Central Asia
development group

Registan Water/Pasture Assessment (UNAMA)

Mid-Project Report
April 30, 2004

Will Hall

CADG

Registan Project Coordinator

Registan Water/Pasture Assessment (UNAMA)
Table of Contents

I. Summary

The desolate Registan desert in Afghanistan's Kandahar and Helmand provinces was previously populated by thousands of kuchi nomads until a devastating drought decimated animal herds and forced the kuchi to live as IDPs (Internally Displaced Persons) on land bordering the desert. Through funding from UNAMA (United Nations Assistance Mission in Afghanistan), Central Asia Development Group (CADG) is assessing conditions in the Registan desert and border regions to devise possible solutions to the problems facing Registan kuchi nomads. Work commenced in mid-February and will continue until the end of June. This report details objectives, completed work, initial findings, and a workplan for the continuation of the assessment until its completion.

II. Project Description

CADG is conducting an extensive water, pasture, and vegetation assessment of conditions within the Registan desert. The information gathered from this work will be used for future development both within the Registan desert and in border regions where agricultural development is possible. UN agencies, Afghan government ministries, and NGOs working with Registan kuchi require good information on whether the Registan desert can again sustain kuchi nomads through range/well rehabilitation or if the settlement of kuchi outside the desert is the best option. There is very little existing data on the conditions within the area and this work will provide valuable resources for organizations doing future work there. Work will be accomplished through the use of hydrological testing, range ecology analysis, IDP camp surveys, GIS (Geographic Information Systems) data collection, and the expertise of international experts. Some of the most difficult portions of the assessment, such as the well/navar (rain catchment) survey work, have been completed. Also, two international consultants have already visited Registan to formulate workplans for range rehabilitation and agricultural development. Work will continue in May and June as two more consultants visit the area to develop workplans and estimate present and future capacity for return. In addition, a test well will be drilled to assess new areas of Registan for kuchi migration.

The term Registan is sometimes used to describe all southern districts of Kandahar, Helmand, and Nimruz provinces. The area covered by this project is limited to the southern area of Kandahar province and the Garmsir desert of Helmand province. This is the point of origin for the large numbers of kuchi who this project will assist.

A. Current Situation

Due to lack of water sources, kuchi nomads now reside in IDP camps or smaller settlements along the edge of the desert. In Kandahar province, the majority of Registan kuchi live in four camps located in the Maiwand and Panjwayi districts- Talukan, Marghar, Moshan, and Qala-e-Shamir. There are few income generation opportunities and camp residents subsist on food provided by the World Food Program (WFP). Income generation opportunities are usually limited to agricultural work and firewood collection.

Few kuchi families possess enough animals to return to Registan even if conditions improve.

B. IDP National Plan

The IDP National Plan was developed to increase the rate of return of IDPs to their point of origin and ensure that the returns will be sustainable. While many Afghan IDPs are in their present situation due to political factors, the plight of the Registan kuchi is clearly due to environmental conditions. Southern Afghanistan has been suffering from drought for the past several years and there are no indications that this drought will end in the near future. In addition, most kuchi families have lost their main source of income-livestock. Without a sustainable means of income generation, most kuchi families will be unable to return to Registan even if environmental conditions become more favorable. The core objective of this work is to provide information that can be used to return as many kuchi as possible to Registan as part of the IDP National Plan and find settlement solutions for those unable to return. It is hoped that kuchi with sufficient numbers of animals can return to Registan after future well rehabilitation programs have been completed and other families can return with the assistance of restocking programs by Cordaid/VARA and other NGOs.

III. Objectives

To accomplish the main objective of finding a solution to this problem by either returning Registan kuchi to their point of origin or settling them in non-nomadic livelihoods, this study will produce several outputs.

- Measurement of existing water and grazing resources.
- Estimation of Registan's capacity for a sustainable return of kuchi nomads.
- Work plan for range rehabilitation program.
- Work plan for well and navar rehabilitation program.
- Work plan for expansion of water resources.
- Work plan for conservation of water resources.
- Recommendations for agriculture-based livelihood interventions for kuchi wishing to settle in areas contiguous to the desert.

A. Water Assessment

The water assessment portion of this study will determine the state of current water sources. The two water sources in the region, primitive wells and navars, have fallen into disrepair through years of neglect. The navars are excavated dykes where winter/spring rains collect and are used as a water source for two or three months. Hand-dug wells exist mainly in the southern area of Registan and are used when the navar water supply is depleted. Many of these wells are more than 100 meters deep but have collapsed or filled with sand. Our desert survey team, working in conjunction with two VARA teams, has finished surveying the majority of water sources in the main areas previously used by

Registan kuchi. This work will give data that can be used for future rehabilitation programs.

B. Pasture Assessment

The sustainability of Registan's pasture needs to be determined before any return is possible. In order to estimate the number of kuchi which could potentially return to Registan and assume their nomadic lifestyle again, pasture vegetation must be analyzed by international experts familiar with range ecology and the migration routes of pastoralists. At this point in the project, two international consultants have visited Registan to develop programs for range rehabilitation.

C. Agriculture-Based Livelihood Development

It is unrealistic to expect any large-scale return of kuchi to Registan due to the few animals retained by kuchi families and the cost of an expansive restocking program. This study will evaluate not only conditions within Registan but possibilities for agricultural development in continguous areas such as Panjwayi, Maiwand, and Garmsir for families unable to return.

IV. Project Framework

Work was started in mid-February of 2004 in close collaboration with kuchi leaders, Afghan government ministries, UN agencies, and other NGOs.

A. Kuchi Shura

With the assistance of VARA, a Kuchi Shura was recently formed to help organize relief efforts and give the kuchi a representative body in Kandahar. There has been a great effort throughout this project to involve the kuchi in all aspects of the assessment. The kuchi have done all guide work within the Registan desert, provided input on previous capacity, given feedback on the project framework, assisted in vegetation classification, participated in the planning of activities, and given input on how they feel the study should be accomplished. It is clear to all involved in this project that work would not be possible without the heavy involvement of the kuchi themselves as they are the only ones who truly know the Registan area.

Prior to mobilization, all four of the main Registan IDP camps were visited to discuss the project with camp leaders and obtain feedback on planned activities. After mobilization, the Kuchi Shura became the main instrument for communication between CADG and kuchi living in the IDP camps of Panjwayi and Maiwand. Kuchi leaders chose all guides and vegetation experts participating in the Registan study and assisted in the development of the project framework with Cordaid/VARA and CADG.

CADG will continue to work closely with the kuchi in May with our IDP camp surveys covering migration routes, return profiling, well management systems, and income generation.

B. Cordaid/VARA Coordination

Shortly after the Registan assessment was awarded to CADG, Cordaid announced that they had received funding for a similar project. In the interest of maximizing resources, CADG and Cordaid developed a joint work plan to coordinate activities and share responsibilities. The work plan developed in late February outlined procedures and a division of duties between the two organizations. Cordaid, with its Afghan partner organization VARA, has a great amount of experience working with Registan kuchi through its programs in the four IDP camps. While several meetings on the Registan study had been held at the Kandahar Department of Refugees and Repatriation (DoRR), these gatherings were too large to facilitate coordination of fieldwork activities. To organize the assessment strategy, a small task force was established with four members: a Kuchi Shura representative, Will Hall of CADG, Piet Tesselaar of Cordaid, and Mohammed Akbar of VARA. During these meetings, a work plan for training sessions, fieldwork team composition, geographic divisions, data collection, database development, mapping, security, and documentation was developed. An MOU (Memorandum of Understanding) for the coordination of activities was signed in early March after the work plan was completed.

C. Afghan Government Participation

The Kandahar Department of the Ministry of Refugees and Repatriation (MoRR) is clearly the lead government body for all work related to the plight of the Registan kuchi. Department President Haji Agha and his staff have worked extensively with Registan kuchi and their office is the focal point for communication between different assistance actors and the Registan task force (CADG, Cordaid, VARA, and Kuchi Shura). The Kandahar Department of MoRR made all arrangements for security, arranged weekly coordination meetings, and allowed staff members to take part in the desert assessment work. As part of the effort to involve government ministry staff in the work, Haji Agha and his staff selected three government representatives to be part of each fieldwork team. Amir Beland Agha (Department of Agriculture), Hajji Nick Mohammed (Department of Irrigation), and Mohammed Omar Jan (Department of Rural Rehabilitation and Development) were all selected to participate in the CADG portion of the fieldwork. Amir Beland Agha left for Registan with our assessment team on April 7 and stayed for ten days to assess vegetation and develop a work plan for range rehabilitation. Haji Nick Mohammed stated that he would be of no benefit within Registan and took consultant Kristina Toderich on a tour of irrigation systems near Takteh Pol to explain possible agricultural development areas for kuchi. Mohammed Omar Jan was not able to accompany our fieldwork team to Registan due to a scheduling conflict and will hopefully participate in our hydrological work in May.

As the Kandahar Department of Refugees and Repatriation (DoRR) is the lead government body for this project, CADG hired DoRR staff member Mohammed Qasim for two weeks during the desert fieldwork period to assist with administration and logisitics. It was felt that there was a strong need for the Kandahar DoRR to have a better understanding of CADG's work in Registan and Mr. Qasim's involvement increased the level of communication. During this two-week period, Mohammed Qasim worked at CADG's Kandahar office with the assessment staff and regularly reported our activities to DoRR President Haji Agha.

Kandahar Governor Yusuf Pashtoon's office provided all security guards and garnered assistance from the Kandahar PRT (Provincial Reconstruction Team). All security was arranged by Governor Pashtoon's NGO coordinator, Engineer Aziz.

D. International Consultants

The original Registan assessment budget listed only two international consultants for extended visits. After further review, it was felt that the consultancy budget would be better used with a larger number of consultants for shorter periods. At the present time, two international consultants have participated in this study. Both are experts in range ecology and drought-resistant crops.

Professor Tom Blake from Montana State University (USA) visited Afghanistan in late March to inspect crop/fodder test plots and develop a program for range rehabilitation. Professor Blake specializes in plant genetics, plant breeding, and molecular genetics. He recently served as director of ICARDA's germplasm program in Syria and has worked with drought-resistant crops for his entire career. For the test plot portion of this project, Professor Blake brought varieties of rangeland grasses from Central Asia that he felt would adapt well to the Registan environment. These grasses have been used successfully for range rehabilitation in similar areas of the United States and may transfer well to Afghanistan. A large portion of his work has been with barley and he brought drought-resistant high-yield barley varieties as well.

Kristina Toderich is Head of the Department of Desert Ecology and Water Resources Research at the Samarkand Division of Uzbekistan's Academy of Sciences. She previously visited northern Afghanistan as part of an assessment funded by Kyoto University and has extensive experience is range ecology, soil studies, desert ecosystems, pasture conservation, desert plant resources, and the improvement of rangeland productivity. In addition, she is one of the authors of "Rangelands of Arid and Semiarid Zones of Uzbekistan." She spent the month of April working in Afghanistan to determine range rehabilitation work plans, range capacity estimation, agricultural settlement opportunities, and crop/fodder testing.

In May, an international hydrologist and a third desert ecologist/drought-resistant crops expert will visit the Registan desert. Our international hydrologist will assess the results of the water source database, develop a work plan for the expansion of water sources, and

advise on the drilling of a test well to determine water levels in an untested area of Registan. Our third range ecologist will continue the work of Professor Tom Blake and Kristina Toderich- estimations of grazing capacity, opportunities for agricultural development, and workplans for range rehabilitation.

V. Implementation

Work started by assessing transportation routes into Registan and available material on the region's range ecology, rainfall, soil, and water sources.

A. Initial Research

While data on the Registan desert is sparse, available information was collected at the start of this project. As Cordaid/VARA have worked extensively with Registan kuchi, they were approached first for access to previous assessments. The only available Cordaid/VARA documentation consisted of:

- Cordaid/VARA January 2003 Economic Opportunity Assessment
- Cordaid/VARA June 2003 Phased Return to Registan Assessment
- rough map of well/navar locations with corresponding name/ownership data
- VARA animal/IDP population records for the four main camps in Panjwayi/Maiwand
- list of kuchi well diggers in the IDP camps

For maps of the desert and contiguous areas, the Kandahar map office gave CADG access to 1950s maps of the region that will hopefully provide a good indication of the level of desertification over time. More recent maps were provided by the Afghanistan Information Management Service (AIMS)- a 1:50,000 scale Russian-language map from the 1980s and a more recent 1:100,000 scale map from the United States Defense Mapping Agency (USDMA). In addition, the Kandahar AIMS office provided low-resolution satellite images of the region. CADG is still investigating the possibility of obtaining higher-resolution satellite imaging to estimate Registan's current grazing capacity. Normalized Difference Vegetation Index (NDVI) is a formula based on satellite imagery to determine vegetation health and a means of monitoring changes in vegetation over time. The formula is based on a calculation of visible and infrared bands of satellite imagery to determine the presence of green leaves.

The Danish Committee for Aid to Afghan Refugees (DACAAR) maintains a water database for southern Afghanistan with attribute data and GPS coordinates but could provide no data on existing wells in the Registan area. At the present time this database includes only DACAAR wells fitted with handpumps in nearby districts. All well information collected during this project will be forwarded to DACAAR for inclusion in their water database. The only necessary data to enter wells in the database are coordinates (longitude/latitude) and the type of well. The United Nations Environment Programme (UNEP) published a post-conflict assessment of the Afghan environment in 2003. It contains no in-depth analysis of the Registan area but they are currently conducting a capacity and institution building program, creating and building a

department of environment which will start organizing these kinds of assessments and environmental quality studies.

Due to schedule changes, additional research in Kabul government ministries will take place later in the project. Most of this research will be conducted in the Ministry of Mines and Industry.

During the initial research period, the majority of information on current and prior conditions within Registan came from Kuchi interviews within the four main IDP camps in Panjwayi and Maiwand. Kuchi nomads were interviewed over the course of a dozen visits to gather information on previous grazing capacity, migration routes, well conditions, tribal relations, and income generation. This work will continue in May with the use of survey forms developed with the assistance of consultants.

B. CADG/Cordaid Coordination Work Plan

The Registan assessment taskforce developed a work plan for the fieldwork and subsequent database development in late February. Three teams were created to assess conditions within Registan- one from CADG and two from VARA. Each team consisted of two vehicles, three kuchi guides, two NGO members, and representatives of different government departments. During the development of the work plan, it was decided that a single basecamp for all three teams would be established within the desert near the "Seven Wells" cluster area. This area was visited by Cordaid/VARA during a prior mapping expedition. It was later decided that due to the vast area being covered, a better method would be to change the basecamp location after well clusters in the surrounding area had been assessed. Likewise, the initial workplan to divide the Registan fieldwork geographically in north-south transects was changed and assessment areas were assigned by the basecamp leader in the field. There are a total of twelve main well cluster areas in Registan (*Appendix 2*): Garmsir, Jahanam, Paghazi, Chamay, Jandozai, Arab & Rustam, Nook Chee, M. Gorano, Choony, Attal, Owa Kahan, and Taband. Each fieldwork team focused on four of the twelve cluster areas but many clusters were divided between teams. For data collection, forms were designed to record information vital to the completion of the the project objectives. The following data was collected:

Navars	Cluster Location, Name, GPS Coordinates, Elevation, Width/Length, Depth, Volume, Existing Water (yes/no), Owner, Ethnic Group/Tribe, Current Residence of Owner, Condition (1-5), Damage Description, Additional Comments
Wells	Cluster Location, Name, GPS Coordinates, Elevation, Water Level (Meters), Water Depth (Meters), Well Diameter, pH, Chloride, Nitrate/Nitrite, Conductivity, Temperature, Owner, Ethnic Group/Tribe, Current Residence of Owner, Name of Owner's Father, Caretaker (If Present), Water Condition Opinion, Well Condition (1-5), Damage Description, Additional Comments
Vegetation	Cluster Location, GPS Location, Vegetation Status (1-3), Tree Status (1-3) Previous Vegetation Description, Current Vegetation Description

GPS Data Codes	Kuchis currently residing within Registan and animal counts (sheep, camels, donkeys, goats, etc.)
General Waypoints	Roads, structures, and other mapping data that does not fit on the other forms.

For navar and well assessment forms, the following numeric codes were used as data fields for estimating damage:

1- Excellent Condition
2- Functional/Minor Repairs
3- Not Functioning/Repairs Needed
4- Extensive Repairs
5- Completely Destroyed

The vegetation assessment form used the following numeric code to track changes in the desert:

1- More vegetation than before the drought.
2- Same amount of vegetation as before the drought.
3- Less vegetation than before the drought.

Tree assessment used the following numeric code system:

1- Trees Present
2- No Trees Present as Before Drought
3- No Trees Present- Removed

This analysis was obviously based on the recollections of kuchi vegetation experts working with the assessment teams. It is hoped that by bringing kuchis back to their traditional grazing areas, they have given fieldworks teams rough data on the present grazing capacity of the range. The tree assessment will give an indication of areas where trees have been removed and previously forested areas.

Water quality testing criteria was developed by CADG's staff hydrologist, Yar Mohammed.

pH	A measure of the acidic or basic (alkaline) nature of the water. The pH of the water will determine the toxic effects of substances such as iron, aluminum, ammonia, mercury.
Chloride	High deposits indicate poor water quality, usually a very salty taste. High levels could indicate the presence of more harmful substances.
Nitrate/Nitrite	Nitrate indicates the presence of bacteria in the water. It converts into nitrite which is extremely harmful to humans in high quantities.
Conductivity	Conductivity refers to the ability of a substance to conduct an electric current. A high reading usually indicates some form of pollution.

Temperature	Standard test.

C. Afghan Government/Kuchi Responsibilities

The Kandahar Department of Refugees and Repatriation (DoRR) took responsibility for all security arrangements and arranged for government employees to take part in the study. Government participants were given GPS and water-testing training. Shortly after the formation of the Registan assessment taskforce, it was decided that the kuchi leaders should act as spokesmen for the taskforce at all larger meetings with NGOs, UN agencies, and Afghan government representatives. The kuchi leaders also selected all guides for the fieldwork teams.

D. AIMS GPS Training and Database Development

In the initial stages of this assessment, different types of GIS software such as ArcView were reviewed with the intention of developing maps and databases to sort collected data. The Kandahar office of AIMS then volunteered to take over all GIS and database development work on the assessment. AIMS staff member Abdul Shafi Khan organized GPS training sessions for fieldwork team members, reviewed assessment form criteria, and created a printed version of the rough VARA well cluster map. At the present time, Abdul Shafi Khan is finishing work on the database software and later VARA and CADG employees will share data entry responsibilities.

D. Assessment Team

CADG's fieldwork team was headed by site manager Abdul Ali. Mr. Abdul Ali has extensive experience in the Registan desert and is a friend of many of the kuchi leaders. He has provided invaluable insight into the logistics of operating in different areas of Registan. Two different CADG surveyors worked on the assessment team in Registan at different times. Other participants were CADG staff hydrologist Yar Mohammed, Arghandab extension worker Nur Mohammed, Kandahar Department of Agriculture Plant Protection Specialist Amir Beland Agha, two drivers, and four kuchi guides.

VI. Registan Fieldwork

Fieldwork teams left for Registan on April 7. The original work plan called for breaks after every five days in the desert but Cordaid's schedule was altered, requiring that all fieldwork be completed by the end of April. CADG's assessment team operated in a similar fashion- staying in Registan from April 7 until the completion of most fieldwork on April 25.

A. Base Camp

The first basecamp was set in the Taband cluster area of Registan. This was later changed to three other locations as work progressed.

B. Transportation

Transportation was extremely difficult in the south-eastern cluster areas where deep sand increased travel times to wells and navars. Two different vehicles used by the CADG team for fieldwork proved to be unsuitable for the conditions and were replaced. This has resulted in increased transportation costs.

VII. Initial Findings

As the majority of fieldwork finished on April 25 and water database construction has not been completed, detailed information on the status of water sources in different areas is not ready for distribution. Initial findings regarding water sources in the twelve cluster areas are not positive. Very few wells are in working condition and existing water levels are often 120-140 meters. Navars are also in very poor condition throughout Registan. The pasture conditions are more positive and the kuchi vegetation experts have stated that they feel lack of water is the only factor preventing a return to Registan. However, our first two consultants found that the seed bank is depleted and range rehabilitation programs are necessary.

A. Needed Range Rehabilitation Work

Different techniques should be tested in the region for range rehabilitation. The most simple method that can be applied in the Registan desert and adjacent territories at the end of 2004 is direct seeding both by hand or using a mixture of seeds of basic species of fodder (imitating the natural state of pastures). At the first stage of a range regeneration program, vegetation or the creation of phytocoenoses (man-made planting) should utilize a mixture of native (more than 70%) and introduced (from different desert areas of Central Asia, Iran, Pakistan, Israel) forage species. Range rehabilitation can be divided into 20% shrubs, 65% semishrubs and 15% herbaceous plants.

The following non-native psammophytes (sandy type of vegetation) species are recommended for testing in the Registan:

Psammophytic/xerophytic plants (reclamation of sandy deserts)
1. Haloxylon aphyllum (Chenopodiaceae) – tree/tree-like
2. Haloxylon persicum (Chenopodiaceae)- tree-like
3. Haloxylon salicornicum (Chenopodiaceae)- tree
3. Salsola richteri (Chenopodiaceae)- woody tree-like
4. S. paletzkiana (Chenopodiaceae)- woody-tree-like
5. Acacia ammodendron (Fabaceae)- tree-like species
6. Calligonum arborescens (Polygonaceae) – tree like species
7. C. caput-medusae (Polygonaceae)- shrub
8. C. rubescens (Polygonaceae)- shrub
9. C. junceum- shrub

10. C. setosum (Polygonaceae)- shrub
11. C.microcarpum (Polygonaceae)- semishrub
12. C. rubens (Polygonaceae) – shrub
13. Ephedra strobilaceae (Ephedraceae)- shrub
14. Halothamnus subaphylla (Aellenia subaphylla, Cenopodiaceae)- shrub
15. Salsola orientalis (Chenopodiaceae)- semishrub
16. S. gemmascens (Chenopodiaceae)- semishrublet
17. Eurotia ewersmanniana or Ceratoides ewersmanniana (Chenopodiaceae) - semishrub
18. Artemisia diffusa (Asteraceae)- semishrub
19. Artemisia iranica
19. Astragalus unifoliolatus (Fabaceae)- shrub
20. A.villosissimus (Fabaceae)- shrub
21. A. maximowiczii (Fabaceae) – shrub
22. A. gossypius (Fabaceae)
23. A. glaucocanthis (Fabaceae)
24. Ammodendron kavirensis (Fabaceae)

The following trees and shrubs from desert/semidesert areas of Afghanistan are recommended for improvement of grazing capacity:

1. Ceratonia siliqua (Carob tree)

2. Various species of Tamarix (Chen gazai trees) for fuel in salty soil and improvement of salt-affected lands in the desert

3. Haloxylon salicornicum - tree for fuel, sand and dust stabilization forest/shelter belts

4. Prosopis spp - large bush

5. Various species of Calligonim - large bush well grazed by camels and goats

6. Various species of Ammodendron and Acacia - trees in desert/semidesert areas for fencing and fuel production

7. Zyziphus spina - large bush for improving of grazing capacity and fuel

8. Phillirea media- improvement of grazing capacity

9. Aellenia glauca- large bush for improvement of grazing capacity

To attain an optimum plant density and a diversified phytocenoses, the following seeding rates (kg/ha) are recommended:

Type Of Shrub	Seeding Rate (kg/ha)
Shrubs (with a low rate of germination)	8-10
Semishrubs (with a good rate of germination like Kochia, Artemisia)	.5-3.0
Different chenopods shrubs	5-8

Legumes such as Calligonum and Convolvulus species should have special pre-treatment of seeds and be tested for seed rate germination due to the presence of hard seeds.

In the sandy desert or sand dunes, the effective establishment practice is to furrow and strip sow. Sowing on sandy soils is carried out by harrowing or soil disking over wide strips (30-35mm or more) separated by 15-20m of undisturbed rangelands. On the fixed sands or interdune spaces with more compact substrate, the most efficient method is the use of open furrow which ensures water accumulation in the pits and also possible leeching of soluble salts from the top-soil layers. The optimal depth of seeding is less than about 2-3cm for most species and in all cases is always less than 5 cm. Pitting plow technology will be also available for the superficial regeneration of Registan range.

Seeding and re-seeding is to be arranged in December-January during the cold and wet weather. It is important to start seeding only after the cold weather has settled in, as rodents, reptiles, and insects are in hibernation and will not collect, store, or eat the seeds. The seeding technique in Registan desert will coincide with the period of grazing of livestock by kuchi. Improved ranges can be grazed with appropriate management after 2-3 years. If well managed, some good strands of shrubs and semishrubs on improved ranges last as long as 20-30 years or as long as 40-50 years when sown with Haloxylon spp and local trees (Hajo, Chen, Gazai). The life span of many perennial herbs in man-made pastures may be shorter but phytocoenoses as whole may last much longer because of self-reseeding and self-regeneration.

B. Sand and Dust Stabilization

Stabilization can be accomplished by the establishment of green forest belts (shelter belts) through tree planting . Each sown strip should be 20-25m wide and positioned (as much as possible) perpendicular to the prevailing wind. The tree and/or tall shrub shelterbelt strips should be separated by 150-300m of undisturbed natural rangelands. With such a distribution, 10-15ha per 100ha can be protected from soil and wind erosion. The area to be sown can be prepared in advance by plowing to a depth of 20-25cm and then harrowing after seeding. Hand seeding can be practiced and aerial seeding will effectively cover wide swaths of land where the soil is less arid. The optimum target density is around 900-1200 trees/ha. Kuchi IDPs can be used for labor. The sandy desert area adjacent to the Garmsir area of Registan is a good candidate land for the creation of a 'green wall' with a sand fence along the perimeter. Low sand and water tolerant vegetation, arranged in optimized checkerboard patterns, will create an artificial ecosystem to stabilize the dunes. A 6-foot-wide gravel platform will hold sand down and encourage a soil crust to form. A similar project named the "New Green Wall of China" was started last year for the stabilization of sands in Taklamakan desert of China but

these methods are not recent advancements. In 1935, overgrazing and drought caused 850 million tons of topsoil to blow off the southern plains of the United States, leaving 4 million acres barren and creating the Dust Bowl. To address the problem, the newly formed Soil Conservation Service introduced the Shelterbelt Project - a 100-mile-wide strip of native trees bisecting the country from Canada to Texas. In a few years, it helped to reduce the amount of airborne soil by 60 percent.

The above proposed range and forestation projects are not only useful for increasing rangeland productivity but also for sand dune stabilization and protecting settlements from sand and dust storms.

C. Semi-Nomadic Pastoralist Systems

Cultivated rangelands as alternative feed resources during drought should be applied in the key resource areas where livestock may be herded in relatively restricted areas within an agropastoral setting. This is possible in most sections except the deep sand areas of Registan where more extensive pastoral production systems are required involving frequent transhuman movement. Before such intervention is implemented, it is important to know how most pastoral herds use the fodder landscape in dry areas, dry seasons, and dry years. These are the 'key resources' that sustain animals in times of fodder shortage.

The following sandy/loamy semidesert xero-mezophytic fodder species are valuable for regeneration of rangeland under foothill semidesert conditions:

1. Kochia prostrata (Chenopodiaceae)- shrub
2. Camphorosma lessingii (Chenopodiaceae)- shrub
3. Kochia scoparia (Chenopodiaceae)- shrub
4. Artemisia turanica (Chenopodiaceae)- shrub
5. A. halophylla (Chenopodiaceae)- shrub
6. Agropyron spp. (different species from this genus Poaceae)- perennial grass
7. Hordeum spontaneum (Poaceae)- perennial grass
8.H. vulgare (Poaceae)- perennial grass
9. H. bulbosum (Poaceae) – perennial grass
10. H. ischnatherum (Poaceae)- perennial grass
11. H. ithaburense (Poaceae)- perennial grass
12. Mellilotus officinalis - legume
13. Onobrychis sativa (Fabaceae)- biennal plants
14. Trifolium spp. (Fabaceae)- legume
15. Astragalus alopecias (Fabaceae)- perennial herb
16. A. agameticus (Fabaceae) – perennial herb
17. Alhagi pseudoalhagi (Fabaceae) – perennial herb
18. A. persarum (Fabaceae)- perennial herb
19. A. canescens (Fabaceae)- perennial herb
20. Cicer spp. (Fabaceae)- biennal or annual herb
21.Caragana grandiflora (Fabaceae) – tree
22. Acacia spp. *should be tested what species from this genus)- tree

23. Glycyrzrhiza glabra (Fabaceae) – perennial – forage and medicinal plant
24. G. aspera (Fabaceae) –perennial herb
25. G. zaissanica (Fabaceae) –perennial herb
26. Secale spp. (wild species), Poaceae- perennial herb
27. Sorghum spp.(Poaceae)- perennial herb

Moreover, some annual chenopods and grasses have been tested in man-made pastures of Central Asian deserts as component of improved or regenerated rangeland. These include the following chenopods: Salsola paulsenii, S. schlerantha, Climacoptera lanata, Krashenikovia lanata, Halimochnemis villosa, Gamanthus gamocarpus, Horaninovia ulicina, and Atriplex spp. Tested annual and perennial grasses include: Poa bulbosa, Eremopyrum orientale, Bromus tectorum, Agropyron desertorum, Aeloropus litoralis , and Carex physodes.

A seed/testing experimental plot for testing of seven drought tolerant fodder plants from Kyzylkum desert (Uzbekistan) were planted in the Bolan experimental farm (Lashkar Gah, Helmand province).

The following sowing/operations technique was used:

Land preparation: Minimal land preparation was done before seeding. A rough tillage was necessary to provide sufficient moisture and eliminate competition from undesirable plants. The optimum depth of seeding was less than 1-2 cm for most f the above-indicated species and in all cases is less than 5cm.

For seed/testing rate of germination we used plastic tunnels. Soil of propagation was of light structure (35-40% sandy soil- not more than 25 % clay , 40% inert substrate with an advisable pH - between 6.5-8.2). The plastic vessels were placed in such a way that air ventilation was possible. Optimal temperature is 25-28C during the day and not less than 15C during the night.

Transplantation: After germinating plants grow to 3.9cm–4.5 cm, they will be transferred into the crop/fodder test plot in the Garmsir area of Registan.

The trial experimental plot in Lashkar Gah (Bolan Experimental Farm) includes:

Salsola orientalis (12 bags)	***Kochia prostrata (12 bags)***
Halothamnus subaphylla (12 bags)	***Ceratoides ewersmanniana (12 bags)***
Haloxylon aphyllum (12 bags)	***Agropyron desertorum (12 bags)***
Artemisia turanica (12 bags)	***Artemisia turanica (12 bags)***
Agropyron desertorum (12 bags)	***Agropyron desertorum (12 bags)***
Agropyron desertorum (12 bags)	***Agropyron desertorum (12 bags)***

We have already noted the first seedlings on some of the above drought-resistant plants.

D. Large Scale Range Rehabilitation/Livestock Income Generation

Professor Tom Blake is currently finishing his consultant report and has developed a plan for a major range rehabilitation program in Registan. While meteorological records indicate an annual rainfall ranging from 140mm/yr in eastern Registan to 70mm/yr in western Registan, productive desert range can be developed with as little as 60mm of rainfall per year. Water harvesting, thoughtful species allocation, and management are critical factors in the development of productive dry range. The 200km x 500km Registan area could support a thriving economy through livestock production. Perhaps half has sufficient water holding capacity to be useful in water harvesting efforts. In an area of $10m^2$ (a pit), 100mm of rainfall adds up to one cubic liter of water per year. If water harvesting is 50% successful (trapping half the rainfall), that means that a plant growth zone $1m^2$ would have access to a column of water equal to 500mm. That's far more than is required for highly productive forage crop production. Pitting plows that can produce catchments will permit water harvesting with an efficiency of approximately 50% or better and allow for the planting of 10% of the useful landscape. If successful, this will dramatically reduce both wind and water erosion, converting at least half of Registan into economically productive land.

This is a large scale work plan to pit and plant 50,000 km^2 of Registan desert. Assuming that productivity is 1/10 that of reasonable rangeland elsewhere (4t/ha), this still equals 20 million tons of forage and feed- enough to support 10 million animals. In terms of income generation, four million animals harvested annually for meat at $100/head equals $400 million. Annual wool production based on 6 million sheep (producing wool worth $20/head) equals $120 million.

The pitting plows needed for this type of project have been available for decades, and were widely utilized to help establish vegetative cover in the arid West of the United States. They till, compress, and form soil into small bowls. One pitting plow can prepare approximately 100ha/day. One thousand plows would prepare one hundred km^2 per day. The 'tillable' part of Registan could be pitted in four years, utilizing the cool season for pitting and planting. Perennial, persistent plant species that are well-adapted to the microclimates available in Registan should be used for this program.

This provides an excellent system for the use and training of kuchi IDPs, possibly as part of a WFP-sponsored food-for-work program. They can provide the labor force needed to produce the thousand seedlings required per hectare, and this labor force can also be utilized to plant the seedlings. Keeping the planting up with the pitters would require about 5,000 laborers. Managing the plastic houses and coldframes used for seed germination would require another 1,000 laborers. All participants (equipment operators, greenhouse workers, planters) would require training and adaptation.

E. Bahoric Agriculture As Alternative Pastoralist Livelihood

This is a type of crop farming used in the rainfed/non-irrigated arable lands of all Central Asian countries.

Grains and Straw

Various drought-tolerant species and varieties of Hordeum, Agropyrom, Cecale, Triticum, Sorghum, Zea mays , Cicer (nohat), Medicago sativa (alfalfa), Onobrichys, sandberg bluegrass, russian wildrye, inland saltgrass, and alkali saltgrass can be tested on small, seminomadic pastoralist farms.

Cultivation of Cash Crops

1. *Charthamnus tinctorius (saflora) from Asteraceae* is a kind of sunflower strongly recommended for cultivation on the foothills or marginal lands of Registan deserts for oil production. In addition, this plant is also good forage for all livestock, as well as a potential plant for silage or winter concentrate.

2. *Species of genus Sesame (kunjut)* can also be recommended for oil-production.

3. *Oases Establishment*

In the manuscripts of 10th century, travelers noted Garma (Jarmak) 'oases'(for nomadic pastorlist activity) in the Persian Basin Desert that served as resting places for caravans crossing Central Asia in medieval times. In the writings of the traveler Maqdes there is a note that "in 1052 from Garmsar to Tabas there were water tanks beside small dams at every 2 farrangs [distance measurement]; the dams served to mark the route in the deep desert; they must be intended to service travelers." (Moqaddas, p.129, medieval reports)

The establishment of a modern type of 'oases' system can be implemented after our survey of 'key resource Registan desert sites.' It is extremely important to clearly differentiate between settled agriculture in the desert and nomadic life.

3a) *Greenhouse Installation*

The installation of plastic greenhouses could provide vegetable production for kuchi families. NETAFIM Family Greenhouse technology could be very useful for the reclamation of sandy/loamy areas of Registan desert.

Such kind of activity can be located around boreholes, watering places, functioning wells etc. In these areas of the desert, it will be possible to initiate:
- reseeding with legumes
- planting singular trees
- efficient breeding and fattening (pregnant animals, lactating females, new borne lambs etc.) operations

- encouragement of female participation in pastoral development and natural resources management
- production of simple thorn (from Lycium, Alhagi) fences to exclude any outside intervention, including migrant herders

F. Biosaline Agriculture in the Registan Desert

For the reclamation of the sandy/clay saline wet soils it is recommended to use different species of *Tamarix.* There are 2-3 local species that can already be used for reforestation and sand dunes fixation (on high saline water table). These plants are good for fuelwood , carpentry, and building material. People can use it to treat gastric disturbance, respiratory disorders, rheumatism, and arthritis.

Phragmites Plant Communities

In the natural desert/tugai communities, especially on dry river banks or on the soils with high water table, this plant always forms pure stands that can be used by local people as common building material or a raw material for paper and chemical industries. It is also used for handicrafts. Drainage canals along the edges of the Registan desert(Garmsir, Takteh Pol, and along Arghangab river) are completely full by dense stands of Phragmites (red grass). By cleaning canals, drainage systems will increase water discharge into irrigation systems. Phragmites can be propogated easily and used for hay and silage (stored winter forage).

G. Sericulture Production

On the marginal lands of the Maiwand and Panjwayi districts, it is possible to cultivate Morus alba, M. nigra, and M.seratta trees for both ornamental purposes and silkworm feed. Silkworm production is one income generation possibility that has yet to be fully investigated. Wood from these trees is recommended for building material. The bark and leaves of these species can be used for yellow and black dyes. The fiber of branches is suitable for rough spinning. Paste from branches is a good material for manufacturing high quality paper.

While sericulture production will be of good benefit to IDPs, fifty percent of trees have not survived the drought. For such a project, it is necessary to establish experimental demonstration plots- possibly at CADG's Zhare Dasht demonstration farm. Production can start with two local Morus species- M. alba and M.setaria (including its hybryds: M. bombycis x M.alba, and M.alba X M. multicaulis)- from cuttings. Production work is similar to that of production from grape or pomegranate cuttings. A plot of about 1600 cuttings in total is optimal for the beginning stage. This process may be initiated at any time of the year and will take at least 2-3 years to obtain mature trees for full exploitation. Such planted trees can be used for 20-35 years or more.

Sericulture training should be start immediately with the involvement of specialists from Central Asia or China. Silkworm feeding lasts 2-3 months and may be timed to

January/February –April (seasonal activity). It is an optimal home activity for women and their childen until livestock keepers graze their flocks in the Registan desert. To establish this at the selected "key resource sites" of IDPs, special sheds and trays can be used for keeping silkworms during their ontogenetic development. There are two alternative variants: individual shed/trays for one family or small groups (3-5 families together). A market research study should be conducted. Silk could be utilized in the local manufacture of carpets, which are much more expensive than wool ones, as well as for scarves and thread embroidery. Such IDP activity should be researched by Cordaid, VARA, and UNAMA in close collaboration with CADG.

H. Water Source Conditions/Water Source Expansion

Between April 7 and April 25, the CADG fieldwork team mapped 469 navars in the following well cluster areas: Jandozai, Choony, Attal, Owa Kahan, Taghazi, Jahanam, and Garmsir. A total of 76 wells were mapped in the following cluster areas: Ghamay, Jandozai, Choony, Attal, Owa Khan, Taghazi, Jahanam, and Garmsir.

While database construction is currently underway, the highest water levels were found at 21 meters in cluster number 1 (Ghamay). The lowest well water level was 139.5 in cluster number 6 (Choony). These water levels indicate only CADG's findings.

Appendix 2 contains a map of all well cluster areas.

The bulk of Registan hydrological analysis will be conducted in May with the arrival of an international hydrologist and the drilling of test well. One possibility for settlement is the relocation of kuchi to northern areas of Registan if water levels, pasture conditions, and the political climate allows. At the present time, the water source database is being designed. The database will combine the data acquired by all three fieldwork teams and should be completed for distribution in mid-May.

VIII. Continuation of Work

The Registan assessment work will continue until the end of June 2004.

A. Research

Previous studies of the Registan area still need to be located. A large portion of this research will be conducted in various ministries in Kabul.

B. Test Well

Project funding has been provided for the drilling of a test well. During the next few weeks, a site will be selected for this work. The aim of this procedure is to determine water levels in an area of Registan where no wells currently exist. This might provide a way for previously unused areas of Registan to sustain the return of kuchi IDPs who have

retained their animals. This work will be done after consultation with our international hydrologist who will arrive in Afghanistan in May.

C. Camp Survey

Survey forms are being developed to gather information on income generation, migration patterns, well maintenance, and political organization. CADG is also profiling kuchi families with substantial herds who would like to participate in return programs. The United Nations High Commission for Refugees (UNHCR) is also currently doing profiling work in the four main Registan kuchi camps and their data will be of great benefit to this assessment.

Appendix 1: Fodder/Crop Testing

Under this assessment, CADG is currently running three test plots to develop a work plan for range rehabilitation and possible drought-resistant agriculture. The two main plots are in the Helmand province- one in the Garmsir area of Registan and the other at the Bolan experimental farm. In addition, we are currently growing saltbush in a test plot in the Zhare Dasht desert outside of Kandahar. These test plots will determine whether alternative types of fodder will grow properly in the Registan desert for future range rehabilitation programs. They will also determine whether kuchis can create a sustainable economy based on agriculture.

Fodder Tests (Toderich)

1. *Kochia prostrata (L) Schrad, variety Otavnyi, Chenopodiaceae*
   Perennial semishrub (height 30-95 cm) with a life span of 7-12 years.
   Expected yield: biomass 1.2-2.0 t/ha. Used for haymaking.

2. *Aellenia subaphylla or Halothamnus subaphylla C.A. Mey, Chenopodiaceae*
   This polymorphic woody bush (height 5-160 cm) is a green, strongly branched plant with a life span of 7-25 years. Propagation by seeding and cutting/ transplanting is available.
   It is a good fodder plant for sheep, camels, and goats - especially in late spring, autumn, and winter. The bush is widely used for rangeland improvement. Expected yield: forage biomass- 0.5-0.8 t/ha; seed production: 0.15-0.30 t/ha.

3. *Haloxylon aphyllum (Minkw) Ilijin- Black saksovul, Chenopodiaceae*
   This is a tree or tree like species (height 4-10 m) with a life span of 50-90 years. It is one of the most important range plants in the Middle and Central Asian arid/semiarid zones. Young vegetative stems and fruits are valuable food for all livestock nearly all year round. Shepherds consider it a highly beneficial plant and it is extensively used for rangeland improvement.

4. Ceratoides ewersmaniana or Eurotia ewrsmannianna Stschegl. Ex Losinsk
   Perennial small medium shrub (height up to 120 cm) strongly branched at the base. Rough forage. Good for livestock all year round as well as for rangeland improvement and natural pastures diversification. Also used as fuelwood. Expected yield: 0.03-2.0 t/ha.

5. Salsola orientalis S.G.Gmell or S. rigida Pall.
   This is a perennial dwarf shrub (height 15-70 cm) branched from the base with a life span 7-25years. It is excellent forage, grazed eagerly by all livestock and good value fodder in autumn-winter. The shrub is also used for hay-making and is a drought and

salt tolerant plant. Used for pasture regeneration. Expected yield varies from 0.81-1.07 t DM/ha to 2.16 on improved cultivated pasture. It is easy to introduce and will grow on the gray-brown, clay, gravelly, or salty soil.

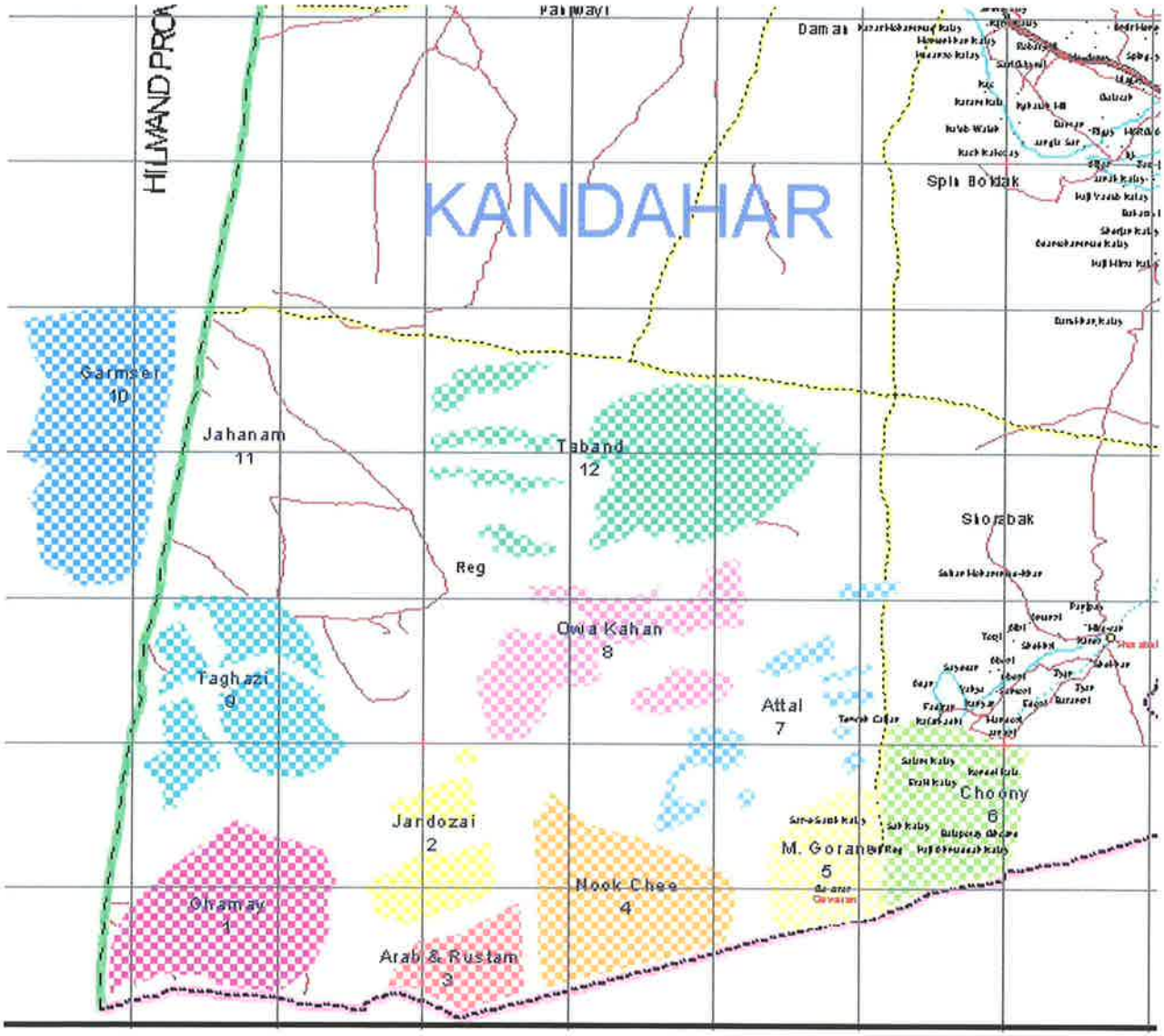
6. *Agropyron desertorum (Fisch) Schult, Poaceae*
   Perrenial loose, tough bunch grass (height 25-90 cm) The root system is filamentous, extending to depth 1.0-1.5 m. It is excellent forage for all livestock before flowering in the spring early summer- a very competitive with other plants on the range, especially weeds. Drought and cold resistant and moderately salt resistant. Used for hay-making and concentrated forage. Improves soils structure as well.

7. *Armemisia turanica H. Krasch ex. P.Pol Asteraceae,*
   Perennial low shrub (height 30-50 cm) with a life span of 7-25 years. It is one of the best rangeland feed for all livestock as it is both drought and frost tolerant. The shrub is valuable for the creation or rehabilitation of autumn/winter pastures as well as for the improvement of degraded arid lands. Expected yield: 0.25-2.54 t/ha depending on soils and state of pastures. Is also valuable for haymaking. Local people can use as fuel.

Fodder/Crop Tests (Blake)

1. *Pasthyrostachys juncea*- Russian wildrye, Bozoisky variety
2. *Alkali grass*
3. *Agropyron desertorum* – Crested wheatgrass, Hycrest variety
4. *Artemisia frigida* – fringed sagegrass
5. *Poa sandbergii* – Sandburg bluegrass
6. *Distichlis spicata* – Inland saltgrass
7. *Atriplex aperta* – Moundscale, Wyntana variety
8. *Krascheninnikovia lanata* – Winterfat, open range variety
9. *Buteloua curtipendula* – Sideoats grama, Bocu variety
10. *Sanfoin*
11 *Hay barley* – Hayes variety
12. *Drought tolerant feed barley* – Haxby variety

Appendix 2: Registan Map



Appendix 3: Soil/Climate Data

The Registan desert stretches along the southern side of Kandahar and Helmand provinces up to Nimroz province. Actual climatic data of the Registan desert area is not available; however, it has similar environmental conditions as the rest of Kandahar, Helmand, and Nimroz provinces. Climatic data of these provinces are presented in the following table:

Province	Annual Precipitation (mm)	Annual Evaporation (mm)	Average Annual Temp. (C)	Mean Monthly R.H. (%)	Mean Monthly Wind Speed (km/hr.)	Elevation (m)
Kandahar	182	2927	18.3	26.61	3.2-8.8	1000
Helmand	90	2920	19.4	30.76	5.3-13.7	780
Nimroz	76	4306	22.4	25.55	7.2-24	490

Soils of the Registan desert area have not been surveyed. Soils of the nearby areas in Kandahar and Helmand provinces belong to the following Great Soil Groups:

1) Clciorthids
2) Torripsamments
3) Torriorthids
4) Camborthids
5) Calciorthids
6) Gypsorthids.

Soils of the area shows alkaline reaction with pH usually ranges 8.0-8.5 (average 8.2). They are mostly calcareous soils and covering an impermeable compact layer of conglomerate and/or other centered material. Soils are usually low in organic matter (less than 1%), nitrogen, available phosphorus, and some micronutrients. Most of the soils contain varying quantities of soluble salts and/or exchangeable sodium. Soil texture varies from loamy sand to clay loam. Silt loam seems the dominant soil textural class in the area. Soil erosion, particularly wind erosion is a serious problem in the area. The area is generally flat, usually with less than 1% slope. Hills of sand are common in Registan desert area.