Nara Desert, Pakistan

Part I: Soils, Climate, and Vegetation

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Introduction

Rangelands constitute an important component of the agricultural system in Pakistan. Besides providing grazing support for the 93.5 million livestock, they are a major source of fuel and timber and natural habitat for wildlife. Because of the arid and semiarid environment and limited irrigated facilities, these areas cannot be converted into cropland. However, this vast natural resource covering over 60% of the country provides great potential for livestock grazing and dry afforestation.

A range management program was initiated for the first time in Pakistan with financial and technical assistance of the U.S. government in Baluchistan province.[1] This project provided a base to identify the problems and their possible solutions by policymakers and natural resource mangers. A number of research-and-development projects for range management were launched in different ecological zones. These initial projects were based on a demonstration of water harvesting and sand dune stabilization techniques. Various parts of the country are explored for the establishment of local and introduced forage species. These range management programs are undertaken in many parts of the country, such as Baluchistan, the Pothwar ranges, salt ranges, Rabbi Hill, the Thal Desert, Cholistan, D. G. Khan, Kohistan, and the Tharparker Desert. The study area at Nara Desert was not previously included for study by the government. The authors explored this area floristically and recorded 160 species, a number higher than that in the Cholistan Desert, which consists of 115 plant species.[2]

A view of stabilized sand dune with dense population of *Aerva javanica*, *Calligonum polygonoides*, and *Dipterygium glaucum*.

The Nara Desert, an extension of the Great Indian Desert, is located in Sindh, which is the southeastern province of Pakistan. These regions are also known as Nara Thar and Parkar Thar, respectively (Fig. 1).[3] These names are used in the present study. The desert lies between 26°–28° north and 68°–70° east, and is comprised of about 23,000 km^2. The altitude is between 50 and 115 m above mean sea level. The study area is semiarid in nature. The topography is distinctly marked with sandy hills, steep slopes, and vast low-lying areas locally known as *Patt*. The accumulation of sand in a huge mass in the form of a hill is known as a sand

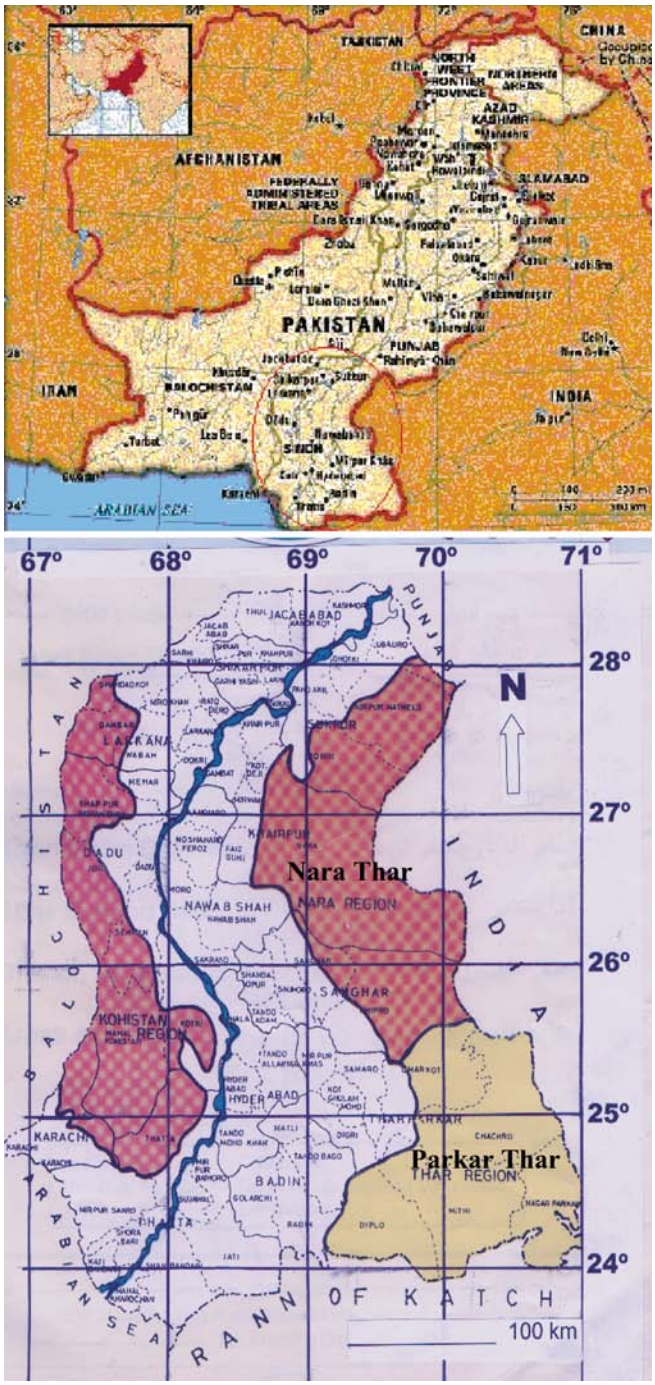
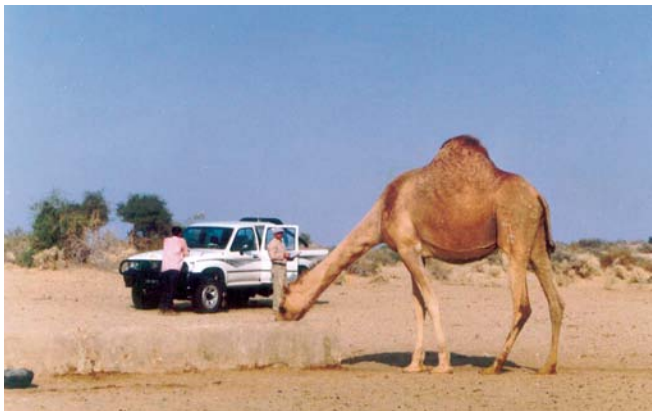


Figure 1. Map of Pakistan showing the location of the Nara Desert.

dune/ridge. A dune has a crest, the topmost portion; a swale (flank), the middle portion; and a foot, the base of the dune. The area between 2 successive dunes is called an interdunal valley. The dunes are of 2 major types: stabilized or unstabilized. The unstabilized dune is a movable heap of sand, not really fixed on the ground, but can be moved with wind action. It lacks or has scanty vegetation, whereas the stabilized dunes are characterized by mixed populations of plant species. The area under investigation has stabilized dunes with low-lying flat areas: the valleys. The typical features responsible for such dunes are the wind, which blows steadily and results in the collection of sand on the windward side, forming a long slope of sand. On its other side, the leeward side, the dune drops in a sharp, curving cliff. Hummock dunes are also common features of this area. These are formed when sand gets trapped around perennial trees or shrubs growing over the top of the sand dunes (crest) or its sides (slopes). It has been observed that the majority of the older bushes are growing on the hummocks, whereas the younger ones are found without the hummock.

The Thar in Hyderabad and Khairpur Division (at present Hyderabad, Mirpurkhas, Sukkur) is formed by sand, silt, salts, and fine seashells blowing from Runn of Kuchh, extended up to Rohri in recent geological times.[4] In Tharparkar districts, because of high wind velocities, the sand hills, sometimes 300 feet high, lie southwest to northeast along the direction of the wind. In southern Khairpur, where wind velocity decreases, the direction of the sand hills changes slightly and becomes south-southwest to north-northeast. In northern Khairpur and Sukkur districts (presently including Ghotki district), the sand hills lie south–north. The sand hills of Khairpur are not as high as those of Thar. There are *Dhandh* (lakes/wetlands), which are formed by rainwater sweeping down the sand mounds. Seepage from the canal recharges the *dhands* in the close proximity of the Nara Canal continuously. This canal is one of the Sindh's 14 main canal systems and originates from Sukkur Barrage at Sukkur. This canal is perennial except for a closure period in mid-January. The rainwater percolates down the sand, where it is held by impervious clay that lies under the sand. The water so trapped or perched out in the form of springs is locally called *Sim.* This process forms all lakes in the desert area. The salt content in these lakes depends on the salts dissolved by rainwater and appearing as *Sim.* Water in most of the *dhands* is brackish, as these salts keep accumulating in them year after year unless removed by humans. When water evaporates, cakes of salt are deposited.

Prosopis cineraria forms pure stands in low-lying flat areas (interdunal valleys).



A camel drinking water from a dugout well in *Taraies*.

Tanka of rainwater stored for drinking purposes.

In some cases, water from wells in the neighborhood is available at the higher water table and then in *the dhands* and is potable. This is actually the *Sim* water, which, instead of seeping into lakes, seeps into the wells.

The *dhands* are shallow, but some of them extend about a mile in length. At one time, these lakes yielded soda ash. *Dhands* close to Nara are even now always full of water because of seepage from the canal. This water is no longer so brackish and has instead become the abode of crocodiles and water-loving reeds and canes like *Sar*. The lakes away from the canal are highly saline. The range of alkalinity of the lakes of Khaipur is higher than that of the Thar lakes. There is always a dispute about the causes of this phenomenon. It is believed that the salt of the lakes, whether in Khairpur or in Sanghar district, are basically of similar ingredients, but in the Khairpur lakes, because of the presence of some bacteria or organic material, the sodium salts are converted into soda ash.

The soil of the desert is sandy silty and moderately calcareous. The entire study area consists of level and gently sloping plains broken by sand dunes. Brown sandy soil, desert soils, and gravelly foot slopes constitute the major soil types in the area. The color of the soil of this area is generally gray, grayish-white, or yellowish-gray. The desert margin consists mostly of flat ground having saline/sodic soils commonly known as *Kharror,* with pH ranging from 7.8 to 8.9 with a mean of 8.33. The electrical conductivity, a measure of the concentration of soluble salts, ranges from 0.15 to 29.3 with a mean of 2.83. Organic carbon content was very low, ranging from 0.14% to 0.78% with a mean of 0.33%.

Climate

Nara is a hot arid to semiarid sandy desert. The mean minimum and maximum temperatures are 20° and 45°C, respectively. The hottest months are May–July, where temperatures range from 47° to 51°C. The lowest temperature, 20°–28° C, was recorded in January. Aridity is the most characteristic feature of the Nara Desert, with wet and dry years occurring in clusters. The mean rainfall ranges from 88 to 135 mm. Rainfall is received mostly during the monsoon (mid-July to the end of August). Winter showers take place during the months of December through March and are of low intensity. No rainfall took place during the study period (1998–2003) in either of the seasons. Therefore, this period was regarded as one of drought.

The typical architecture of houses (*Chunra*) in the Nara Desert.

Exposed roots of *Salvadora oleoides* due to soil erosion.

Table 1. The most common plant species recorded from the Nara Desert, Sindh, Pakistan				
Species no.	Plant species	Family	Local name	Life form/habit
1	*Acacia jacquemontii*	Mimosaceae	Banwar	Shrub
2	*Acacia nilotica*	Mimosaceae	Sindhi Babur	Tree
3	*Acacia senegal*	Mimosaceae	Angrezi Babur	Small tree
4	*Aerva javanica*	Amaranthaceae	Booh	Subshrub
5	*Aristida adscensionis*	Poaceae	Lumb Gaah	Grass
6	*Aristida funiculata*	Poaceae	Lumb Gaah	Grass
7	*Arthrocnemum indicum*	Chenopodiaceae	Laano	Shrub
8	*Calligonum polygonoides*	Polygonaceae	Phog	Shrub
9	*Capparis decidua*	Capparidaceae	Kirar	Tree
10	*Capparis spinosa*	Capparidaceae	Golaro	Subshrub
11	*Cassia italica*	Caesalpiniaceae	Ghora Wal	Subshrub
12	*Carthamus oxycantha*	Asteraceae	Uth Chaaro	Subshrub
13	*Cenchrus biflorus*	Poaceae	Mohabbat Buti	Grass
14	*Cenchrus ciliaris*	Poaceae	Bhurt	Grass
15	*Cocculus hirsutus*	Menispermaceae	Fareed Buti	Shrub
16	*Cynodon dactylon*	Poaceae	Chhabar	Grass
17	*Cyperus arinarius*	Cyperaceae	Moniah	Sedge
18	*Cyperus conglomeratus*	Cyperaceae	Moniah	Sedge
19	*Dactyloctenium aegyptium*	Poaceae	Gandheer Gaah	Grass
20	*Desmostachya bipinnata*	Poaceae	Drabh	Grass
21	*Dichanthium annulatum*	Poaceae	Dinohi Gaah	Grass
22	*Dinebra retroflexa*	Poaceae	–	Grass
23	*Dipterygium glaucum*	Brassicaceae	Phair	Subshrub
24	*Echinops echinatus*	Asteraceae	Kanderi Wal	Subshrub
25	*Eragrostis minor*	Poaceae	Makhani Gaah	Grass
26	*Fagonia indica*	Zygophyllaceae	Dramaho	Subshrub
27	*Grewia tenax*	Tiliaceae	–	Shrub
28	*Haloxylon stocksii*	Chenopodiaceae	Sacho Laano	Shrub
29	*Indigofera oblongifolia*	Fabaceae	Jhill	Shrub
30	*Lasiurus scindicus*	Poaceae	Booro	Grass
31	*Leptadenia pyrotechnica*	Asclepiadaceae	Khipp	Shrub
32	*Ochthochloa compressa*	Poaceae	Mandhano Gaah	Grass
33	*Panicum turgidum*	Poaceae	Sewan	Grass
34	*Prosopis cineraria*	Mimosaceae	Kandi	Tree
35	*Prosopis juliflora*	Mimosaceae	Devi	Tree
36	*Salsola imbricata*	Chenopodiaceae	Laano	Shrub
37	*Salvadora oleoides*	Salvadoraceae	Jaar/Peroon	Tree
38	*Saueda fruticosa*	Chenopodiaceae	Laano	Shrub
39	*Setaria pumila*	Poaceae	Sawri	Grass
40	*Stipagrostis plumosa*	Poaceae	Lumb Gaah	Grass

Table 1. Continued

Species no.	Plant species	Family	Local name	Life form/habit
41	*Tamarix aphylla*	Tamaricaceae	Lao	Large tree
42	*Tamarix indica*	Tamaricaceae	Lai	Shrub
43	*Tribulus longipetalus*	Zygophyllaceae	Bakhro	Subshrub
44	*Zizyphus nummularia*	Rhamnaceae	Jhanguri Ber	Shrub

There is a scarcity of water in the Nara Desert. Water supplies are scanty, limiting agriculture activity. The groundwater resources are limited and are met at a depth of 50–300 feet from the surface. The only source of water for human beings and livestock is from dugout/natural ponds in which the rainwater is stored during the monsoon.

Natural Vegetation

Floristically, 160 plant species belonging to 118 genera and 45 families were collected from the Nara Desert during 1998–2001. Of them, 1 species of gymnosperm, 3 sedges, and 20 grass species were determined. Statistically, the area contains 21% of the plant families, 8% of the genera, and 3% of the total species of Pakistan.[5]

The vegetation in this region is typical of arid regions and consists of xerophytes, which are adapted to extreme temperature fluctuations and a wide variety of edaphic conditions. Most of the Nara Desert is covered by stabilized sand dunes. The entire area is occupied by a wide range of nutritious, palatable, and drought-tolerant species of herbs, shrubs, and trees. Although these plants are slow growing, they respond very well to favorable climatic conditions and provide ample biomass for livestock consumption. Important genuses of grasses include *Aristida, Cenchrus, Cynodon, Dactyloctenium, Desmostachya, Dichanthium, Dinebra, Eragrostis, Lasiurus, Ochthochloa, Panicum, Setaria,* and *Stipagrostis* along with sedges such as *Cyperus* and *Fimbristylis*. The most common and favorite forage grasses and browsing shrubs and trees are presented in Table 1.

Of these, *Acacia nilotica, Acacia senegal, Capparis decidua, Prosopis cineraria, Salvadora oleoides,* and *Tamarix aphylla* are notable indigenous trees in the Nara Desert.

Conclusion and Recommendations

Cyperus arenarius and *C. conglomeratus* are highly palatable and more desirable than the other plants. Their populations have been almost eliminated in the northeastern area of Nara Desert. Field observations reveal that this may be because of less or no rain during the reporting period. Severe climatic conditions during the past 5 years caused severe depletion of the grass and sedge populations because of overgrazing. The populations of grasses and highly palatable annual plants are gradually decreasing because of excessive utilization as forage at very early growth stages and before seed formation. This practice will remove the herbage cover from the soil surface. This—and the resulting decrease in litter formation—will decrease fertility over time.

Under the circumstances presented here, it is crucial to initiate projects in this rangeland to help sustain human life and to help strike a balance between living and nonliving components of the environment.

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