who were traveling to Dadal. We accompanied this group to the banks of the Balg River and after waiting for the tardy military transport truck that assisted with the crossings, a few jeep drivers started across on their own. Some jeeps made it, while others did not; our group made it. Water, however, flooded into the vehicle wetting everything in the vehicle. After getting out of the river, we drove in the dark a few miles and made our camp again in the rain.

9/8: Every packet of seed was wet, along with clothing, sleeping bags, and food items. We spent the day drying things out in the sun and also made a few collections (254 total). We proceeded to the next barge crossing, stopped at Dadal Sum Center to obtain supplies, and then made camp just outside of this small town.

9/9: We learned that the route behind us had been closed because of a plague quarantine. Traveling further east was ruled out for a number of reasons. We purchased fuel and decided to head back to Ulaanbaatar. We made 26 collections as we progressed west from Dadal, Bajnadarga, and Batshireet Sums.

9/10: Awoke to a downpour and broke camp without breakfast. Stopped at a ger for lunch and made 26 more collections (now 306 total) throughout the day before making camp.

9/11: We are now retracing the same route that we traveled during the first days of our trip through Batshireet, Omnogelger, and Sinkormondel Sums. We made 12 collections and drove in the dark a long time before making our final camp on the Kherlen River.

9/12: Camp was broke in the rain, and we made our way to Bognur, a medium-sized coal town, to purchase food for lunch and petrol. We made one final collection (final count of 319) and arrived at Byambadorj's apartment at 1800.

9/13: Toured the Ministry of Agriculture building complex with Byambadorj (where one of his offices is located) and tried to send e-mail messages.

9/14: Met with the Mongolians and discussed trip details; miscellaneous items were returned from the vehicles. The Hentii Team had dinner at a nice restaurant to celebrate a successful trip.

9/15: Went to RIAH to organize the division of seed between the Mongolians and Americans and to assist in the taxonomic verification of voucher specimens. Went to the airport with Byambadorj to send off Dennis and Hugh Sheehy for their return trip home.

9/16: Went back to RIAH with the Hovsgol Team and reviewed the seed division process and finances for both teams. Mark Majerus and Susan Winslow reviewed the status of seed production trials started in 1997 with Dr. Jigjidsuren from seed provided by the Bridger Plant Materials Center. We also discussed the potential for future cooperative evaluations aimed at mineland reclamation, pasture renovation, and rangeland seeding.

9/17: Seed processing continued at RIAH. Susan Winslow spoke with the Mr. Ed Birgells, US AID Director for Mongolia, about the Food for Progress (FFP) Program and learned that technical aspects of a possible FFP project need to be discussed with Dr. David Kincaid (USDA-FAS).

9/18: Seed processing was completed, and receipts for the collection trip were finalized. A farewell dinner was hosted by Dr. Erdenechimeg at her home in the evening.

9/19: We left for the airport at 0900. Mongolians that bid us farewell included Byambadorj, Jigjidsuren, Erdenebaatar, Sanchir, and Erdenechimeg. We flew to Beijing and were greeted there by Dr. Gu Anlin, a researcher from the Grasslands Research Institute in Huhehot, Inner Mongolia, who had worked at the Bridger Plant Material Center in 1990-91. Doug Johnson discussed Anlin's possible participation in a germplasm collection expedition to Tibet in the year 2000. We were picked up at 1730 by Dr. Liu Xu (Deputy Director/Associate Professor) and Dr. Xueyong Zhang (Associate Professor) from the Chinese Academy of Agricultural Science (CAAS), who had worked previously at the USDA-ARS Forage and Range Research Laboratory at Logan, UT. We toured CAAS and then ate a delicious Chinese dinner.

9/20: Mark Majerus, Susan Winslow, Doug Johnson, and Tom Johnson left for the airport at 0815. Doug and Tom Johnson continued their travels through China. Mark and Susan returned to Bridger, MT at 1930 via Narita, Japan; Seattle, WA; and Billings, MT.