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The Pastoralists of Kalibangan

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ABSTRACT The hunter-gatherers who pioneered Kalibangan, gradually transformed to pastoralists. The pioneers intensified gathering over hunting. Instead of killing, they rescued the animals trapped in river side marshes. They brought their dwellings closer to the central gap located between the hillocks of the levee they had occupied and the one to its east. Ramp slope of the gap reached them to the trapped animals. The south of the ramp enabled them to learn domestication of the rescued animals. The domesticated animals, were tended to the forage south of the levee. Overgrazed grasses of the training field became more palatable to humans enabling them to gather their seeds for food. Necessitated by sharing the plants with the grazers, the graziers stall fed their animals on remanents of food and raw material collected for their needs. When the herders learned to domesticate plants, they included cultivated fodder in the stall feed of their animals. Pastoralism expanded with urbanisation and came to an end with the fall of the Harappan metropolis of Kalibangan.

INTRODUCTION

More than 7000 years ago, some Mesolithic hunters-gatherers climbed to a levee located along the Ghaggar river in what now constitutes Ganganagar district of Rajasthan and is known as Kalibangan. The wonderers were seeking protection against flood in the river. Water receded but the refugees continued to anchor at the levee. Instead of killing, they began to domesticate some of the animals rescued from the riverside marshy traps. Bringing their camps closer to the ramp reaching to the marshes, they tended the rescued animals to the forage south of the levee. They collected seeds of the cereal grasses grazed by their animals before stall feeding them on the forage gathered and then fodder crop cultivated. Speculation on the transformative act is based on realism (Bhaskar, 1979) which explains an act as release of causal powers (Harre, 1971, 1985) of the habitat in intentional acts of the people inhabiting it (Mamatamayee, 1990), similar to structuration of a locality (Giddens, 1979, 1981). Evidence of the habitat-people relation is based on dispersal of some material remains of these pre-historic people over the western levee occupied by the refugees (Thapar, 1985) before its transformation into a Harappan metropolis. Regression in the past is given in form of anologies of the experience of existing relations (Fales, 1990) between living things and their niches or micro habitats.

THE CENTRAL GAP

The hunters-gatherers taking refuge at Kalibangan camped at the mid-north of the western levee, KLB-1, but descended back to the north of the central gap to facilitate gathering (Mamatamayee, 1991 a). The gap is located between hillocks of the levee KLB-1 occupied by the migrants, and those of levee KLB-2 in its east. It rises from an elevation of 176 m at the river front to a col at 179 m in the centre, lowering again to 177 m in the south (Fig.1). Rising to the two levees in the east and west, it is a narrow gap with north-sourth stretch of 100 m in the north, 50 m at the col and 150 m in the south. Entire stretch of the gap is a ramp with slope of less than 2 per cent averaging over gradient of

1 in 50 in the north and 1 in 125 in the south. It is nearly gradient less at the col. Consequently, the gap is centred at the convex slope of the col, dropping to rectilinear slopes in the north and south, terminating in basal concavities (Young, 1972) on either side.

The Ghaggar splayed through the central gap before it was captured by the Yamuna and the Satluj. The Ghaggar in its flood state appended a terrace along the channel which was used by the wonderers to reach Kalibangan, and the levees, one of which was sought by the refugees. Splays trapped in microbasins swamped the basal concavities of the alluvial plain in the south. Water pools abandoned by the receding river swamped the microbasins of the northern concavity. Contributing to the swamps was surface drainage, as it would be in anologous observed conditions (Kohnke, 1968: Greggard, 1981; Trudgill, 1988). Rain water flew largely overland at the col, percolating and moving laterally along the rectilinear slopes. Over-and through flows combined at the surface of the basal concavities. The percolating water that reached ground water table was redrawn by the capillary fringe (Fig. 1).

A capillary fringe is an effective source of water to plants if water table pressurizing it is close to surface and if capillary movement is rapid as in sands. Movement is too slow to replace transpiration losses from plants in clays if water table is more than 80 cm (Konhke, 1968: 220) to 85 cm (Daubenmire, 1974: 113-114) from water table. The fringe was effective in sand dominated north of the central gap as a river deposits most of its sand next to its channel while carrying clay to the farthest distance. Northern sand had enough vapour pressure for an effective capillary fringe. Part of the pressure was caused by channel water which combined with convergence of streamlines of ground water at the channel bed as in other influent streams of non-arid climates (Strahler and Strahler, 1977: 233-234).

Sandy texture prevailed from the north to the col head but the capillary fringe became progressively ineffective due to its increasing depth. Clay dominated in the south of the col. Compaction of clay caused by river splays formed an impervious hard pan on surface. Rain water pooled over the pan resulting in formation of clay *in situ* through chemical process even after the river stopped splaying to the south as in latosols of the tropics (Bridges, 1970; Selby, 1971). Clay rendered capillary fringe ineffective in the south of the col until water table came close to surface at the alluvial plain of the south.

THE BIOTIC COMMUNITIES

Combined condition of capillary fringe from below and water percolating downwards or seepening laterally was contingent on plant niches (Weaver and Clements, 1938; Daubenmire, 1974). The niches were hydric in basal concavities. Well drained hydric niches, as in the north, were liable to support cucurbits, cotton, date palm, groves of bamboo or banana. The hydric niches tend to be occupied by amphibious plants like reeds where water stagnates slightly above or below ground surface. Such niches formed a band along the Ghaggar and small pockets around swamps in the south (Fig.1). As water table lowered with distance from the channel, the northern niches turned mesic, supporting mesophytic trees common to zonal climate of Kalibangan (Mamatamayee, 1991 a).

The niches turned xeric at sand dominated col. Small amount of percolating water that escaped overland flows (Fig.1) was the only source of water in these niches. More aridic niches could support cacti or succulents but the most widespread were sod forming mat grass of *dub*. In such grasses, the ratio of above ground biomass to below ground biomass tends to be 0.2 to 0.04 and most of the biomass is concentrated in 15 cm of surface soil (Ramode, 1981). Rain water with exception of heavy showers, is absorbed in mat of shoots and dense network of roots (Rodda, 1976). Interspersed through grasses can be mesophytic shrubs and trees with long tap roots, such

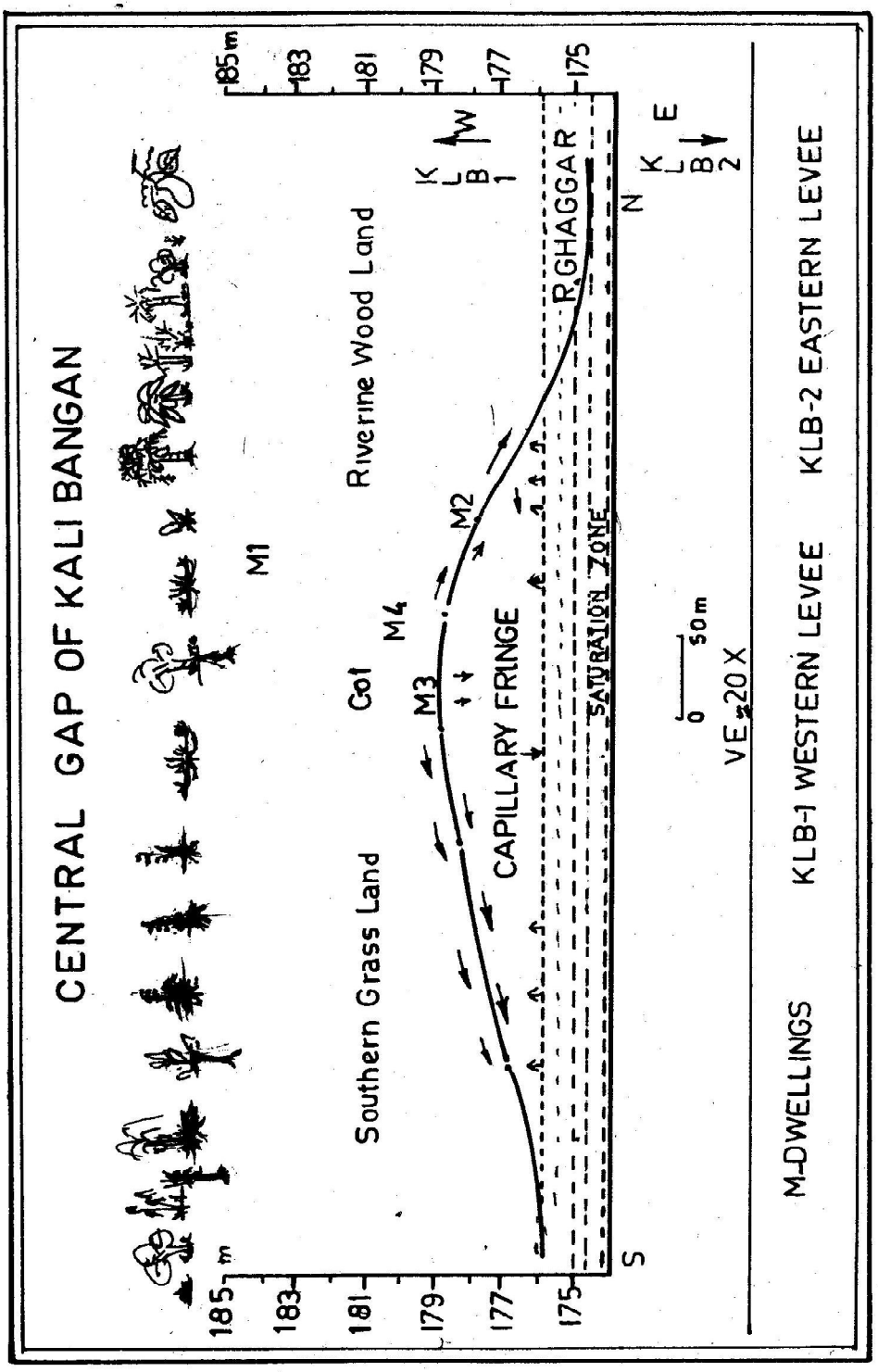
CENTRAL GAP OF KALI BANGAN
185 m
183
181
179
177
175
M1
Col
M4
M3
M2
Southern Grass Land
Riverine Wood Land
CAPILLARY FRINGE
SATURATION ZONE
R.GHAGGAR
S
N
K L B 1
W
K L B 2
E
0 50 m
VE = 20 X
M-DWELLINGS
KLB-1 WESTERN LEVEE
KLB-2 EASTERN LEVEE

Fig. 1

as *peepal*, *banayan* and *Jujuba*, reaching to the capillary fringe under the col.

Extending through the xeric niches of the col were bare patches of trails most treated by animals and humans. Constant trampling over the same area had left the ground bare. The col was a natural passage between the rectilinear slopes providing easy ramp to the river in the north and the levee back in the south. It was also an easy passage between eastern and western levees to the extent that the Harappans of the metropolis kept openings in either side of the fortification walls they had erected on the two levees to facilitate cross movement between the two (Kesarwani, 1984; Thapar, 1985). Use of the col as a path contributed to the bareness of the soil, presence of trees contributed to the endurance of the passage by providing shade for rest to the wondering beings.

The niches to the south of the col were mesic though drying on surface in summers. They were liable to support mesophytic herbs, namely grasses. Mat grasses dominate where water availability is restricted to a brief wet season and amount is small. Annual clump grasses take over where amount is moderate, giving way to perennial clump grasses where water availabilty is prolonged over large part of the year (Tivy, 1971). Ground between the clumps can be bare but more often is occupied by leguminous forbs, shrubs or trees (Polunin, 1960; Billings, 1964; Tivy, 1971; Ethrington, 1975). Density of forbs increases with increasing aridity (Mahadevan, 1980) as they grow by tap roots which reach to a capillary fringe but cannot penetrate through it (Weaver and Clements, 1938). Where water table comes close to the surface, as in depressions, grasses intermingle with trees and bushes.

The entire habitat of Kalibangan was a characteristic grassland dominated by herbs, namely grasses. Northern niches dominted by date palms, were hydromorphic modification of grassland anologous to palm savana of Nigeria (Riper, 1962; Riley and Young, 1968; Billings, 1964). The upland flats and steep slopes of Kalibangan were covered with *dub* representing xeric modification of the grassland. Annual clump grasses of barley and wheat intermingled with perennial grasses such as *kusha*, and leguminous forbs of horse gram, peas, mustard and perhaps, sesamum, dominating over the southern slope and the alluvial plain fringing it, separated by pockets of swamps.

Plant communities are liable to be differentiated in preferential habit of herbivorous animals (Kendeigh, 1975), especially hooved animals (Billings, 1964), in conjunction with slope and water conditions. Steep slopes may not hinder movement of swift legged antlers but are avoided by cattle (Kendeigh, 1975), as the latter prefer level ground to slopes and tend to gravitate towards water holes and salting pans (Dasman, 1976) where they can rest under shade of trees (Mathur, 1990). There is nothing to suggest presence of salting pans at Kalibangan but level ground, water holes and trees for rest must have gravitated cattle towards the basal concavities at Kalibangan. Sheep and goat prefer forbs and browse and climb to steeper slopes as in the extant of the levee hillocks. Grasslands lack natural nesting places for birds. In contrast, open woodlands have enough nesting places and branches are not too close to each other to obstruct wings of birds on flight (Kendeigh, 1975), as it must have been in the woodland in the north of the central gap. The archaeological remains suggest presence of these animals at Kalibangan (I.A.R., 1964-65).

HERDS AND THE HERDERS

The biotic communities in conjunction with terrain and access to water (Mamatamayee, 1991 b) emerged as resource defining habitat built in acts of the people of Kalibangan. The peoples who took refuge at Kalibangan levee hunted aquatic, amphibious, terrestrial and aerial animals and gathered plants of their use. They settled in the north of the levee (M 1 in figure 1) from where they could fish, hunt and gather river side plants for food and for raw materials needed by them. They had direct access to river water

for their use (Mamatamayee, 1991 a). Potential for gathering was greater at the riverine north where plants had greater density and diversity and their renewal was more assured. Some of the pioneers descended down to the north-eastern slope of the levee KLB-1 overlooking the col (M2 in figure 1) for greater ease in gathering.

People translocating themselves at the new site intensified gathering over hunting though paradoxically hunting of the herbivores was easy in the north. Foraging animals gravitated to the riverside for water and to rest under shade of trees. Many of them got trapped in the riverside marshes and swamps which is a common event in marshy habitats (Kendeigh, 1975). Trapped animals could be killed but people rescued some of them for domestication. Gathering of trapped animals was added to plant gathering.

All the trapped animals could be rescued but the ancient settlers were not liable to domesticate all of them. Antlers were too swift on legs for easy domestication. Sheep and goat flocked more to the levee hillocks which the settlers had just left behind. Cattle, on the other hand, avoided hillocks and tended to move along the ramp slope of the central gap located besides the dwellings of the settlers. Through collective effort of many generations, the Kalibangans caught and domesticated more of cattle than other animals as suggested by dominance of the Indian *zebu* in the remains of animals at Kalibangan (I.A.R., 1964-65).

Animals rescued from the riverside marshy traps could forage on river side vegetation but it had to be saved for its multiple use in acts of survival of the people (Mamatamayee, 1991 a). So the animals were tended away to the grassland to the south of the col. Legumes of the grasslands provided crude proteins to animals as in other grasslands (Tivy, 1971; Cobley and Steele, 1976). Animals lived in comparatively disease-free drier habitat, unlike the wet habitat of the north. Death by drowning in swamps and water was less frequent, lowering their mortality rate and adding to their population. Southern grassland was punctuated by swampy water holes and trees for shade while the foraging ground dominated by mat grasses extended far to the south. Animals rescued from the riverine marshes could be tended to the south and the northern forage conserved for human use.

The herds being tended to the south gravitated towards the water holes which were at least 200 m to the south of the dwellings in the north. The herders crossed this distance twice in their daily acts of tending animals to the water holes and taking them back home. Movement was slow and lax as the herders stopped on the way to gather things of use, anologous to practices of tribal people (Sahlin, 1972). Movement was constrained by short days of winters. The herders overcame the difficulty by anchoring closer to the southern forage raising some dwellings in the south of the col (M3 in figure 1). New site was at the same level as that of the northern dwellings. The site was made level by mat grasses and bare patches of paths. It had stands of individual trees where animals could be tethered when not being tended to the southern pastures. Translocation shortened one way distance by 50 meters. The gradientless col gave them access to the northern dwellings and the northern ramp reaching the river. Adjoining gullies gave them comparatively easy slope to the mid-north dwellings.

The gatherers tending their animals to the south were deprived of the raw materials and food which could be gathered only from the riverside, such as bottlegourds for making *Kamandals*. Reeds and date palms, neccessary for making wattle huts and household furniture were less plentiful in the south. Compensation was sought by gathering clay which could be moulded to earthen wares and mud bricks. Earthen pots enabled storage and transportation of water, enabling distanciation of dwellings from the edge of the river (Mamatamayee, 1991 b), more so when potters and other industrial workers settled close by (M 4 in figure 1).

The southern rectilinear slope became a training ground where animals learnt to take commands, but while foraging they tended to gravitate to water holes of the southern swamps.

In the process of taking commands, the animlals defoliated grasses of the southern ramp. Defoliation decreased the population of the ungrazed tall, soft and erect grasses resulting in profusion of lateral branching. The transformation was anologous to the change from 'decreasers' to 'increasers' (Dyksterhuis, 1949; Dasman, 1976). Defoliation by grazing does not injure grasses as their growth tissues are located at base of the blades (Brown, 1935). Defoliation instead, stimulates growth of lateral shoots if it is no more than 2 or 3 times in one growth period of the plant and does not lower the plant to more than 7.5 cm from its base (Kucera, 1956; Anslow, 1967; Brougham, 1970; Korte and Harris, 1987; Radcliff and Baars, 1987). These constrains limit the carrying capacity of all grasses to 11 cattleheads per sq km (Kendeigh, 1975: 122) though in managed grasslands of cold climates the capacity increases by more than its two times (Holmes, 1987).

The southern ramp of 250 m x 150 m was barely liable to support a single cattlehead yet grasses survived defoliation as the ramp was only a passage for the herds being tended to the south. Increase in population of the grazing grasses enabled prolonged use of the southern ramp as a training ground. It was also a qualitative change. Defoliation produced more succulent and thicker growth which was highly palatable to animals. This enabled prolonged use of grasses for grazing, causing further qualitative change in grasses of the southern ramp. Seeds of wild grasses are brittle and tightly packed in their husk coat (Blake, 1970; Cobley and Steele, 1976; Kochhar, 1981). They scatter easily if plucked so are difficult to gather. They are unpalatable to humans unless roasted but plants in their entire are highly palatable to animals. Continued defoliation make the seeds less brittle and they are less tightly packed in their husk coats. They can be gathered more easily and eaten raw, roasted or made to a gruel. Seed bearinng stalks of grasses grow on upper portions of tall blades so that humans could collect seeds for food while cattle could forage on the lower stalks. However, animals could not be prudent and selective so they had to be stall fed on the plants gathered, keeping seeds for human food.

While gathering seeds of the cereal grasses the prehistoric people learnt to domesticate these grasses, namely barley and wheat. As farming practice became more refined, the ancient Kalibangans cultivated fooder intercropped with other crops. Intercropping is suggested by a ploughed field excavated at Kalibangan (I.A.R., 1968-69). The field was prepared for horse gram and mustard which are liable to be used as fodder and food crop respectively. Animals could not be let loose to graze in the field if the other crop had to be conserved for food. Stall feed of fodder crop was added to other feeds intensifying and reproducing pastoralism in Kalibangan.

CONCLUSION

Carbon dating assigns the excavated ploughed field to a period between *circa* 5000 BC to *circa* 7000 BC (Lal, 1971). Pastoralism was well established by then. The land was given to cultivation of fodder crop in preference over food crops of barley and wheat which were in use of the people (Vishnu-Mittre and Savithri, 1982) and were cultivable in Kalibangan. The preference suggests significance of pastoralism in Kalibangan.

Pastoralsim in Kalibangan intensified when tall erect grasses were grazed and transformed to more laterally spreading increasers. Further intensification of pastoralism in Kalibangan led to overgrazing whereby increasers give way to sod and then to clumps of unpalatable grasses with large bare patches between them (Dasman, 1976). This happened to the training ground of the southern ramp which eventually became a bare passage leading to the southern pastures. Bareness of the ground enabled expansion of the metropolis to the south, covering the ploughed field with the Harappan structures (I.A.R., 1968-69; Lal, 1971). Urban expansion increased the demand of animal for food and for pulling carts, necessitating spread of grazing to the south. Pastoralism came to an end when cattle were tied

to carts, enabling exodus of the residents and fall of the metropolis, thereby terminating the demand for animals. Herders who were place bound, serving the local non-herders, became habitat-independent. Exodus of pastoralists coincided with termination of pastoralism at Kalibangan.

The people learning to domesticate animals and reproduce pastoralism could be of the same lineage, providing material continuity to place and people (Mamatamayee, 1991 a). They could have been joined by other groups adding numbers to the population of the pastoralists.

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