

Traditional irrigation and water distribution system in Ladakh

Dorje Angchok¹ & Premlata Singh²

¹Division of Agricultural Extension, Field Research Laboratory, DRDO, C/o 56 APO

²Division of Agricultural Extension, Indian Agriculture Research Institute, New Delhi

E-mail: achuk_iari@rediffmail.com

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An attempt has been made to discuss the importance of water to Ladakh farmers, its use pattern, traditional irrigation and water distribution methods, prevalent management institutions, and how these phenomena are codified through expression in folk tradition and local beliefs.

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Ladakh constitutes the easternmost trans-Himalayan part of Jammu and Kashmir state, bordering Pakistan and China (Fig. 1). Described as cold arid desert, it covers an area of 59146 sq km situated at an elevation varying between 216-420 m above sea level along the valleys of the Indus river, with an estimated population of 1,70,541¹. Intensive sunlight, high evaporation rate, strong winds and fluctuating temperature characterize the general climate. Vegetation is sparse, rains are very rare, and most of the land is a mountainous desert of rocks, sand and dust. Only small parts are used for cultivation and animal husbandry through terraces and irrigation canals. Because of high mountains all round and heavy snowfall during winter, the area remains inaccessible to the outside world for nearly six months in a year. Irrigation technology in Ladakh was transferred from neighbouring regions². The farmers have made use of the barren alleviated semi desert conditions by cultivation through skillful irrigation; said to have been introduced in tenth century³. Since the streams run away from cultivable land or are incised deep below to bring a long canal, it requires considerable traditional expertise. The bed of the canal is often made of very porous material, loose stones and boulders, so there is considerable loss through seepage. The *Stongde Gompa* (in Zangskar valley of Ladakh) canal loses nine/tenths of the initial flow of 0.01 m³/sec before reaching the *Gompa*⁴. Wherever it is possible farmers have skillfully canalized the water through construction of long canals, some of them running over few kilometers traversing through rocky mountains. These canals were con-

structed in a very early stage of the history of the region.

The melted snow water from various rivulets, called *kangs-chhu* (ice water) merging at some point forms a *togpo* (stream), that flows through a valley touching many villages connected by a main channel, called *ma-yur* (mother channel). It is built along a mountainside that forms its retaining wall, and is lined with clay to hold the water. This is termed the Ladakhi version of a dyke. At some places rocks are broken to allow the passage of water or else where the rocks are too hard, a hollow poplar or willow trunk, called *va-to* is cut into two equal halves to allow the water easy passage. Water from the *ma-yur* is further diverted into *yu-ra* (small canals), which irrigates the fields. The point from where *togpo* water is diverted into *ma-yur*, and *ma-yur* water into a *yu-ra* is called *yurgo*; and *ska* is the point from where *yu-ra* water is diverted to the field. Water in the *ska* is further guided through channels known as *snang*, which carry the water into the field. The water distribution through a system of channels is quite complex with different sizes of channels distinguished by various names (Fig. 1) as enumerated below⁴:

Main channel:	<i>ma-yur</i>
Intermediate channel:	<i>yu-ra</i>
Channel to field:	<i>nang-yur</i>
Channel along top and sides of the fields:	<i>yi-hu</i>
Channel down middle of a large field:	<i>star</i>
Small near contour bunds across field:	<i>nang</i>
Gaps on lower side of <i>nang</i> :	<i>tomik</i>
Control sluice by field:	<i>ha (rKa)</i>
Stone for blocking sluice:	<i>hardo (rKarDo)</i>
Sod or earth blocking sluice:	<i>fang (sPang)</i>

*Corresponding author

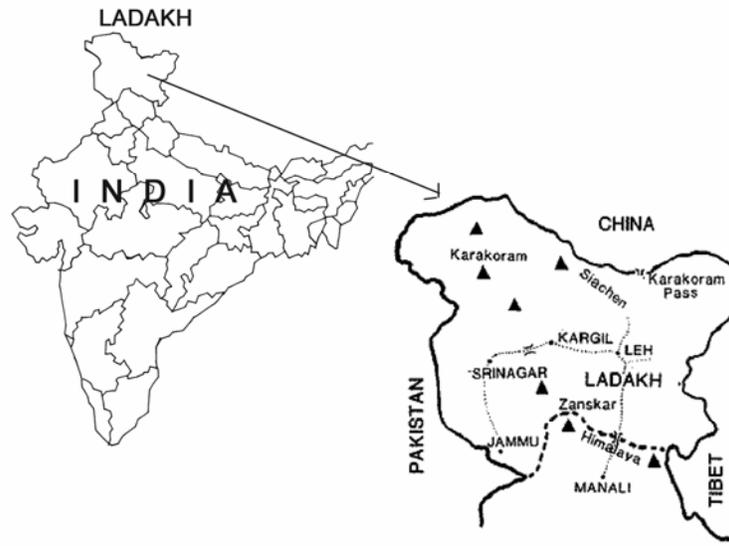


Fig. 1. Location Map of Ladakh

Social organisation

Irrigation water is a critical source of food and wealth in Ladakh. The combination of an effective social organization with technical expertise suited to the local environment has enabled the farmers of Ladakh to convert a few patches of their semi-desert to a very intensive and highly productive agriculture. It has been reported that farmers in Zangskar produce yield of staple crops equal to those of many developed countries. This adaptation by the Ladakh farmers to a high altitude semi-arid-desert is the foundation of human settlement in Ladakh. It is very difficult to arrange distribution of a fair share of water daily to every farmer. Farmers in large villages, like Hunder, sNimo, and Leh are divided into groups commonly known as *Schhu-cho*, and each group gets right to water according to the traditional distribution system. The groups and the distribution pattern of water are recorded in the land records, on a silk document in the village itself, generally referred to as *bandabas* by local people. Mostly villagers prefer to negotiate their disputes at the village level.

Distribution of water for irrigation is in accordance with the rotational system, which is largely determined by the village topography, total village acreage, relative exposure to sun, average temperature, size of glacier, soil type and seepage in the irrigation channel, and other factors⁵. Acreage and number of irriga-

tion channels in any given village determine the kind of rotational scheme to be used. If the village is small enough and the irrigation channels are few, rotational system of water distribution is pegged to the household, rather than the channels. In Leh and Sakti, water distribution is arranged by channels; in Phey (small village of around 33 household), water distribution is arranged by the household (Fig. 5). In a village where distribution is arranged by channels, the field lying along the given channel is irrigated in order, belonging to a large variety of households. These predetermined rotational scheme between households, are in accordance with *bandabas*. In the rotational system, monitoring / surveillance is the most significant element.

Ponds

In some villages, water from the *togpo* through *ma-yur* is stored in a *rdzing* (pond); the pond water is then diverted into a *yu-ra* that carries it to the field (Fig. 6). Individual families rarely construct their own pond. Every year in the beginning of *spit* (spring), ponds are cleared of silts. Villagers collectively undertake the cleaning operation. Usually, the silts piled up into *lut-pung* (small mounds), on the edge of the pond to hold the water. Farmers have invented an indigenous method of blocking and releasing water of a pond. A wide opening is made at the end of a pond, and a large

stone is placed. Depending on the size, one or two holes are made in the stone and is filled with earth to block the water. When water is to be released, these holes are opened with a stick and closed with earth when required. In some villages abandoned clothes are wrapped around one end of the stick and are struck in the holes and pulled out to release the water. The stick also serves, as a measuring rod for the water level. The area where the opening of a pond is dug is called *hormi-lig*. Usually a pond gets water supply from the village stream through the *ma-yur*. In some villages like Phey, *a-Yu* and *Ska-ra* ponds are also supplied water from *chhu-mig* (spring water).

Chhur-pon

Water supply to individual families for irrigation is supervised by a *chhur-pon*, meaning Lord of the water (*chhu* = water; *pon* = Lord). The *chhur-pon* is an official, selected by the villagers, who is in charge of water distribution for irrigation and is perhaps the most important functionary in this regard⁶. He is expected to have the following qualities:

- *ska-tsir shes-kan*: one who knows the order of the *ska*, from where the water of *yu-ra* is diverted to the field and the priority for irrigating the crops of that particular village.
- *chhu-tsir shes-kan*: one who knows the order in which water to be distributed to a particular crop.
- *yul-dat-chan*: one who considers the fields of the whole village as his own.
- *chhu-a sta-thog gya-la cho-shes-kan*: one who knows how to preserve during scarcity of water.

The *chhur-pon* has to be a lucky person; there should be sufficient snowfall during his term. In some villages the word *chhur-pon* is also assigned as individual house name (in Ladakh every house has a name), indicating importance of *chhur-pon* in the villages. If water is available in abundance, then a *chhur-pon* is not appointed; during acute crisis of water, more than one *chhur-pon* is appointed. The tenure of *chhur-pon* differs among villages. In return to their service a *chhur-pon* is given *so-nyom* (one man load of cereal crop) after the harvest. In case the water is being directly diverted into the *yu-ra* from the *ma-yur*, then, the *chhur-pon* has to stay near the *yur-go*. In some villages like in Phey, the main *yur-go* is guarded by a group of people on a rotational basis. As a customary respect for water, while stopping or releasing water from *ma-yur* to the *yu-ra* the *chhur-pon* has to

keep his *gon-cha* (long overcoat) at ankle length and cannot tuck it into his belt. It is expected of the *chhur-pon* to distribute water according to the *rota* system, and monitor the activities of other farmers. The first watering of the field occurs soon after the *sa-ka*, a festive-auspicious ceremony is performed. The day for *sa-ka* is decided by the village *onpo* (astrologer). On this day, schedule of cultivation, construction of *ma-yur*, *yu-ra* and their repair work, etc. is decided, and persons from the village are selected for various jobs. *Sa-ka* is performed in each village, or sometimes a group of village performs it jointly. Its time varies from valley to valley or even from one sub-valley to another. It was customary to celebrate *sa-ka* ceremony on *gya-pe ma-zying* (mother field of the king), who possessed land in every village. *Zying* is a general term for fields where cereal crop is grown. *Ma-zying* is the mother field or the original field sown by the farmer's ancestors. After the conquest of Ladakh by General Zoravar Singh, *sa-ka* was held in the *ma-zying* (mother field), these days; it is performed in main field of the monastery.

Irrigation

The amount of winter snow determines the anticipated supply of water during summer, cultivation during spring. The weather in spring determines whether irrigation water supply will start early or late affecting ploughing, sowing time and sequence crop cultivation. Only skilled persons especially elders are involved in the irrigation process. Fields are irrigated for the last time in autumn after the soil is ploughed when harvesting of crop has been done. This practice allows the water to freeze in the soil making it available when spring thaw occurs. Water from the stream is diverted into the pond through the *ma-yur*, and eventually into the family *yu-ra* or water from the *ma-yur* is directly brought into the *yu-ra*.

First watering (*tha-chus*)

In sham area men folk undertake the work of diverting the water to the family *yu-ra* and the women irrigate the field. Once the field is irrigated it is left for 3-15 days, depending on the quality of the soil. The moist earth is called *ser* (gold) or *chhu-ser* (*chhu* = water). Soil with the right moisture is best suited for sowing and is referred to as, *ser-phar-tog* (gold is ready); if it is too damp, then it is called *ser-lchin-te dug* (gold is heavy). When snowfall of winter melts, the earth absorbs the water and remains moist, called



Fig. 2 Ihu-bangs

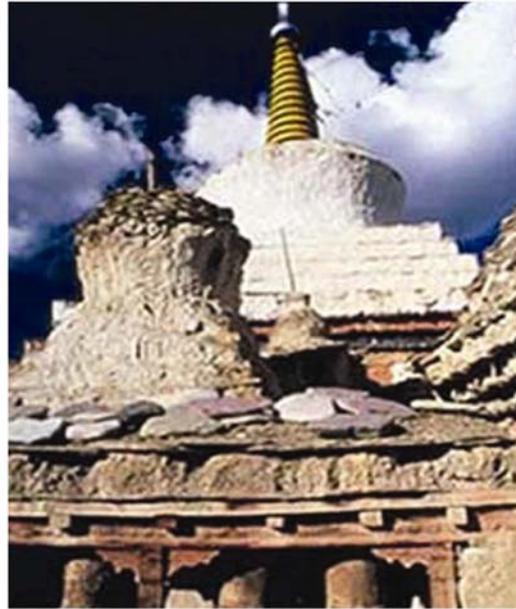


Fig. 3 Rig-sum-ngon-po



Fig. 4 Rig-sum-ngon-po

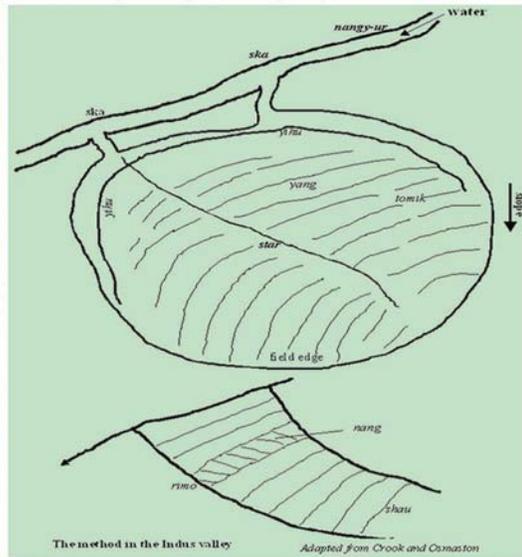


Fig. 5 Field irrigation in Tongde village

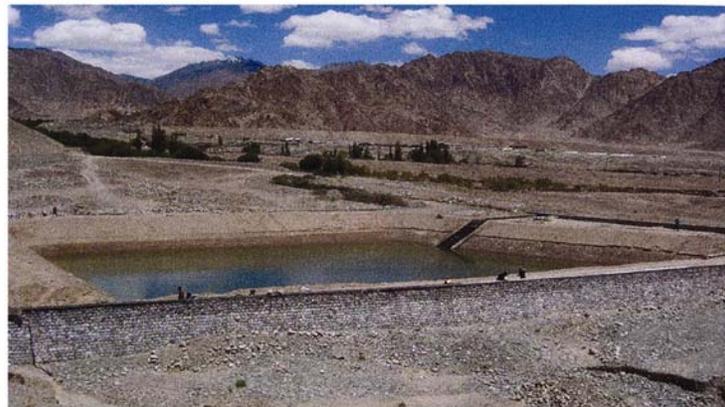


Fig. 6 Water Reservoir (r Dzing) in Phey Village

kha-ser (earth made gold by the snow) till onset of ploughing and sowing being expressed as follows:

spit-la kha baps-na
zying kha-ser-la song

If there is snow in the early spring, then it is the duty of the snow to irrigate the field for first watering.

Second watering (*dol-chhu*)

After the field has been ploughed and sown, the second irrigation is given. Around 15-20 days of gap exists between first and second irrigation. Second irrigation is done when the seeds have just sprouted: *dol* (to sprout), *chhu* (water), i.e. watering the tiny budding shoots. A skilled and knowledgeable person irrigates the field. Insufficient or excess of watering may lead the tender plants to get *tshik-ches* (burnt) or *shi-ches* (die). The *khyem* (spade) used for irrigation also serves as measuring rod.

dol-chhu khyem thil-la
ner-ner tsug-pa chhu zyen-chuk.

Let the *dol-chhu* flow till the iron portion of the spade submerges in the water.

Third watering (*sak-chhu*)

It is given 15-20 days after second irrigation. It is generally a light irrigation given when the crop has grown up to a height of about 13 cm. If denied irrigation at the right time, the upper portion of the crop dries up, so as per demand, one *sha-gu-gang-ngi* or *nang gang-ngi chhu* (a channel full water) is released.

Fourth watering (*non-chhu*)

It is given 10-15 days after third watering. At the time of *non* (all the crop has grown to the same level) *chhu* (water), condition of the field is quite clear. From now onwards, the crop is watered regularly once a week, or about six times before the last watering, which is called *do-chhu* depending on the moisture in the soil and weather condition.

Last watering (*do-chhu*)

Application of *do-chhu*, meaning watering of fully-grown crop field is very important. If not watered, the ears of crop get dry and start falling. The web of irrigation system binds the Ladakhi villagers to each other and these reflect a shared source of life. However, the same web creates claustrophobic technique of surveillance by which villagers keep each other in check⁵.

Local tradition and belief system

In an inhospitable environment like the one prevalent in Ladakh, the transfer of knowledge becomes much more important, and gives scope for further ways to improve upon the adaptation process. The settlement pattern of villages and agricultural practices in Ladakh are determined to a great extent on the basis of availability of water. Many of the folk traditions in Ladakh mention the *chhu* (water), which is a clear indication of its importance in the everyday life. Some of these folk traditions are enumerated below:

sa-jam-mi chhu-kags,
mi-jam-mi mi-kols.

Soft earth is used for stopping the waterflow, (but) a soft person is used by all.

skar-do sher-ri nang-ngi chhu-mig gya yot,
nye spon-bo zang-po-a ldam chho tshor-rat,
spon-bo zang-po-a ldam tshor-na,
nga pu-mo-bo ya-chhu ldan-shik.

In the town of Skarso, there are over a 100 springs. The mud bothers my handsome lord, if the mud bothers my lord, may I the girl turn into the clean water (Skarso is now in Pakistan).

khyod ni phar-ke sta-pa,
nga ni thur-kr sta-pa,
tam-zyik tang-ngin sam-ba, tab-thak chhu-yi chat-song.

(a lover is telling his beloved): you are on the other side of the river with your horse, I am on this side of the river with my horse, I want to talk to you, but the river has cut the rope of my words.

chhuk-po nor-ri mi-gang,
gya-tso chhu-yi mi-gang

Wealth does not satisfy a rich person; water does not satisfy the sea.

gya-tscho-e bu-a-la,
chhu-srin-ni ser-nat.

Bubble belong to the sea (and) miserly is the crocodile.

chhu-sang sing-ngs,
nya-sang jam-ma.

Thinner than water, (and) softer than the fish. (this express the poverty level)

chhu-zyig be-na gyal,
mi-zyig dum-na gyal.

Diverted water is safe, (and) people living together are safe.

chhu mang-po-a rags met,
sper-ra mang-po-a rin met.

A wide river has no ford and a long speech has no value, i.e. if there is too much water, a boundary wall will not do; likewise too much talk is of no value.

phe tshal-na chhu,
chhu tshal-na rom-kang.

If *phe* (roasted barley flour) gets struck (in the throat) water will help, but if water gets struck, there is only the cremation ground.

phu-a kang-ri chags-na,
do-a gyam-tso khil.

When glacier forms in *phu* (high altitude areas), ocean is formed in the lower parts.

Srin-ni ku-cho-a char met,
Pomo sperbat-la bags-ston met.

Thundering cloud has no rain, (and) the gossip girl has no wedding.

Ladakhi farmers' way of life is highly influenced by Mahayana Buddhism, which was introduced into Ladakh from Tibet around 8th century by tantric master Padma Sambhava⁷ (Figs. 2-4). Appropriateness of Buddhist institutions and belief system in an environment with limited resource base of high altitude Himalayan region to ensure maintenance of production equilibrium has been reported^{8,9}. Some researchers describing negative implication of Judeo-Christian thought on the environment emphasized the importance of religious belief system in environmental behaviour^{10,11}. Belief system in Ladakh includes a multiplicity of wrathful and benevolent deities; *lhu* is a female deity associated with water and earth. Pollution of outer environment, chopping trees, and polluting streams and water points offends them.

Water spirit influenced the Tibetans meticulously careful to avoid polluting springs and streams¹². In Khala-ste village, there were clump of poplars, wild currants and tamarisks, on opposite side of the Indus in the middle of steep, bare slope¹³. People believe that a terrible *lhu* lived by the spring and guarded the water and these trees were *lha-shing* (God-trees) inhibited by mountain Gods. *lhu-bangs*, a religious structure is often seen near water points like one's *yur-go*. It is believed that *lhu* resides in and around them. It helps to spell fortune on the villagers, their crop and animals. A person, who has become ritually unclean, is called *ba-ngags-pa*, and they are expected to take care not to cross the ditch, a deed that particularly annoys the *lha* and *lhu*. To purify and to placate the water spirit *lhu-stor* is performed.

Apart from *lhu-bangs*, a religious structure, called *rig-sum-ngon-po*. It consisting of three, relatively small *chor-sten* (reliquaire or stupa) painted white, red and blue is often seen. This colour system is attributed to *Avalokiteshvara* (Boddhisatva of compassion), *Vajrapani* (Boddhisatva of power), and *Manjushri* (Boddhisatva of wisdom/knowledge). Lay people often give alternate explanations. Relating to *iha-yul* (land of God), red to *bstan-yul* (land of terrestrial deities and demons), and blue to *lhu-yul* (land of subterranean guardians and water serpents), a cosmological division that stems from the local beliefs. This structure is generally found at the entrance gate of a village, around some vital resource like the *ol-tang* (field of alfalfa) and water points. Their function is similar to that of *lhu-bangs*. Care for nature, and use of local knowledge perfectly symbolizes the harmony established in Ladakh among knowledge, power and compassion.

References

- 1 *Statistical Digest* (Government of Jammu and Kashmir, Jammu, Kashmir), 1993.
- 2 Osmaston Henry A, The Productivity of the Agricultural and Pastoral System in Zangskar, Second Ladakh Colloquium, University of Pau, *Acta Biol Montana*, 5 (1985) 75.
- 3 Bell Sir C, *The People of Tibet*, (Oxford: The Clarendon Press), 1928.
- 4 Crook John H & Osmaston Henry A, *Himalayan Buddhist Villages: Environment, Resources, Society and Religious Life in Zangskar, Ladakh*. (Motilal Banarsidass Publications, Delhi), 1994.
- 5 Gutschow Kim, Lords of the Fort, Lords of the Water, and no Lords at all: The Position of Irrigation in Three Tibetan Societies, Proc 6th Int colloquium Ladakh, Leh, 1993, 105.
- 6 Koshal S, *Ploughshares of God Ladakh: Land, Agriculture and folk Tradition*, (Om Publications, New Delhi), 2001, 288.
- 7 Gyaltzen J, The Introduction of Buddhism in Ladakh, Proc 6th Int Colloquium Ladakh, Leh, 1993, 303.
- 8 Chatterji S, Development Prospect in Ladakh, *Mountain Res Dev*, 7(3) (1987) 217.
- 9 Melvyn C Goldstein, High Altitude Tibetan Population in the Remote Himalaya: Social Transformation and its Demographic, Economic, and Ecological Consequences, *Mountain Res Dev*, 1 (1981) 5.
- 10 White Lynn Jr, The Historical Roots of Our Ecological Crises, *Science*, 155 (10) (1967) 1203.
- 11 Moncrief Lewis W, The Cultural Basis of Our Environmental Crises, *Science*, 170 (1970) 508.
- 12 Ekvall Robert B, *Religious Observances in Tibet: Pattern and Functions*, (University of Chicago Press, Chicago and London), 1964.
- 13 Ribbach SH, *Culture and Society in Ladakh*, Tr. John Bray (1987), (Ess Ess Publications, New Delhi), 1906.