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## Camel production systems in Asia

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Due to uneven distributing of global population (i.e. 18.58) million heads, >80% camels are found in Africa. Asia is the second largest host of camelids where 70% population is found in India and Pakistan. Both dromedary and bactrian camels are found in Asia, however, former is in eventual majority. All camel habitats are unique ecological niches i.e. extremely marginalized and highly inaccessible temperate as well as tropical deserts. The physical/physiological uniqueness of camel enabled humans to inhabit these deserts. hence pastoralism involving exclusively camels or mixed livestock remains the dominant use of natural resources in arid and semi-arid ecosystems of Asia. Within these ecological specificities camel production is the mainstay of livelihood. Being extremely low input animal, the camel has been supporting the main subsistence needs of pastoralists across large-scale biological and geo-political diversities, Camel has been the key resilience animal species of pastoralists to absorb various external shocks particularly climatic and geo-political vulnerabilities. The adventitious vulnerabilities of camel pastoralists had led to various camel production systems.

The Camel Applied Research and Development Network (CARDN), Pakistan has documented the camel production systems in Indo-Pak subcontinent based on socio-cultural terms. Hence, three categories of camel pastoralists have been recognized which are migratory or nomadic pastoralists, transhumant or semi-migratory pastoralists and sedentary or household pastoralists. The International Livestock Research Institute (ILRI) has reported 10 global livestock production systems. The agro-ecologically based production systems are also directly applicable to camel production systems in Asia. The livestock production systems have been redefined in commercial context. These include a) traditional rural livestock production; b) commercial milk production; and c) desert/rangeland production. These are equally good to be used for camel production. The camel production systems have very recently been reported as following a) traditional system; b) peri-urban system; and c) ranching of camels. Although very complex issue, we need to define camel production systems based on universally agreed parameters.

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### Summary

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As a consequence of vulnerability to external forces, socio-economic transformation of camel as well as other pastoralists is emerging as gradual phenomenon, hence, the treasures of biological as well as cultural diversity are at stake. This changing scenario is calling for appropriate collaborative research and development initiatives to optimize the general understanding of key external shocks like macro economic framework, demography and access to land & other natural resources, drought and other climate related events.

*Key words: camel population, distribution, statistics, species and breeds, habitats, production systems.*

## Introduction

The camel was domesticated around 2500 – 3000 B.C. (Graham, 1996). It was believed that the dromedary camel was domesticated in southern Arabia, the north eastern part of Yemen and the west of Oman (Khan *et al.*, 2003) Camels were the domestic animals of particularly nomads for the milk, meat and transport needs. However, the greatest cultural impact on the recent distribution of camel was the advent of Islam. The Arabs took their one-humped camels with them towards north east Asia and Mediterranean sea. Gradually dromedary emerged as food security animal in extremely harsh and arid sandy as well as mountainous deserts. The Muslims developed especial religious association with camel since it was quoted in the '*Quran*' as a gift for man from God.

The camel production was also strongly recommended in the pre-Islamic sacred religious books in Iran. Maqddam and Namaz-Zadeh (1998) reported the use of camel during ancient Iran era, hence contradicting the notion of the Muslims driven distribution of dromedary out of Arabian Peninsula.

It was believed that the bactrian camel was domesticated on the border of Iran and Turkmenistan and spread towards Mongolia and China (FAO, 1982). The bactriaian camels were domesticated before 2500 B.C (Graham, 1996). Isani and Baloch (2000) found little or no knowledge about the domestication of two humped camel.

## Camel population and distribution

The statistics of world camel population differs from source to source. The National Research Centre on Camel (NRCC), Bikaner, India reported in its website total 19.31 million camel, worldwide. It was further reported that there were 15.13 million camel in Africa, and 4.17 million in Asia. Based on camel population, various countries were ranked as following. 1<sup>st</sup> Somalia (6.2 million), 2<sup>nd</sup> Sudan (3.2 million), 3<sup>rd</sup> Mauritania (1.2 million), 4<sup>th</sup> Ethiopia (1.07 million and 5<sup>th</sup> India (1.03 million). Isani and Baloch (2000) cited 18.84 million camels throughout the world distributed over Africa (13.82 million), Asia (4.76 million) and 0.01 million in former Russian states. Khan *et al.* (2003) reported 18.58 million camels

in the world i.e. Africa 13.62 million, Asia 4.76 million and Australia 0.2 million. They further mentioned that there were 1.2 million camels in Pakistan.

FAO (1978) estimated that there were 2.9 million camels in Asia and the regional camels population is summarized in Table 1.

Another website indicated camel population for various Asian countries as reported in table 2.

The camel population in Iran has decreased from 0.3 million in 1975 down to 0.14 million in 1998 (Moqaddam and Namaz-Zadeh, 1998)

More than 80 % of all dromedary population is found in Africa. East Africa contains about 63% of all old world camelidae. In Asia, about 70% of dromedaries are found in India and Pakistan.

The statistic cited in above paragraphs is concerning single humped (i.e. dromedary) camel. Estimates for bactrian camels are scant. However, the bactrians are mainly found in central Asian states of former USSR and in China. More than 90% of the habitat of the bactrian camel lies in Inner Mongolia (China), outer Mongolia (Gobi desert) and the desert steppes of Kazakhstan. Bactrian is also found in northern Afghanistan and a few animals in Northern Areas of Pakistan (Isani and Baloch, 2000). This species has also been reported to a lesser extent in Iran and Turkey (Moqaddam and Namaz-Zadeh, 1998)

*Table 1. Regional camel population in Asia (FAO 1978).*

Country/Region	Million camel
India	1.2
Pakistan	0.8
Afghanistan	0.3
Iraq	0.2
Saudi Arabia	0.1
Iran	0.03
S. Arabian & Gulf states	0.02
E. Med. Countries	0.05

*Table 2. A possible alternative composition of the Asian camel population.*

Country	Million camels
India	1.52
Saudia Arabia	0.422
Yemen	0.18
UAE	0.16
Oman	0.094
Jordan	0.018
Kuwait	0.0086



## Species and breeds

There are two species of camel, dromedary (*Camelus dromedaries*) or single humped camel and bactrian (*Camelus bactrianus*) or double humped camel. Dromedary, commonly called Arabian camel has generally been categorized into three work classes i.e. racing camels, baggage or draft camels and milch camels. Modern breed description has rarely been applied for camel till the Camel Applied Research and Development Network (CARDN) initiated the spade work in this region. Under the auspices of CARDN, Isani and Baloch (2000) documented twenty breeds of camel in Pakistan based on morphological characteristics, habitats and geographical distribution. However, Khan *et al.* (2003) concluded that in depth research work was needed to verify the breed documentation of Pakistani camel due to gaps in knowledge and overlapping of characteristics of some local breeds, NRCC, Bikaner has reported three camel breed in India (Kachchi, Jaisalmeri and Bikaneri). Moqaddam and Namaz-zadeh (1998) cited four breeds of Arabian camel i.e. Torkammam, Baloochi, Bandari (Port) and Kalkooi in Iran. In Saudia Arabia the most commonly used classification for camel breeds is based on colours. In the former Soviet Union, all one humped camels are categorized as Arvana breed (Khan *et al.*, 2003). Lot of work on documentation of camel breeds in member countries of CARDN is in progress.

Three breeds of bactrian camel are recognized in the former Soviet Union i.e. Kalmyk, Kazakh and Mongolian. Khan *et al.* (2003). Moqaddam and Namaz-Zadeh (1998) reported long legged bactrian and short legged bactrian camels in Iran.

## Habitats

Since its domestication, the camel has been a food security animal of subsistence oriented pastoralists in exclusively very harsh arid and semi-arid ecosystems. Due to its uniqueness, the camel emerged as key

animal species of both cold and hot deserts. Because of specific adaptations, the Bactrian camels inhabited the cold arid deserts where as the dromedary camels encroached into warm as well as hot arid deserts.

The dromedary accounts for 95% of total world camel population (Wardeh, 1996), hence this single humped camel is distributed over vast arid and semi-arid mountainous as well as plain areas in Asia.

his habitat stretches over Afghanistan, north eastern Iran and Balochistan province and Sulaiman Rodkahi mountains of Pakistan. The climate is hyper arid to semi-arid where annual precipitation varies from 50 mm to  $\geq 250$  mm. Mountainous terrain is a dominant topographic feature of this habitat, hence animal grazing is an ultimate land use, however, along with minimal crop and orchard farming. Temperature regimes vary widely from cool temperate to sub tropical. Shrubby vegetation is classical characteristic of this habitat.

Rajestan in India, Cholistan, Thal and Thar deserts of Pakistan and sandy deserts of Saudi Arabia, Gulf States, and other middle eastern Arab countries are classical examples of this type of habitat. Sandy deserts are characterized by great daily variations in temperature, maximum being in summer rising to  $\geq 41^{\circ}\text{C}$  and sometimes as high as  $50^{\circ}\text{C}$ ; minimum in January ranging from  $3$  to  $8^{\circ}\text{C}$ , with few frost days and relatively low humidity. These extreme temperatures are accompanied by hot and high wind velocity. Droughts and famines are frequent in these hyper arid to arid deserts. Mean annual rainfall ranges between 100 to 250 mm. The vegetation is essentially dictated by sand dunes formation.

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**The dromedary habitats**

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*Mountainous highlands*

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*Sandy deserts*

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### **The bactrian habitats**

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The two humped camel inhabits mainly the mountains of central Asia at altitudes of upto 2 000 m. It may be found at even higher altitudes under snow cover. Wild forms of bactrian are found in Gobi desert. The annual precipitation in the desert steppes of central Asia is 80 to 120 mm, hence extremely arid climate where winters are very cold. The bactrian camel is generally not found in temperature over 21°C.

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### **Production systems**

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Camel production systems to be discussed here would be relating to the dromedary only. Historically, the production systems have been very extensive and migratory in nature. However, over the period, the traditional subsistence role of camel has been subject to visible changes throughout Asia. Thus, emergence of various production systems is a gradual phenomenon. The CARDN, Pakistan documented the most traditionally prevailing camel production systems in at least four countries i.e. Afghanistan, Iran, India and Pakistan. Socio-economic importance of camel is closely associated with existing production systems. These system are generally determined by climatic conditions, topography, plant phonology, water resources, socio-cultural norms etc.

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### **Migratory production system**

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The migratory production is characterized by extensive animal husbandry in both mountainous and sandy desert habitats with following three basic features:

- Camel heads are diversified with other species of livestock like sheep, goat and donkeys. This strategy involves socio-economic considerations of a pastoralist family.
- Herds mobility is an obvious fundamental strategy for survival.



- It enables the pastoralist to share camel with other fellows of different areas incase of a natural disaster or less forage availability.

Based on differing migratory natures, the migratory production system is further divided into following two: a) Nomadic production; and b) Transhumant production.

True nomads are generally found in mountainous habitat of camels i.e. Afghanistan, Iran and Balochistan province of Pakistan. These nomadic pastoralists are infact international and migrate between at least two countries i.e. Afghanistan and Pakistan or Afghanistan and Iran. They follow seasonal patterns of forage production. They would spend summers in highlands of Afghanistan and winters in warmer and relatively low lands of Pakistan in Balochistan province and/or adjoining Iranian provinces. Nomads travel on historically/traditionally approved routes across open grazing lands with herds camping for a few days at a location. The camping duration would be linked with availability of range vegetation to animals.

These nomads are called '*Kuchies*'. The *Kuchies* have been facing great problems since the advent of Afghanistan crises. The present Afghanistan government is trying to address their problems at national as well as international levels. Due to security concerns, some of these pastoralists had opted to contain their movements within one country i.e. Pakistan or Iran, however, schedule and routes remain unchanged. In low lands, they enter into contracts with local farmers for buying stubbles, grazing rights, straw and other forage for their animals to mitigate feed shortage in winter. Meanwhile, they would work as labourer to support their family income through seasonal employment. These low lands also offer them an opportunity to market their surplus animals/products etc. Their backward migration coincides with the seasonal regeneration of vegetation in uplands. Usually they depart from winter places in early spring and reach their summer grazing areas in early summer.

There are three types of nomad camel herders.

1. *Nomadic camel herders*. They own pure herds of camels. Herd size may vary from 50 to few hundreds.
2. *Mix camel herders*. This type of nomad family would own on average 24 camels, 95 sheep and 32 goats. Three or four families usually keep their livestock together hence, making up herd/flock size of about 380 animals. Jasra and Isani (2000) estimated that these pastoralists generated 48% of their gross income by sale of live animals, camel services, 30% by marketing small ruminants and 8% by off-farm employment.
3. *Nomad pastoralists*. The livelihood of these partoralists is largely based on small ruminants (sheep and goat) production, however a normal family may keep more then one camel for travel and transportation of goods, household items etc.

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*Nomadic production system*

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*Transhumant production*

Transhumance is semi-nomadism and is also basically a migratory livestock production system. Some researchers have linked transhumance with shifting of tillage operations among rainfed area during certain seasons of a year. However, this definition does not necessarily apply on camel producers in all habitat as most camels are owned by small farmers, peasants or landless pastoralists.

The transhumant producers would always move between specific locations hence, their migrations follow fixed annual routes. In mountainous habitat, the local farmers in highlands would cultivate their rainfed crops mainly winter wheat and as soon as sowing is over, they would move alongwith their camels and other livestock down toward low lands, where they behave like true nomads.

The other category of herders is almost completely dependent on their camel herds as well as small ruminants. They are co-owners of common tribal rangelands and in most cases their migrations take place within the limits of their tribal lands. They may move from commonly owned rangelands to open rangelands as forage availability fluctuates and would usually return to their permanent dwellings during summer months.

Migration of camel herders from one place to another is a regular phenomenon in most sandy deserts. Seasonal migrations are primary feature of camel herders. The camel production practices vary among tribes, however, two practices are generally recognize.

1. *Wandering camel herds.* The pre-monsoon period i.e. April to June in sandy deserts of Indo-Pak is very hot and harsh. Just to avoid high labour input in hot summer, few tribes would execute jointly the wandering camel grazing scheme till the onset of monsoon in July. They would let their camel herds un-attended to graze freely in desert however, would appoint duty persons at watering wells distributed





over the desert. These duty persons would wait for thirsty camels to offer them water. With the onset of monsoon rains, all watering ponds are filled in hence the duty persons on wells are no more needed and camel herds keep grazing the lush green desert as free roaming animals. Sometimes in October, the post monsoon period, all tribes put up a search for their camel herds and drive them back to their settlement. During winter, their grazing movements are watched since it is the breeding season.

2. *Watched camel herds.* Some tribes never leave their camel herds un-attended in desert. They would migrate to riverine banks and/or adjoining irrigated plains during the pre-monsoon period to avoid harsh hot weather and to feed their animals from unconventional feed resources. The migration period may vary from three to six months, however these pastoralists would return to desert as soon as monsoon is commenced.

This kind of pastarolists are permanently settled. They own mostly cultivable land and keep other animal species like sheep, goats, cattle etc alongwith camels. Herds are rarely moved far away from their base area. These camel producers are generally subsistence oriented small farmers, peasants, landless tenants and camel is their main traction/draft power source to undertake tillage and other agricultural operations. They would own one or few camels/family.

Sedentary camel producers are found throughout mountainous region, sandy deserts and irrigated plains of India and Pakistan. However with the influx of tractors, the role of camel as a source of traction power is considerably declining. The classical example in this regard is the Thal sandy desert in Punjab, Pakistan, where camel used to be prime draft animal. However, since 1980's camel has gradually been knocked out by tractors and allied machinery.

In Indo-Pak subcontinent, the dietary preference of local people for camel milk and meat has been very low as compared to other animal species. Hence, the value of camel as milch and meat animal never got a boost for exploiting its commercial aspects. Although camel milk and meat are consumed at domestic level, but marketing of both is not customary. Camel meat is sold by mixing with other beef and similarly camel milk is mixed with cow/buffalo milk for selling. Thus, such environment discourages commercial camel production for camel products. However in Afghanistan and Western mountain ranges of Pakistan, the preference for camel meat is relatively higher than in sandy desert and irrigated plains. Thus, there is absolute need to promote camel milk and meat as delicacy, for example for diabetic persons, however, based on sound research findings. Unless the commercialization of camel milk and meat is targeted, the camel production in south East Asia would remain at subsistence. The camel producer would continue to stay below poverty line and most probably the camel population would drastically decline in coming few decades.

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### Sedentary production system

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ILRI defined 10 livestock production systems for the developing world. The description of each system is primarily based on agro-ecological classification (Thornton *et al.*, 2002). In Pakistan, three livestock production systems have been reported which are a) Rural livestock production b) Desert/Rangeland livestock production and c) Commercial milk production. The former two are infact sedentary and migratory production systems as defined by Jasra and Isani (2000), however, the latter one is recent development applicable to commercial cattle/buffalo dairy farmers ([www.pakissan.com](http://www.pakissan.com)). These are equally good to be used for camel production. Khan *et al* (2003) have reported the camel production systems as following:

1. Traditional system.
2. Peri-urban system.
3. Ranching and
4. Research system.

Most of these systems do not describe properly the camel production systems in Asia. Hence, there are so many ways to define camel production systems and there is need to define universally agreed parameters in this regard.

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## Conclusions

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As a matter of fact, the CARDN work in Pakistan has been taken as case study for the dromedary production systems in Asia. Jasra and Isani (2000) identified following major constraints for camel development;

1. **Issues of production systems.** Majority of camel herders (90%) inherit this profession from their ancestors of subsistence economy. Though they are well versed with camel raising yet their indigenous camel production system need up-gradation based on modern animal husbandry practices keeping in view a shift from subsistence level to commercial camel production.

2. **Management specific constraints.** The primitive approach of camel management in all three production systems (i.e. nomadic, sedentary and transhumant) manifested in general poor feeding of animals, hence slow growth rate, delayed maturity, long calving interval, low calving rate and high disease incidence are common constraints on camel productivity. Mean pubertal age of females was reported as five years. Average calving rate ranged between 70.6% to 82%.
3. **Socio-economic implications.** 88 to 94% camel herders are illiterate. For usual farm operations in mountains > 50% respondents preferred camel over bullocks. Majority camel producers are below poverty line and their livelihood focus is subsistence.
4. **Marketing concerns.** In sandy deserts, 21 to 100% camel herders reported problems with marketing of camel milk and meat during survey. Upto 60% reported middlemen exploitation. More than 80% of respondents in coastal areas reported low marketing prices for their animals and no government control on market operations.
5. **Disease problem.** High incidence of parasitic as well as infectious diseases in camel herds was reported as serious concern. Trypanosomiasis was reported in 30 to 45% of sample camels population of coastal zone. Similarly, 28 to 50% respondents of irrigated Punjab reported Surra. Mange and Ticks were reported by upto 98% respondent camel herders. Among infectious diseases Pneumonia was widely reported.
6. **Veterinary extension service.** In sandy deserts, 45 to 100% respondent herders were using traditional medicine for sick camels. More than 65% of respondents were un-satisfied with a general treatment of diseases. None of the respondents drenched his animals against parasites or treated again Trypanosomiasis.
7. **Policy implication.** At both policy level (i.e. federal as well as provincials), the livestock sub-sector has traditionally been given low priority within agricultural sector. And under livestock sub sector, the camel had been victims of neglect by both research and development functionaries.
8. **Technological deficiencies.** There is severe deficiency of camel specific and appropriate technological packages for camel herders to construct a track for camel development.
9. **Gender issues.** Women were rarely involved in marketing of camel and their products and were mostly not consulted for decision making. Majority of women were unaware of the concept of development and an increase in number of animals was development for them.
9. **Machinery threats.** Camel is quickly loosing its traditional draft value. Mainly against machinery and tractors over the past thirty years. It was estimated that machinery and tractors had taken over almost 50% of camel draft power responsibility in terms of transportation and agricultural operations in sandy deserts. Under this scenario, the traditional camel production systems may not sustain too long.

11. **Drifting of production systems.** The second phase survey revealed that all three traditional classes of pastoralists (i.e. nomad, sedentary and transhumant) were subject to transformation in one or other way in Balochistan Province, the largest camel habitat. Expanding cultivation under government policies is gradually restricting movements of free roaming flocks/herds. Nomads were found highly vulnerable to external forces. It was further concluded that the drift in traditional pastoralists' production systems was conclusively occurring because of changes in overall household as well as community economic structures and part of survival strategy under given socio-political and biological constraints.

This scenario is calling for commercial camel production, however, a rough task due to a little market demand for camel milk and meat.

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