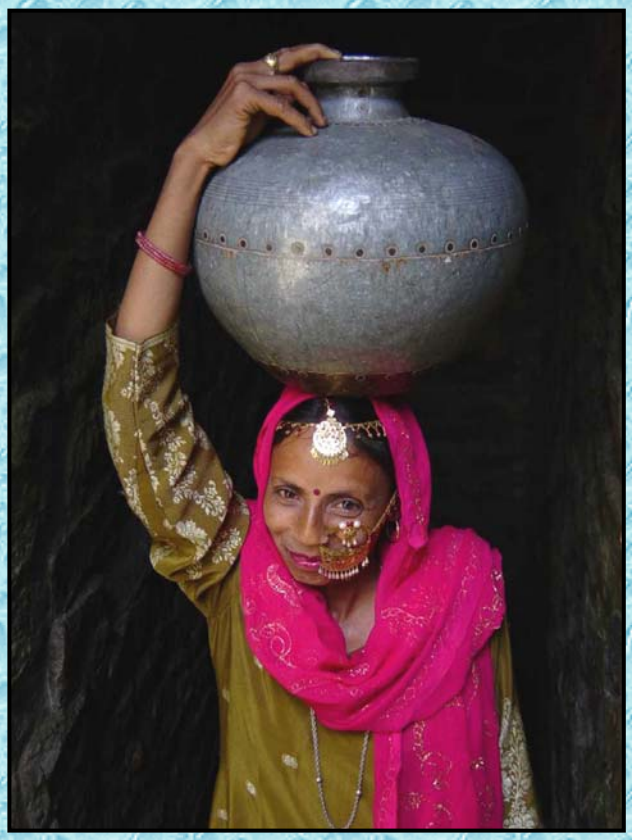
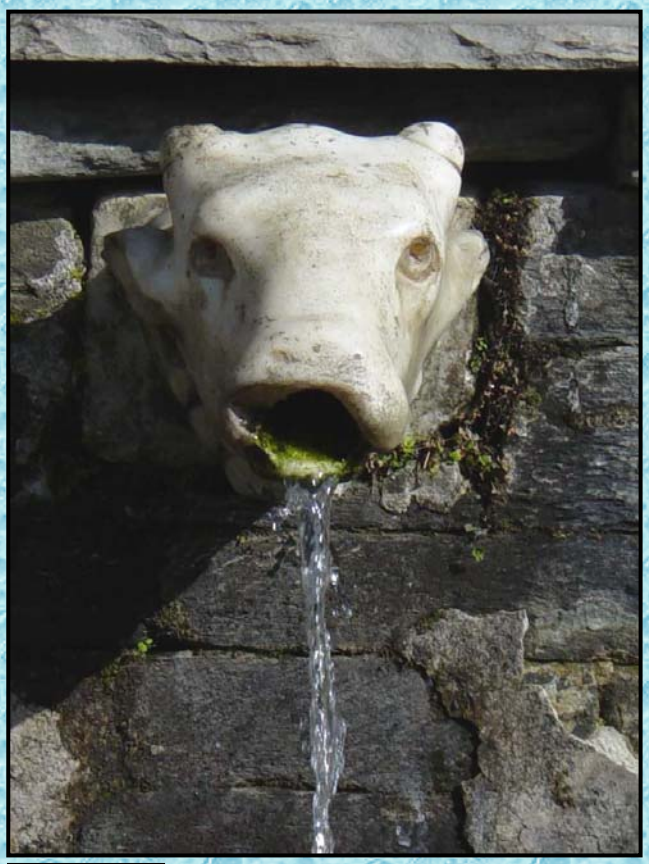
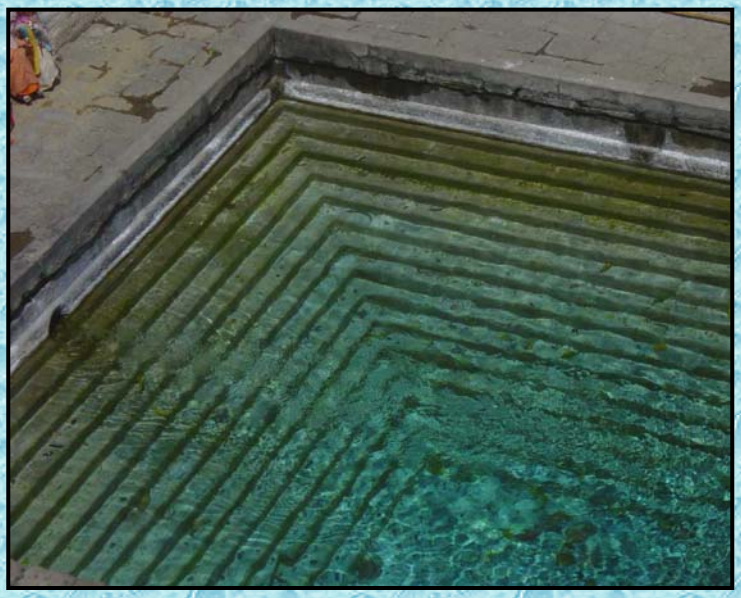
Survival Lessons

Water Management Traditions In The Central-Western Himalayas







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Abstract

India is home to fantastic water harvesting traditions that have evolved over millennia. The central western Himalayan states of Himachal Pradesh and Uttarakhand are no exceptions to these traditions. The present review describes a variety of water harvesting structures found in this region. It highlights their features with reference to specific structures. Traditionally, local communities exercised rights of ownership, use and management over their natural resources. They devised a variety of management systems suited to their own specific situation. Examples of innovative management systems are cited for traditional farmer managed irrigation systems. The traditional systems developed within the prevailing social context. Caste played a major role in the access to water. Usually, separate resources were allocated to the lower castes.

Sanskar *(precepts and rites),* sanskriti *(culture and customary practices) and* niti *(state policy and administration) were the bases of water harvesting traditions and their longevity. Individual dharma and social customs were the necessary conditions for sustaining these traditions, while local autonomy in resource management was the critical sufficient condition. Colonial governments eliminated the traditional rights and powers of local communities in their territories of Himachal Pradesh and Uttarakhand. They chose to make state powers supreme and gave some limited rights to individuals. The basic approach in the post-independence period has been to adopt, expand and amend the colonial legal and administrative framework. The transformation of* niti *alienated the local communities from their resources and eroded the related* sanskar *and* sanskriti. *The decline of tradition has continued.*

Practical steps to build on the living traditions of the central-western Himalayan region are outlined in the concluding section.

I. Introduction

India lies in the monsoon belt of the globe. Rain and snow fall over a period of less than a third of the year. Over millennia, communities all across the country learnt to collect the rainwater, store it and husband it to last for the rest of the year. And thus, a fantastic water-harvesting civilization took shape in India.

The central-western Himalayan region, comprising of Uttarakhand[a] and Himachal Pradesh, was no exception to the nation's water-harvesting traditions. The tremendous geological and ecological diversities in this Himalayan region led to a glorious profusion of water harvesting structures like naulas, *baoris*, *nauns*, *dharas*, *panihars*, *chharedus*, *khals*, *chaals* and *khatris* (See Table 1). They stored rainwater that flowed down hillsides, percolated through rocks and emerged as springs in the mountain terrain. They were used for bathing, washing, drinking, worshipping, watering livestock, irrigating and for village industries. Thousands of kilometers of hand-dug *kuhls* and *guhls* tapped mountain streams, carrying water for irrigation and powering thousands of *gharats* or watermills. Communities took pride in their water systems, as evidenced by the exquisite ornamentation and architecture of many of these structures.

An amazing aspect of these structures and systems is that a large number of them function even today, hundreds of years after their construction. They continue to be used by the local people, while the modern, newly-built structures often become dysfunctional in a matter of a few years. They are living examples of sustainable technologies.

The next section of this paper describes the variety of traditional water harvesting structures and systems in Uttarakhand and Himachal Pradesh. The bases of tradition lay in scriptural precepts, cultural practices, jurisprudence and administrative systems. These are reviewed in the third section, followed by a section on the erosion of tradition. The concluding section culls lessons for survival from the principles of traditional water harvesting structures and management systems.

Table 1: Traditional water harvesting structures in the central-western Himalayas.

Structure	Use
Uttarakhand	
Chaal/Khal/Chuptyaula	Animal consumption
Naula/Baori	Domestic water use
Dhara	Drinking water, occasionally irrigation from large *dharas*.
Guhl	Irrigation and operating *gharats* (watermills)
Hauzi	Irrigation
Gharat	Milling
Himachal Pradesh	
Chappri/Talaai/Talaab	Livestock/irrigation
Baori/Khatri	Domestic water use
Naun	Bathing & washing clothes
Chharedu/Panihar/Nahun	Bathing, drinking water
Kuhl	Irrigation & operating *gharats*
Gharat	Milling

II. Traditional Water Harvesting Structures and Systems





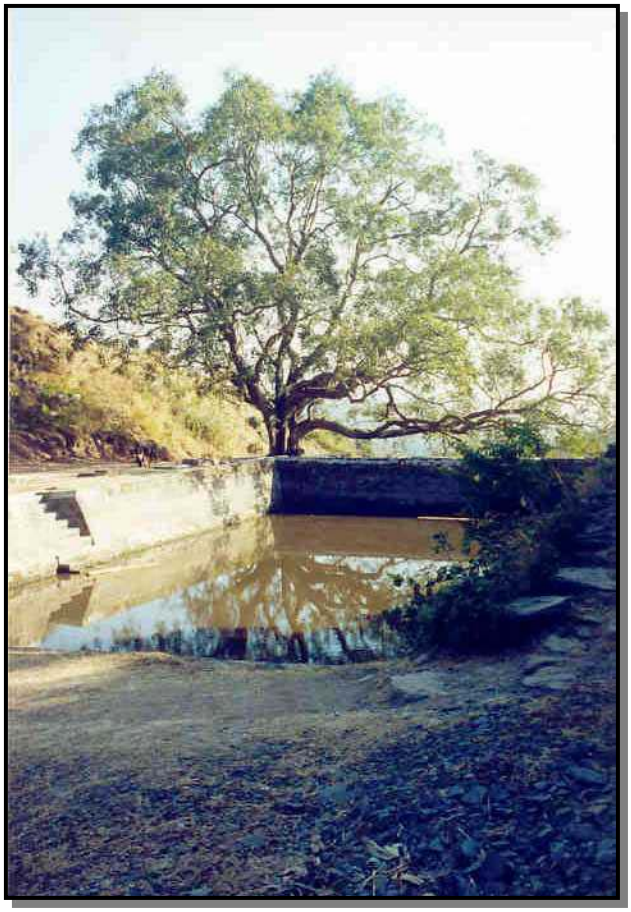

Water harvesting refers to the collection, storage and utilization of all locally available water, including precipitation, surface runoff, snowmelt, lakes, ponds and groundwater, as springs and wells, but excluding groundwater that has to be pumped up.[1]

Traditionally, water for household use was obtained from springs, flowing mountain streams or built rainwater harvesting structures. Open water bodies, such as ponds, masonry tanks, *chappris*, *chaals* or *talaais,* provided water for animals, irrigation and for washing purposes. For human consumption, people preferred to (i) harvest underground seepages in *baoris* or *khatris* (Himachal Pradesh) and *naulas* (Uttarakhand), or (ii) tap springs through *dharas* (Uttarakhand) or *panihars*/*chharedus* (Himachal Pradesh). Irrigation was based on diverting water from a mountain stream into a channel laid across the contours of a mountain to convey water to terraced fields. All of these structures were usually common property resources. They were largely owned, used and maintained by the local communities. These technologies still provide for a significant proportion of the water needs of communities in this region.

The variety of water harvesting structures arose from the ecological and geological diversities of the region. Some of these systems were originally constructed by local rulers, feudal lords, or by well-to-do families in the community, but most belonged to the community. There was minimal state intervention in water rights or management. Inevitably, the traditional systems incorporated prevailing cultural practices. This section describes various types of structures, their management systems and current status.

[1] J.S. Samra, V.N. Sharda & A.K. Sikka (2002) : Water Harvesting And Recycling Indian Experiences, Central Soil & Water Conservation Research & Training Institute, Dehra Doon.

II.1 *Chaals, Khals, Chappris, Talaais, Chuptyaulas* and *Simars*



A variety of natural formations or depressions in the mountain areas are used for rainwater harvesting. The most common are *chaals or khals*. *Chaals* are usually found along mountain ridge tops, in the saddle between two adjacent crests. They were formed in the past by the glacial action of snowmelt, resulting in the formation of small lakes or ponds with a relatively thick soil bed. *Khals* (lakes) are larger and can store several thousand cubic metres of water. The water caters to the needs of people and their livestock. It also seeps through pore spaces, fissures and fractures in the underlying rock to recharge springs at lower elevations. In Pauri district alone, 70 well-known *khals* have been enumerated.[2]

Chappris, in Himachal Pradesh, are usually shallow dug ponds without any masonry work. They are mostly used for livestock and irrigation needs. They are located on the hill sides where the slope tends to flatten out. A grand *chappri* can be seen on a hillock in Pirthan village, overlooking the backwaters of the Bhakra dam in Bilaspur district. It was constructed about a 100 years ago according to the villagers. It is a big rectangular structure with nine steps leading to the water. A huge *peepal* tree and a mango tree grow on opposite sides. "Until 15 years ago, when there were no taps in the village, everyone was completely dependent on this *chappri*," says Nikka Ram, 70, of Pirthan. Now the 40 households of the village use this structure only in times of crises and only then is it cleaned.

Other natural rainwater harvesting structures include *chuptyaulas* and *simars*. The former are rudimentary structures, found in the high-altitude areas of Uttarakhand, which collect water from springs or where it oozes out of the earth. They are normally used as watering holes for animals, and occasionally for human use. Wild animals and birds depend on these structures as well. *Simars*, on the other hand, are natural features – waterlogged flat lands. High quality crops like basmati rice, or medicinal plants and herbs, are sometimes grown in *simars*.

[2] B.Sharma, A.K.Lal and T.Singh (1997): "Rainwater Harvesting Structures – A solution for water crisis in the Himalayas: A case from Ir Gad microwatershed in Pauri district, Garhwal Himalaya", Paper presented at a workshop on Futuristic Model Habitat, Pauri.

II.2 *Naulas*

Naulas, sometimes also called *baoris*, are shallow, four-sided stepped wells. They are characteristically found in those parts of the Middle Himalayan region, which often face water shortages. In Uttarakhand, *naulas* are more commonly found in Kumaon than in Garhwal. They are designed to collect water from subterranean seepages or springs and are used to meet domestic water needs by the local communities.

Most *naulas* have a similar basic design. The well is constructed in the form of an inverted trapezoid. The lowest step usually outlines an area of 1ft x 1ft, which increases to about 8ft x 8ft at the top. The well is walled on three sides and covered with a roof of stone slabs. Water may seep in from fissures in the steps or the base. Sometimes the source may be one to five meters away and water may be led into the well by a channel or a pipe. The drainage is usually designed so that the source is not contaminated by any of the well's uses. Animals are prevented from entering the tank area.

Pande describes the construction of a *naula* as follows:[3]

> "Once a site has been identified a pit is excavated gently so that the water source is not disturbed. A dry stone masonry wall is built across the direction of flow of water. A backfill of pieces of stone, gravel or other coarse material is placed behind this wall. Stone masonry walls in mud mortar constitute the other three walls of the tank. To ensure that water does not seep through the three outer sides of the tank these are built as double wall-i.e. two walls with an intervening space. This space is filled with clay puddle. A raised platform is made on one side underneath which a narrow drain is provided to lead excess flow away from the *naula*. This structure is built entirely underground and is shaped as an inverted pyramid. Since water from a *naula* is used generally for domestic consumption it is invariably provided with a roof."

The structure of *naulas* can vary considerably. Some *naulas* are massive and ornate structures, with rooms and platforms for bathing and washing clothes. Elaborate drainage systems keep the source water clean. Other structures might be just basic step wells, made of locally available materials and surrounded by trees. Usually, wells in villages are of the latter type, while those built by local rulers or in towns are of the former type. In his Gazetteer, Atkinson mentions that:[4]

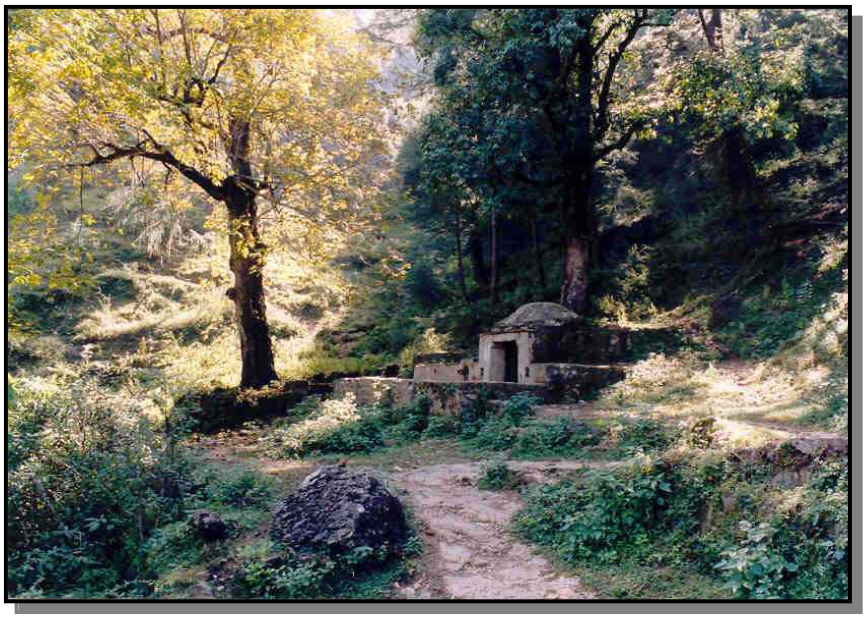
> *(Naulas)* "in most of the region are covered reservoirs only. Some have been built by ex-rulers and exhibit architectural features. There is a pillared veranda around them. Sculptures have been engraved for the interior decoration. Because the construction of *baoris* is considered honourable,

[3] U.C.Pande (1995): Design By Experience, Joginder Sain & Bros, New Delhi, p.85.
[4] E.T.Atkinson (1996): The Himalayan Gazetteer, v3 part 1, Natraj Publishers, Dehra Doon.

> therefore, these kinds of structures can be found in the neighbourhood of almost all villages and along the side of main highways."

The most amazing aspect of Kumaon's *naulas* is their longevity. Many of them are still in use today and are symbols of a sustainable technology. Perhaps the oldest functioning *naula* is the *Badrinathji-ka-naula*, c. 7th century A.D. Other important ones are Jahnvi *naula* (c.1263 A.D.) in Gangolihat, *Patan-ka-naula* (14th or 15th century) in Champawat district and the Syunrakot *naula* (14th or 15th century), the oldest one in Almora district.[5]

Almora city became the capital of the Chand dynasty in 1563 A.D. It has been said that at one time it had 360 *naulas*![6] But there is no recorded data to authenticate this number.[7] Pant's study has identified 99 springs in and around Almora, of which 69 are functional today.[8] Almora's more well-known *naulas* include the Kapina, Champa, Dhara, Hathi, Khazanchi, Dugalkhola, Malla and Baleshwar *naulas*.



A basic factor for the longevity of the Kumaoni *naulas* appears to be their maintenance by the local communities. Almost throughout history, until about 30 years ago, *naulas* were distinctly community property. Usually there were no detailed rules of management. The *Prant Panchyat Vidhan* issued by the ruler of Tehri Garhwal in October 1938, was an exception.[9] This royal decree identified the cleaning of *guhls*, ponds, *panghats* and *baoris* among the duties of the *panchayat*.

Villagers traditionally revered their *naulas* and the rituals observed in constructing them were similar to those of a temple's construction. Their water was considered sacred and basic rules of sanitation and hygiene were observed. Sacred tree species like the *peepal* and banyan trees, were planted near a *naula* to signify its sanctity and to protect and shade it. To ensure the potability of a *naula's* water, it was often treated with medicinal plants such as *amla* and *neem*.[10] The local communities tended to have a holistic perception of the local ecosystem. They not only looked after the *naulas*, but also tried to protect their catchments.

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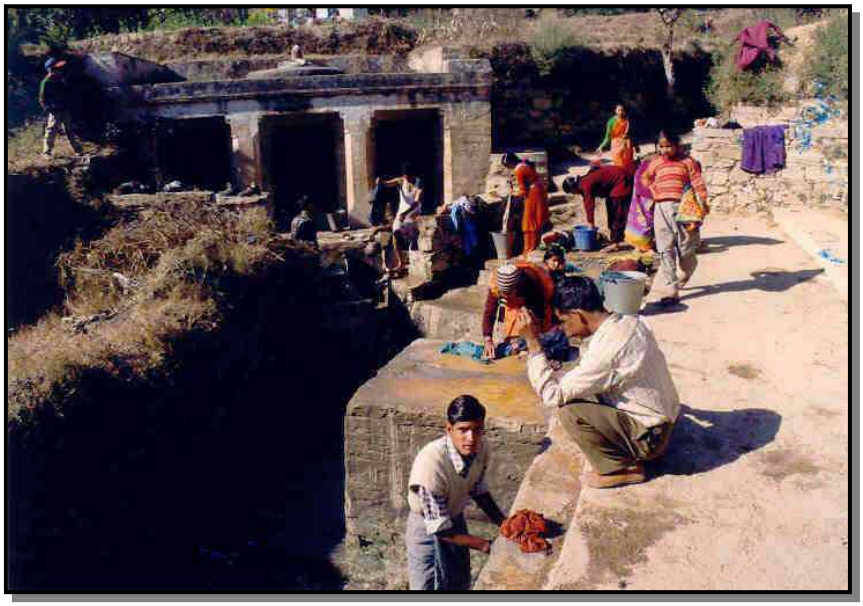
[5] A.Upadhyay & P.Bisht (2001): "*Uttarakhand Mein Jal Prabandhan: Ek Sinhavlokan"*, Naini Tal, p.7. (in Hindi)
[6] P.C.Pant (1995): *Parvatiya Jal Srot*, Shree Almora Book Depot, Almora, p.26.
[7] P.Rautela (2000): Water Resources In The Himalayas: Harvesting, Tradition and Change , Concept Publishing Co., New Delhi, p.54.
[8] P.C.Pant (1995): *op.cit*., p.16.
[9] U.C.Pande (1995): *op.cit*., p.28.
[10] A.Agrawal & S.Narain (1997): Dying Wisdom, Centre for Science & Environment, New Delhi, p.45.

Current Status: Today, thousands of *naulas* in Uttarakhand lie forgotten and decaying. Their degraded condition reflects a decline in community water management -- following the complete take over of water resources by the state -- and the ecology, culture and traditions that supported these systems over centuries. Ecological disruptions like deforestation, landslides, earthquakes, changing land-use patterns, increased population pressure and other factors also disrupt the subterranean flows that feed *naulas*. Where piped water has been provided, the cleanliness of *naulas* is not always ensured. Most significantly, the skill in locating sources, building and designing these structures is gradually being forgotten, probably a casualty of the heavy out-migration from the region. [11]



A vast majority of *naulas* in Uttarakhand are perishing under the onslaught of modern development, particularly road construction. In Champawat, the ancient Tapnaula was buried during the construction of the Lohaghat-Barakot motor road. Similarly, several *naulas* such as the Nagnaula of Dungra village in Champawat, Bhannaula (on the ancient Kailash-Mansarovar pilgrim route), the *naulas* of Gangolihat block in Pithoragarh district and the naulas of Almora City are neglected, silted up, or paved over and lost.

Yet, faced by the threat of declining reliable water sources, some communities have made efforts to renovate and revive their *naulas*. In 1958, the residents of Meldungri village renovated a historic *naula*. It is heavily used today. (But, it appears that dalits are not allowed to use it. They have to use water from two nearby *dharas*.) A beautiful *naula* in Tharkot appears to have been reconstructed from the remains of a damaged temple. The local villagers use it and maintain it.

[11] A.Upadhyay & P.Bisht (2001): *op.cit*., p.11.

The Historic *Naulas* of Kumaon*

In Kumaon, historic *naulas* are found near old towns and settlements, like Champawat, which was the capital of the erstwhile Kumaon state, in Gangolihat, Almora, Dwarahat and Pithoragarh, and the Katyur valley. Many of them still serve the populations of these towns and cities, especially when piped water supplies fail. While village communities built simple basic structures to meet their daily needs, local rulers, their courtiers and wealthy families in the region built elaborate structures in towns and highways particularly on important pilgrim routes like the Kailash-Mansarovar route. Almora, once the capital of the Chand dynasty, is a city of *naulas*. Of its 69 *naulas* that are still used, the more well-known include the Kapina, Champa, Dhara, Hathi, Khazanchi, Dugalkhola, Malla and Baleshwar *naulas*.

The historic value of a *naula* is usually related to its age, architecture or religious aspects. The oldest *naula* in Kumaon appears to be the *Badrnathji-ka-naula* in Gadser village of Bageshwar district. In the 7th century A.D., the Katyuri kings established Garur-Baijnath as the capital of their kingdom. To commemorate this event a temple to Lord Badrinath and a *nuala* near it, were built. It still exists.

Jahnvi *naula* (c 1263 A.D.) in Gangolihat town was built by Raja Ramchandra Dev for use by worshippers of the nearby Kali temple. Its water supply has reduced due to the disturbance of its catchment as Gangolihat town has grown. But it has been cleansed and restored for use by the Archaeological Survey of India. *Syunrakot-ka-naula*, the oldest in Almora district and *Patan-ka-naula* in Champawat both date back to between the 14th and 15th centuries.

The Ekhathia (one-handed) *naula* near Dhakna village in Champawat district is a unique example of the old Kumaoni architecture. There are several stories about its name. The most commonly believed are that it was built by a one-handed mason or, that after its completion the king had the mason's arm chopped off so that a similar structure could not be built elsewhere. Sculpted in its stone walls are a variety of scenes from everyday life with impressive images of dancers, singers, fruit-laden women, kings, their courtiers and soldiers. Other architecturally important *naulas* are the Bhannaula near Meldungari village in Pithoragarh district and the Haat-Boragaon *naula* near Balakot. The latter has been described as probably the most beautiful *naula* in all of Uttarakhand. But it is also neglected and unused.

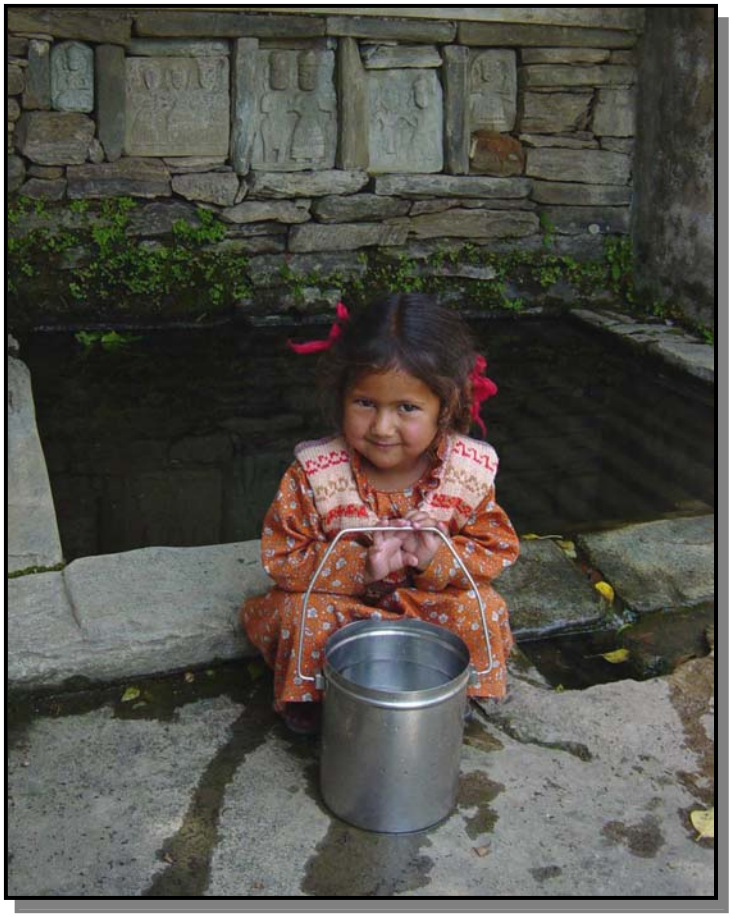
Several *naulas* in villages near Gangolihat are well-known for their sheer sizes. But Pungeshwar *naula* near Berinag in Pithoragarh district may be the largest. A long gallery leads upto the well itself. The gallery's roof rests on two stone slabs, about 19 feet long. On either side of the gallery are 18 ft long platforms. It appears to have been a *naula* and a resting place. But today it is in an unused and decaying state. Grass and weeds in its walls are weakening the structure.

Lord Vishnu is associated with water in Hindu scriptures and mythology. Hence many *naulas* have idols of Vishnu installed in them or sculpted on their stone walls. The finest sculpture is of Vishnu reclining on Shesha Nag in the Kapina *naula* of Almora city. The Nagnaula (c 16th century) of Dungra village in Champawat district has two beautiful idols of Vishnu. Baleshwar *naula* (c 1272) in Champawat town is unique in that it has a stone image of Lord Budha on its far wall. *Patan-ka-naula* and Hat-Boragaon *naula* have idols of Lord Ganesh installed in them.

The number and scale of Kumaon's *naulas* reflect a vision of water management among rulers and communities, and a strong committment to provide and sustain water management systems that enhanced their well-being.

* Based on, A. Upadhayay & P. Bisht, (2001): *op.cit.*,

II.3 *Baoris* and *Nauns*



Baoris are the *naulas*, shallow step wells of Himachal Pradesh. The bigger ones measure about 5m x 5m at the top while the smaller ones, called *baoru*, may measure just 2m x 2m. Very large *baoris* are called *nauns*. While water from *baoris* is used for all domestic purposes, *nauns* are mainly used for bathing and washing clothes. Platforms may be built outside a *naun* for washing purposes. *Baoris* are usually covered structures, but *nauns* are uncovered. Baoris are walled to keep animals out and also to prevent unclean water from entering it. A trough is sometimes provided outside a *baori* for animals to drink water from.

Baoris and *nauns* are largely found in the Outer Himalayan region, with moderate rainfall. This includes the districts of Shimla, Mandi, Kangra, Hamirpur, Bilaspur, and the northern part of Solan district. Sandstone rocks in these areas tend to retain water, which then seeps out through faults and fracture zones.[12]

The majority of village *baoris* have been built by local communities and are very simple structures. Some built at the initiatives of rulers and influential community members, had elaborate structures. Though many *baoris* are said to be several hundred years old, the practice of constructing them appears to have continued through the twentieth century. Many of the latter are built in memory of departed elders or to earn spiritual merit. There are several such examples in Solan district, like the two big *baoris* in Subathu town or the Byos *baori* in Jagjitnagar gram panchayat, built by Gyan Devi in 1961, in memory of her husband.

In general, there are no well-defined rules of water management related to *baoris* and *nauns*. Caste discrimination, however, appears to be a common feature. In many locations, there are separate *baoris* for people of upper and lower castes. The ones for the lower castes are usually smaller and unadorned structures by comparison. Most *baoris* do, however, have a hallowed status. This is evident from the planting of *peepal* and *banyan* trees that have religious significance and the carving or installation of idols of local deities in the walls of the *baoris*.

[12] P.Rautela (2000): *op. cit.*, p.42.

Himachal's *Baoris*

Mandi district is to *baoris,* what Almora is to *naulas.* The town of Mandi, the headquarters of the erstwhile Mandi State, has elaborate temples, exquisite *baoris* and big *nauns*. The most important *baori* in Mandi town is the Shiva *baori* which looks like a temple. An elaborately carved door leads to the well. Lord Ganesh sits in the middle of the gate flanked by two yakshas. Its roof is shaped like a lotus. People use the water flowing out of the *baori* through a pipe.

Rani-ki-baori was built at the instance of the Queen of Raja Lakshman Sen about 300 years ago. It is located on the Mandi-Sundernagar road, about 5 km from Mandi town. It has a big well about 5m x 5m at the top and with 11 steps. Idols of Varuna, Mahasu, Ganesh and a Shivalinga adorn it. Water flows outside through a pipe and is regularly used by the local people. Other important *baoris* in Mandi district include the Kaldo *baori* in Kalar village, Tandu *baori* on the Mandi- Pathankot highway, the small Guphi *baori* in Tandu village, Nagchala *baori* near Harabag village and the Gumma *baori* in Gumma village.

Raja Karam Chand built a large *baori* in Jubbal town, the seat of the Jubbal State in Shimla district, about 300 years ago. It is a big well measuring about 5m x 5m with 13 steps. A huge idol of Nandi, the attendant bull of Shiva, sits in the water while idols of many deities lie around it. Its water falls outside through a marble fountain in the shape of a cow's mouth. Its clean water is used for drinking purposes. The *baori* is looked after by the Municipal Council.

Nirmand village of Kullu district – once known as the Kashi of the mountains –had seven large *baoris* and seven small ones serving seven castes in the village. Now only four big ones survive. The most important is the Chandi *baori* located next to the Chandi temple. Its water is clean and is used by the villagers. The Lateba *baori* on the other hand, though regarded as built by the Pandavas, lies neglected and in ruins.

In Bilaspur district, several *baoris* were constructed at the initiative of local women. These include the Fandauri *baori* in Bumb village and the Baidu *baori*, about 2km away from Bumb. In Chandruhi village of Hamirpur district, there is a large *baori* which was built by a woman named Chandruhi. Local people claim that she had 101 *baoris* built in the region.

In Ganglauj-Barohi villages of Bilaspur district, despite 3 handpumps and 2 stand posts, people fetch the sparkling clean water from their local *baori* to cook and clean. "There are unwritten rules that everyone follows," says Brahmi Devi,76. A bamboo tree in its vicinity and idols in the *baori's* walls indicate its hallowed status and explains its cleanliness. And that is how the tradition endures.

Current Status: The sanctity of *baoris* has eroded in recent decades with piped water supply being provided by the Irrigation & Public Health department. Care and maintenance is irregular and a large number are in a decrepit state. "We have ruined our *baoris*," laments Balwant Singh, 58, of Kolhada village in Shimla district, where four out of seven *baoris* have gone dry.

There are, however, several examples of people preferring to drink water from their *baoris*, rather than from piped water supplies. In Khajret village, Solan district, the residents continue to use water from a local *baori* even though a water lift scheme has been providing water since 1988. Jassi Ram an elder of the village explains this preference saying, "We don't consider water stored in closed tanks as being healthy. Open water which is in contact with air is better."

People tend to clean *baoris* in the summer when piped water supply often fails. Thus paradoxically, the shortcomings of the IPH department keep the tradition alive.

Nauns

Nauns were usually built by local rulers. They serve a variety of purposes – for domestic consumption, washing and ritual bathing. Among the most well-know *nauns* is the Sujanpur Tirha *naun*, dating back to the 15th century, inside the Sujanpur Fort in Hamirpur district. It is an excellent example of rain and groundwater harvesting. But the structure itself now needs repair. Its water is used only for the livestock. About one-third of it is filled with silt, moss and weeds.

The Guptganga *naun* is part of the Guptkashi Dham in Kangra town. It is also a large structure measuring about 30m x 25m x 2m. Though legend has it that Arjuna struck an arrow into the ground here to start the water flowing, history attributes its construction to the Mughal Emperor Shahjahan in the 17th century. "People come here for holy dips on auspicious days like *Makar Sankranti* and *Baisakhi*," says Kashmir Singh Rana, President, H.P. Temple Trust Committee.. Its cleaning is organized on a fortnightly basis by the temple trust.

The Jinh *naun* is a large stone structure about 25m x 20m x 10m in Jinh village of Hamirpur district. It is fed from a perennial spring whose outlet is shaped in the form of *nag devta*. It is said to have been built by Raja Sansar Chand Katoch of Sujanpur more than 200 years ago. Its cleaning is a massive job and is done about once in a few decades. Besides ritual bathing, its water is also used to irrigate about 10 ha downstream.

II.4 *Dharas, Mungurus*[13]

A common source of drinking water in Uttarakhand is the *dhara* or *munguru*. It is essentially a drinking water fountain. Water from springs or subterranean sources is channeled out through carved outlets. The latter are often in the shape of either a simple pipe, figures of women with water pitchers or animal face masks. The shape of the outlet is such that even with low water pressure, water can be easily drunk. The degree of detail and ornamentation of a *dhara* varies according to the status of the builder. *Dharas* often bear inscriptions paying tributes to the rulers.

There are three types of *dharas*, depending on their height above the ground. If one can drink from a *dhara* while standing straight, it is called a *sirpatia dhara*. These *dharas* are sometimes decorated with face masks of animals like cows, lions, elephants, snakes or crocodiles. If one has to bend over to drink from one's hand or to fill a container to drink from the *dhara,* then it is called a *mudpatia dhara*. These *dharas* also have animal face masks or simple pipe structures. The third type of *dhara* is a seasonal one. During the monsoon season, wooden spouts or broad leaves are stuck in the path of a flowing spring or seepage to create them. They are called *patvinyan dharas*. Often one has to sit on the ground to drink water from them.

Dharas are evenly distributed in Uttarakhand, from mountain crests to the valleys. They are also found in old towns and cities. The main road of Pauri is called *Dhara Bazaar*, after an ancient *dhara* which has now dried up. It used to be a major source of water for the town and fed a system of *guhls* and canals. Water flowing from *dharas* is usually fit for human consumption and other household uses since the source is either a spring or subterranean seepages. *Dharas* can also be used for other purposes. In Bhotia villages, special *dharas* were made for cleaning wool. Sometimes their water is stored in tanks for human and livestock use. *Dharas* with large flows are used for irrigation.

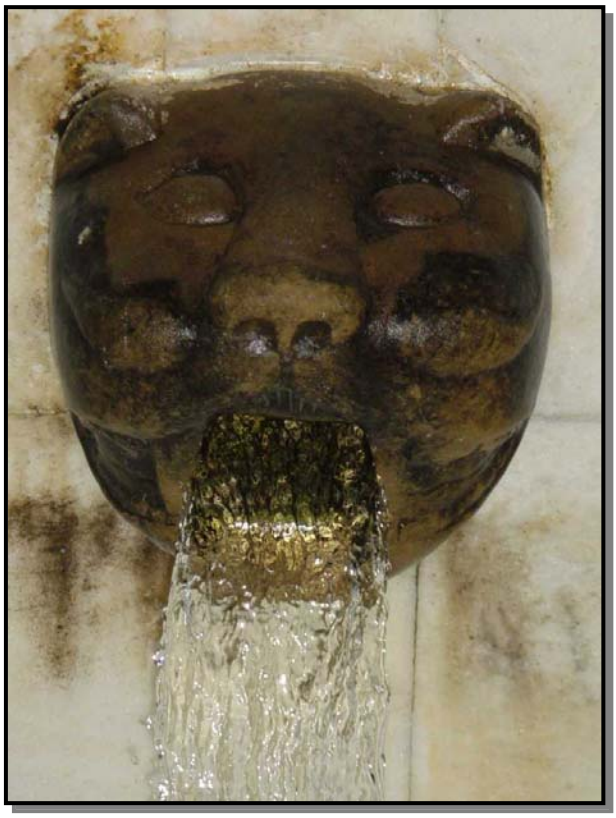
Current Status: Many urban and rural settlements still depend on *dharas* for a secure supply of water. Two *dharas, Parda dhara* and *Sipahi dhara* supply water to a large population in Nainital. In Gopeshwar, a perennial *dhara* near a Shiva temple supplies water to the city. Ghunsera,

[13] Based on A.Upadhyay & P.Bisht (2001): *op. cit*, pp.12-13.

Nakuleshwar (Panchdhara), Berinag, Devalthal, Chopta, Thal, Harinanda, Kantheshwar Mahadev of Pithoragarh district and Naini, Jainti and Trinetreshwar of Almora are all places with ancient *dharas*. Tharkot village, near Pithoragarh, has several old *dharas,* which provide the village with water. These *dharas* are beautifully carved and ornamented, one example having several deities and an idol of a woman carrying a pot from which the water emerges.

Dharas, however, are very sensitive to environmental disturbances and geological activity. In the Garhkot watershed of Tehri Garhwal district, an old perennial *dhara* called *Amni-ka-dhara* dried up after the 1991 Uttarkashi earthquake. Deforestation and the associated reductions in groundwater storage and water retention capacities also affect *dharas*. The loss of this resource can have a severe impact on the local community. Pauri, having lost its ancient *dhara*, is now a water-starved town.

II.5 *Panihars, Nahuns* and *Chharedus*



A ***panihar*** is a cistern in which water flows from a spring or a diversion of a stream.[14] It is most commonly found in the Ravi, Pangi and Chenab valleys of Chamba district in Himachal Pradesh. They were constructed as an ancestor worship ritual. It was believed, "that the dead acquire[d] *pun* or merit from the pious act of the living, and [were] thereby enabled to rejoin their ancestors."[15]

The common *panihar* usually had an image of the deceased person roughly cut into the stone slab. But those constructed by local rulers and wealthy *zamindars* were ornately carved with images of gods, goddesses, and common people. They bear elaborate inscriptions which are important sources of the history of the local region since they are dated. The Chamba Gazetteer (1904) makes a special reference to such fountain stones at Churah, Pangi, Sai, Naghai,Devi-Kothi and Mul-kihar. The last named had "thirty stanzas in excellent Sanskrit" describing "the genealogy of the local Rana and the circumstances under which the cistern was constructed."[16] The oldest fountain stone dates back to the start of the twelfth century A.D.

[14] _____(1996): Gazetteer Of The Chamba State 1904, Punjab States Gazetteer v XXII A, Indus Publishing Co., New Delhi, p.197. (Reprint)
[15] *Ibid*, pp.196-197
[16] *Ibid*, p.55.

Nahuns are larger water fountains seen in the Pangi and Chenab valleys, up to Kishtwar in Jammu. They were great feats of human labour as evident from the following description:[17]

> "The *nahuns* are usually square or oblong in shape, closed in at the sides and back, but open in front. The floor is formed of two massive stone beams, reaching from side to side in front and behind, and over these flat slabs are laid, diagonally overlapping one another. The larger slabs are as much as 20 feet long, three feet broad, and two feet thick; in the smaller *nahuns* they range from six to twelve feet in length. The stone spouts are in the back wall and may be as many as ten in number. The most massive *nahuns* are found in the Bhutna Nala in Padar but they have no inscriptions. The handling of such immense blocks of stone must have been a work of great difficulty. They had first to be quarried and dressed, and then dragged to the site of the fountain, which may have been some considerable distance away, and the drag-holes may still be seen in the ends of the stone. As many as 100 men were sometimes required for this purpose, and occasionally even the women had to be requisitioned. The erection of a *panihar* or *nahun* was regarded as an important and auspicious occasion and was accompanied by certain religious rites; all who assisted being entertained at the expense of the builder. In most cases, as appears from the inscriptions, they were the work of the Ranas or of wealthy *zamindars*. Some are still in a fair state of preservation, but most of them are now in ruins."

Chharedus are spring fountains found in the Kangra valley and are essentially used for bathing. The spring water falls through a carved stone. A rectangular enclosure with a drain is constructed around it. The outflow goes to the fields through an earthen channel. Women also fetch water from the *chharedu* for domestic uses.

A *chharedu* inside a temple in Ghugghar village, about 5km from Palampur town, provides sparkling clean water from a *kuh*l. Images of Buddha, Vishnu and Lakshmi on Sheshnag are carved its walls. A bamboo grove and a *peepal* tree grow in the vicinity. Near the temple is a funeral platform. Water from the *chharedu* is used by the local people for domestic purposes and for ritual bathing after funerals.

On the outskirts of Palampur town, an old *chharedu* has been crowded out by the town's urban sprawl. The spring feeding it has been diverted to save the foundations of newly built houses. "Nobody needs the *chharedu* these days. People have modern baths with hot water in their homes now, "says Sudarshan Katoch, a local shopkeeper. With the mountain regions expected to see a massive wave of urbanization in the 21st century, his statement sounds like an ill-omen for the traditional water-harvesting structures that still dot the region's landscape.

[17] *Ibid* ,p.198.

II.6 *Guhls / Kuhls*

Archaeological excavations reveal that terraced agriculture has been practiced in the central Himalayas for a thousand years or more.[18] The problem of irrigating the terraces has been historically resolved by diverting water from nearby mountain streams through channels known as *guhls* in Uttarakhand and *kuhls* in Himachal Pradesh. These are small gravity flow irrigation channels that gently traverse the contours of a mountain slope. Though *guhls* are primarily meant for irrigation, some also provide hydropower for *gharats* (water mills) or for turning potters' wheels or water for domestic uses other than for drinking.

Guhls have traditionally been farmer managed irrigations systems (FMIS). But after Independence, an increasing number of *guhls* in Uttarakhand and Himachal have been taken over by state government agencies. Their importance for mountain irrigation can be recognized from the extent of the area irrigated by them. *Kuhls* irrigated about 84 per cent of the net irrigated area in Himachal Pradesh in 1994-95.[19] FMIS accounted for 48.6% of the total irrigation potential created in the state till March 1999.[20] In Uttarakhand, *guhls* accounted for about 42% of the total net irrigated area in the state in 1993-94.[21] In the mountain districts of Chamoli, Uttarkashi, Tehri Garhwal, Almora and Pithoragarh, this ratio was over 62%.

Traditional FMIS in Himachal Pradesh and Uttarakhand had a highly formalized system of management. British administrators recorded water rights during the revenue assessment exercises – called Settlements – undertaken in the 19th and the early 20th centuries. The *Riwaz-i-abpashi* are a unique and comprehensive form of recorded water rights of farmers in HP. All FMIS, however, do not have a formal management system. This is especially true of those areas that were ruled by local feudal lords.[22]

Some Well-known FMIS

Soon after the British acquired the territories of Kangra district and Kumaun in the early part of the 19th century, they took note of the highly evolved FMIS in these regions. In Kangra, some of

[18] U.C.Pande (1995):*op.cit.*, p.67.
[19] ____(1996): Statistical Outline Himachal Pradesh, Economic & Statistics Dept., GoHP, Shimla, p.62.
[20] ____(2000): Annual Plan 2000-2001, Planning Dept., GoHP, Shimla, p.195.
[21] A.Joshi, P.S.Garia & I.Hasnain (1999): Uttarakhand Update, Kanishka Publishers, New Delhi, p.72.
[22] R. Chand (1994): "Role of Water Rights in Farmer-Managed Hill Irrigation Systems", EPW, March 26, 1994, p.A-27.

the *kuhls* were large systems built by formers rulers and their courtiers. They were expensive and designed to last, with lined canals and sometimes with permanent diversion structures at the head. User-built systems on the other hand were short – typical lengths being a few hundred meters -- with narrow and unlined channels. As Barnes wrote about Kangra's *kuhls* in his Settlement Report (1855):[23]

"Most of these canals have been projected by the people themselves; the larger ones, which supply water to four or five villages, are generally the work of individuals, the relatives or connections of ancient rajas …. The peculiarity of the canals is that they are managed entirely by the people, without any assistance from government. The people maintain an organized staff of officers, usually one for every village, to patrol along the canal course to prevent theft, stop leakage and to distribute the water. Every village has its own code of rules."

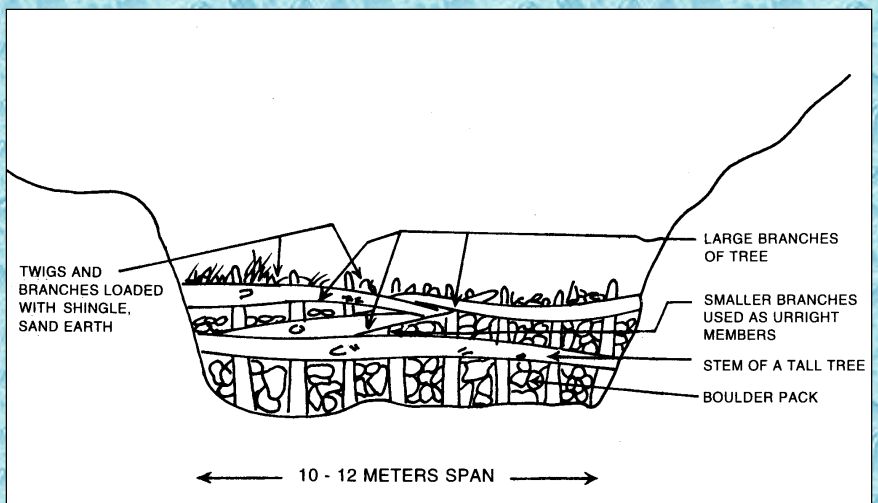
Rulers of Kangra's Katoch dynasty, or their nobles, may have sponsored the construction of the big irrigation systems in Kangra during the pre-colonial times – 17th century to the early 19th century. Most *kuhls* are named after the stream or village of origin. But some of the big *kuhls* were named after the nobles who sponsored them, like the Kripalchand *kuhl*, Mian Fatehchand *kuhl*, Mian Kimanchand *kuhl*, Gyanchand *kuhl* or the Sujan Singh *kuhl*. The Kripalchand *kuhl* is almost 30 km long. It is designed to serve an area of more than 2400 ha and carry a peak flow of 2 cumecs (2000 lps).[24] This *kuhl* diverts water from the Neugal Khad (stream), a perennial stream near Palampur which originates from the snow-clad Dhauladhar range. Today 39 *kuhls* from Neugal Khad irrigate about 5000 ha in the 85 sq km (8500 ha) Neugal basin.[25] Dai-di-kuhl has its diversion weir just a few meters upstream from the Kripalchand *kuhl*. It was built by the daughter of Raja Sansar Chand.

The legendary *guhl* in Maletha village of Tehri Garhwal district is perhaps the most well-known *guhl* in Uttarakhand (See box: The Legend of Maletha *Guhl*). It was built by digging a 100 m tunnel through hard rock about 350 m from its diversion point. The Katyuri kings (9th to 15th century A.D.) built tunnels at several places in Uttarakhand to provide water for otherwise dry

[23] G.C.Barnes (1855): Report of the Settlement in the District of Kangra in the Trans-Sutlej States, Chronicle Press, Lahore; as cited in E.W.Coward, Jr. (1990).
[24] U.C.Pande (1995): *op.cit.*, p.33.
[25] J.M.Baker (1997): *Common Property Resource Theory and the Kuhl Irrigation Systems of Himachal Pradesh, India*, Human Organization, v.56, n.2, p.201.

villages. Such tunnels can be seen at Lakhanpur, Patal Bhubneshwar, Jakh, Devalgarh and Chandpur even today.[26]

Maletha's *Guhl*



Diagrammatic Representation of Diversion Weir for Maletha's *Guhl*, Built Annually by Irrigators *(from U.C. Pande, 1995)*

This legendary *guhl* was built in Maletha, a chronically dry village, by Madho Singh Bhandari in the reign of Tehri's king Mahipat Shah (1625-1642). Madho Singh, with the help of the other villagers, dug a 100 m tunnel through hard rock to bring the waters of Chandrabhaga river, flowing on the other side of the mountain ridge, across to Maletha. Legend has it that Madho Singh had a dream in which he was anointed by a goddess to undertake this task. He picked up a shovel and began digging. Inspired by his courage the community joined him. It was a truly courageous and skillful effort. The story of Madho Singh's heroic effort is eulogized in many Garhwali folk songs.

Earlier, the Maletha *guhl* was an FMIS. Villagers formed a committee to manage it. The committee met every month. It appointed a person known as *ullalu* to supervise the distribution of water. He was also responsible for mobilizing voluntary labour from each family to repair any damage to the *guhl*. After every crop season he was given grains as a fee by every family.

Today, more than 350 years after its creation, Maletha's *guhl* still brings water to the village. With its broad irrigated terraces, this village is a symbol of prosperity. Though it is now owned by the state, the villagers are actively involved in its operation. It irrigates about 125 acres. The main crops grown are wheat, paddy, pulses and vegetables. The village is self-sufficient in grains and vegetables. Each year an annual ritual is held at the temple near the site of the diversion weir, before starting work on its construction.

A cluster of 31 small *guhls* take off from the 15 km long perennial Mansari Nala and its feeder streams in Almora district.[27] They irrigate an area of 90 ha in eight *gram sabhas*. These *guhls* are typical of traditional FMIS. Nine *guhls* in Talla Baigaini *gram sabha* in the same cluster are said to be more than 400 years old, though there is no record of their age. Other well-known *guhls* in Uttarakhand include the ones in Ladyura-Bayala Khalsa *gram sabhas* and at Sheraghat in the

[26] U.C.Pande (1995): *op.cit.*, p.21.

[27] U.C.Pande (1991): State and Farmer Managed Irrigation Systems in district Almora in UP Hills 1989-91, Water & Land Management Institute, New Delhi, pp.63-74.

Saryu valley. They have innovative water management systems (See box: Managing Irrigation Water).

Design Features

The construction elements of a *guhl* are very basic. A traditional *guhl* starts off with a temporary diversion structure in a stream bed. It has a dug-out earthen main channel – about a few hundred meters to a few kilometers long -- followed by numerous distribution points and field channels. Their engineering simplicity and the use of locally available materials enabled village communities to construct thousands of *guhls* in the central-western Himalayas. The 1915 Settlement Report of Kangra district recorded 715 *kuhls* irrigating multiple villages and over 2500 *kuhls* that serviced one village each.[28] Beckett's Settlement Report (1863-1873) for the area that constitutes the present Kumaun division of Uttarakhand recorded an irrigated area of 12655 ha.[29]

Unlike the present state-built irrigation systems, which are essentially engineering exercises, traditional *guhl* designs incorporated principles of hydraulics, materials engineering and aspects related to water distribution, operation and maintenance. The design of a system's diversion weir was often based on the manner in which the water was to be shared by different systems on the same stream. This comprehensive approach to design enabled a large number of systems to stand the test of time.

Diversion structures in the parent stream were temporary, semi-permanent or permanent. Temporary diversion weirs were preferred because annual flood flows could be extremely high and destructive, especially in the event of a cloudburst. "In fact, in most cases it would be technically inadvisable to build a permanent weir for hill irrigation systems," argues Pande.[30] Permanent weirs are too expensive for most communities. They have been constructed with state support in the Suketi *khad* in Mandi district, Dai-di-kuhl in Kangra and on the Gaula river in Nainital district.

Temporary diversion structures were built using locally available materials like boulders, brushwood, logs or tree branches. *Riwaz-i-abpashi* rules often specify the design of a diversion weir in the case of multiple *kuhls* on a single stream. Upstream structures are made porous enough so that water can flow through the structure with minimum hindrance to downstream

[28] J.M.Baker (1997): *op.cit.*, p.200.

[29] U.C.Pande(1991): *op.cit.*, p.8.

[30] U.C.Pande (1995): *op.cit.*, p.53.

kuhls. Upstream diversion walls may use boulders, shingle and sand, while clayey earth and grass may plug leaks in downstream structures. Such structures are inexpensive and easily repaired after they are damaged by floods. Traditionally, farmers volunteered their labour for such purposes.

Kuhl Numbers*

Typically the head flow of a main channel is about 50 to 200 liters per second (lps). Private systems owned by a family may have flows as low as 15 lps. Only very large systems like the Kripalchand *kuhl* in Kangra carry a load greater than 1 cumec (1000 lps) at the head.

The main channel of a *guhl* is 10 to 12 inches wide with a square or trapezoidal cross-section. The bed has a gradient of 4.5 m/km in the head region, reducing to about 3 m/km after the first kilometer. This gives a surface velocity of about 0.6 to 0.8 m/second. In a traditional FMIS, the main channel was unlined though some older systems had a stone lining with lime or dry mortar. Leakage losses from channels are estimated at 9 lps per kilometer length, dropping to 4.5 lps/km for lined channels. To minimize percolation losses, farmers apply dung at the head of a *guhl*.** The dung mixes with the water and settles along the bed of the *guhl*. It is claimed that the dung particles block the pores through which the water percolates, thus increasing the transmission efficiency. In government projects, stone masonry in cement mortar is used to line the main channel. But due to financial constraints, only 50 per cent of the length is lined. Occasionally, in remote areas of Kinnaur and Kullu districts of H.P., it is possible to see a limited timber-lined portion of a *kuhl*. FMIS have a command area of 10 to 20 ha per kilometer length. In the upper reaches of a stream this ratio is lower.

In an FMIS, given a flow rate of about 50 lps, a 1 ha command can be given about 5 cm depth of irrigation in about 3 hours.

* Based on U.C.Pande (1995): Design by Experience, Joginder Sain & Bros., New Delhi.
** R.Kumar, D.Sen & R.Chopra( ): "Guhls: A Traditional Irrigation System In Garhwal", in Traditional Water Management , B.C.Barah (Ed.) p.206

Pande has described a variety of outlet devices that are used to release and regulate water from the main channel to the field channels.[31] Typically, a farmer floods his/her field and then removes a stone plug at the outside edge of the field so that water can flow to the next terrace below. The excess water drains back into the *guhl* at the lowest point and the *guhl* itself joins the main stream.

Management Systems

While the physical works for gravity flow irrigation systems (GFIS) require engineering skills, devising systems for ensuring equitable distribution of water, operations and maintenance requires finely honed management systems. The management systems of traditional GFIS vary from those with no formal institutions or rules to those with highly formalized institutions, written records of water rights and devices for regulating water flows. For most traditional FMIS, the water rights of individuals users are known, even if they are not formally recorded. In the absence of formal records, however, might is often right.

[31] U.C.Pande (1995):*op.cit.*, pp.91-93

In Himachal Pradesh, water rights and management rules have been recorded in the *Riwaz-i-abpashi*—the register of irrigation customs. In the earlier British-ruled territories like Kangra, a register was maintained at the sub-district (tehsil) level and another at the village level, as part of the village revenue records.[32] The sub-district register recorded the customs for specific *kuhls*. The village revenue records referred to the irrigation rights within the village or its hamlets. These rights were legally enforceable. The erstwhile princely states often emulated British administrative systems and also established legally enforceable rights.[33] But in areas ruled by feudal lords, such customs or rules did not exist. In the British-ruled Kumaun region, irrigation customs were mentioned in *hukumnama* (orders), *ikrarnama* (agreements) and in the *wazib-ul-arz* (record of rights) of each village as part of the Settlement exercise.[34]

Though the *Riwaz-i-abpashi* contents of different *kuhls* differ, a typical record gives the history of the *kuhl*, the list of villages and farmers served and their rights, water distribution rules, the type of diversion structure, operation and maintenance procedures, penalties for non-participation in these chores and finally signatures of the beneficiaries affirming the veracity of the record.[35] These records have legal validity in Himachal Pradesh, even today.

Since most FMIS irrigate the fields of a number of farmers and sometimes stretch across several villages, a variety of systems have been devised for managing the distribution of water, operation and maintenance of the system. (See box: Managing Irrigation Water) The two main challenges in water distribution are: how to achieve an equitable distribution of water among the users of the system, and how to balance the use of water between different *guhls* that draw water from the same stream. Upstream users and those who are close to the head of a system are generally likely to receive a greater flow than users at the tail end. The challenge of water distribution is made more difficult by the fact that the maximum demand for water arises when the availability of water in the system is the lowest. For example, the maximum demand for most systems is during the preparation of the nursery for the paddy crop and it's sowing – March to end-May, when the evapotranspiration rate far outstrips the precipitation rate.

Traditionally, the maintenance and repair of an FMIS is a collective affair. Thus rights also entail responsibilities. All users are expected to participate in operation, maintenance and cleaning chores. Though such participation is not always to an equal extent for all users, there is little scope for free riding. At the network level, a general rule appears to be that the tail end village(s) is responsible for repair and maintenance of the main channel. In fact, extension of systems to new villages is often based on acceptance of this principle. Non-participation in O &M activities leads to a cash penalty, non-payment of which can lead to cutting off of the water supply or imposition of social sanctions.

Though complex arrangements exist in many traditional FMIS to ensure fairness in water sharing, it would be incorrect to say that water sharing in all such systems is equitable. In fact, in systems

[32] E.W.Coward, Jr (1990*): "Property Rights and Network Order:* The Case of Irrigation Works in the Western Himalayas", Human Organization, v.49, n.1,p.80.
[33] R. Chand (1994): *op.cit.*, p.A-27.
[34] U.C.Pande(1991): *op.cit.*, p.102.
[35] U.C.Pande (1995): *op.cit.*, p.31.

that service multiple villages this is rarely the case. The general rule appears to be that tail end village(s) supply the labour for maintaining the entire length of the main channel whereas the head end villages work to maintain only their limited portion. Coward's case study of the Bharul *kuhl*, where the tail end Deogram hamlets have irrigation rights only during the initial sowing period of the *kharif* season, but help maintain the entire main channel – highlights this imbalance between the rights and responsibilities of the head end and tail end villages.[36] For the remaining *kharif* season the Deogram hamlets depend on local seasonal streams that are refreshed by the monsoon rains. Why then do the Deogram farmers agree to such an apparently unfair regime? Coward contends that the critical needs of these farmers for irrigation water during the sowing of the *kharif* crop, when their own streams are dry, forces them to accept an unequal arrangement.

Chand has reported the case of the Gandhori *kuhl* in Solan district where the water sharing is highly skewed in favour of Rajput farmers, to the detriment of the schedule caste cultivators.[37] Bon cites a similar case of discrimination from Chauras village in Sirmaur district (H.P.).[38] These case studies are representative of a general situation in Himachal Pradesh and Uttarakhand, where schedule caste cultivators are at the short end of water sharing arrangements. These two case studies and another of the lower Baijnath kuhl in Kangra district[39] also reveal that SC households receive a better share of irrigation water in government managed systems.

Once the water distribution rules are negotiated, FMIS often appoint an individual – a *kohli*, *abpashi* or a *chowkidar* – or individuals to operate the system on a day-to-day basis. The *kohli* is mainly responsible for organizing labour and materials for repair and maintenance of the diversion structure and the main channel of a *kuhl*. He is usually not responsible for maintenance of the secondary and tertiary channels at the village level. He also supervises the distribution of water in accordance with the accepted rules. Traditionally, the *kohli* was an authority figure in Himachal Pradesh who also resolved conflicts between irrigators. In addition he conducted religious rituals – propitiating the local *devta, devi* or *pir* – for a successful harvest, at the start of a cropping season. This reinforced his authority.[40] The *kohli's* position was often inheritable.

In recent years the role and authority of the *kohli* has been eroded due to the impact of non-farm employment or state intervention in the management of an irrigation system. State agencies often appoint a *beldaar* in place of a *kohli* or *abpashi*. The *beldaar* generally feels more responsible to the departmental hierarchy than the villagers. Non-farm employment reduces the availability of labour in the village. At the same time, the reduced dependence on agriculture of families with off-farm incomes, enables them to defy the demands of the *kohlis* for voluntary labour, or paying penalties without disputing the *kohli's* authority.

Current Status

The role of farmers in managing irrigation systems and the accompanying traditions are undergoing major changes. State intervention in irrigation and the decreasing dependence on

[36] E.W.Coward, Jr (1990): *op.cit*., p.84
[37] R. Chand (1994): *op.cit.*, p.A-29.
[38] E.Bon (2000): "Common Property Resources: Two case studies", EPW, July 15,2000, p.2570.
[39] R.Ahal & SRDA (1995): The Lower Baijnath Kuhl, (mimeo).
[40] J.M.Baker (1997): *op.cit.*, p.203.

agriculture in rural areas are the main driving forces for these changes. These two factors comprehensively reflect the impact of various ecological, social, economic, political and technological changes taking place in the central-western Himalayas.

***State Intervention*:** Independent India was born in the shadow of the Great Bengal famine (1942-44). Provision of food security for a rapidly expanding population became a prime concern for the nation's political leaders and administrators. State intervention to increase irrigation facilities became a cornerstone of planned economic development. At the local level in Himachal Pradesh and Uttarakhand, deforestation leading to drying up of springs and streams, and the raised aspirations of farmers, led to demands for more irrigation facilities. Political leaders and parties lobbied for irrigation projects in their constituencies as a reward or allurement for support.

In the central-western Himalayas, state actions for expanding irrigation facilities have included (i) construction of new irrigation projects (ii) renovation and modernization of traditional FMIS and (iii) expansion of the administrative structure to undertake operation and maintenance of the new and renovated systems. To obtain unhindered access to water sources for irrigation and other needs, the state enacted new laws and modified old ones, empowering and enabling it to alter and even abolish ownership, control and rights of the local communities to these sources.[41] In the first two decades of independence, state agencies – particularly the community development department – sought to strengthen the traditional FMIS by providing (i) financial and material resources to farmers' organizations for upgrading the physical structures and (ii) forming them into cooperatives to encourage community management systems. From the 1970s onward, the state agencies have focused more on an engineering role and establishing their control over the natural and built water resources.

More often than not, the state's intervention in irrigation is based on its legal and financial muscle. In H.P., however, the farmers' rights as recorded in the *Riwaz-i-abpashi* have restrained the government from initiating many projects that would transgress existing rights. Thus, in Kangra district -- where the *Riwaz-i-abpashi* records are well maintained and the irrigators are aware of them – till March 1989, out of the 108 state-owned irrigation projects, only 26 were gravity flow irrigation schemes, the remaining 82 being lift irrigation or tubewell schemes.[42] Nineteen out of the 26 flow irrigation schemes were large projects with cultivable commands of more than 100 ha each, indicating that the acquisition of existing FMIS was probably related to expenditure of large sums of money which the local community would not have been able to afford.

In the erstwhile U.P.hills (present Uttarakhand state), though the irrigators' traditional rights were abolished in 1975 after the passage of the Kumaun and Garhwal Water (Collection, Retention and Distribution) Act, U.P. state chose not to enforce its provisions very vigorously. Now with the region becoming a separate state political compulsions may change, seriously endangering the farmers' abilities to exercise their traditional rights. By using stream waters for domestic water supply schemes, the state has in practice eroded the rights of downstream *guhl* irrigators.

[41] U.C.Pande (1995): p.40
[42] *Ibid*, p.36

Farmers fiercely oppose state projects where they perceive violation of their water rights, or a reduction in their share of water. This is highlighted by the case studies of the Birari *kuhl* in Kangra by Coward[43] and the Supakote minor in Almora district by Pande.[44] In both the cases, the state took over existing FMIS, extending them by several kilometers to provide water to new villages and hamlets. The original FMIS owners (irrigators) of the Birari *kuhl* took the Irrigation & Public Health department to court. Once the IPH department became the owner of the *kuhl*, the original FMIS owners refused to pay the irrigation charges. They continued to operate the *kuhl,* occasionally supplying water to the tail enders when they deemed their own irrigation requirements to be fulfilled. In the case of the Supakote minor, the upstream original FMIS cultivators simply did not allow the water to flow beyond the original 3.2 km distance, against a total length of 7 km. The hapless downstream farmers continued to rely on their seasonal streams and grow mainly coarse grain crops.

Pande has cited examples of important *kuhls* in Kangra district, including the well-known Kripalchand, Dai-di-kuhl and Fatehchand *kuhls*, that have been taken over by the state and have been working less efficiently thereafter.[45] In the case of the Kripalchand *kuhl* the irrigated area has dropped significantly. Chand has discussed the case of the Gandhori *kuhl* in Sirmaur district, where 97 per cent of the respondents expressed disappointment with the renovation done. A review of the *chak* development programme of the lower Baijnath *kuhl* in Kangra concluded that the irrigators were dissatisfied with the results of the state takeover of their FMIS system.[46] They complained about theft of water, benefits mainly for influential families and increased conflicts. There was no grievance redressal. The review claimed, however, that the scheme had benefitted SC families who were now assured of a share of the irrigation water. But there was no involvement of the users in planning, implementation of the project and its maintenance. They had not paid the irrigation dues after the takeover.

There are examples of FMIS schemes that have been taken over by the state and have worked well. These include the Jadhul *kuhl*[47] in Kangra district and the Kalowan *kuhl*[48] in Solan district. In both these cases the state intervention led to actual and perceived increases in the water supply and did not affect the traditional arrangements for water distribution and the water rights. In the case of the Jadhul *kuhl*, the original owners themselves appealed to the government for assistance.

[43] E.W.Coward Jr (1990): *op.cit.*,p.86.
[44] U.C.Pande (1991): *op.*cit., p.76-80.
[45] U.C.Pande (1995):*op.cit.*, p.35-36.
[46] R.Ahal & SRDA (1995): *op.cit*., p.14.
[47] E.C.Coward Jr (1990): *op.cit*., p.85-86.
[48] R.Chand (1994): *op.cit.*, p.A-27.

Managing Irrigation Water*

Ladyura-Bayala Khalsa *Guhl:* The FMIS irrigating the Ladyura and Bayala Khalsa *gram sabhas* in Almora district is very well-known in Uttarakhand. These two *gram sabhas* share the same *guhl*, irrigating about 40 ha of land. Ladyura is upstream from the Bayala Khalsa villages.

The two *gram sabhas* have a long history of conflict over water use, going back to 1855. Since 1944-45, the Ladyura cluster is entitled to water from sunrise to sunset, and the Bayala Khalsa cluster gets water from sunset to sunrise according to a court ordered settlement.

In contrast to Bayala Khalsa, the Ladyura cluster has a very well-developed irrigation management organization. It has a *sinchai samiti,* or irrigation council, which makes decisions on water distribution and enforces correct allocation. The *sabhapati* (chairperson) is usually a Thakur, an upper caste landowner. Most farmers are either Rajputs or Harijans. Members of the *gram sabha* are concurrently members of the 10-person *sinchai samiti*. Major decisions are made at meetings which are open to the villagers. Decisions about allocations of water are made before the cropping season begins and the *sabha* serves as a conflict resolution body. Its decision is generally respected. In Ladyura, there is an annual or biennial reversal of the order in which farmers receive water, in order to ensure equity of distribution. To ensure equitable distribution of water, the diversions to individual fields along the *guhl* are blocked by rocks which get successively smaller along the *guhl*.

The *sinchai samiti* appoints a *chowkidar* who is responsible for preventing water thefts, ensuring the correct supply of water to each farmer, and preventing cattle from damaging fields. He is paid one *nali* (about 1.8 kg) of grain for his services by each irrigator. If the crop fails, he is paid less than his due. Similarly, if the crop is damaged by cattle, the *chowkidar* must pay part of the fine for the damage. If he notices any farmer interfering with the system, he will publicly inform the offender at a general meeting, and if the person fails to address this complaint, then a *nyaya panchayat* penalises the offender. The fines collected are used to maintain the *guhl*'s infrastructure. The villagers also volunteer their time to help maintain the system. They usually help clean and repair the *guhl*. Those who cannot personally contribute, hire labourers to fill in for them.

Hara System: A contractual irrigation system, known as the *hara* system, exists in the Saryu Valley near Sheraghat, on the boundary of Almora and Pithoragarh districts. Though most of the *guhls* in the system were created in the early 1920s, the first contractual system was established around 1896. The main channels were constructed and maintained by contractors, who entered into long-term contracts – typically, 30 years -- with farmers for supply of irrigation water. Payment for these services was in kind, and initially farmers paid as much as a third of their produce at the beginning of a contract, when the contractor invested a large sum of money to build the *guhl*. Currently the rate is about one-tenth to one- eighteenth of the produce, mainly for maintenance and repair of the canal. Usually, a legal document is signed by the contractor and the irrigator. The contractor can cut off irrigation water for farmers who default on their payments. In this system the community is less involved, and sometimes this reduces delays due to disputes amongst farmers. A single system irrigates 15 to 50 hectares.

These systems record high crop productivity which benefits the contractors and the farmers. The farmers pay the contractors only after harvesting, saving the cost of financing irrigation related activities. This model is of great relevance for areas where high male out-migration has reduced availability of household labour. But the fact that this system is found only in the Saryu Valley – where the streams have plentiful water all year round – indicates that there may be site specific limiting factors.

Lottery System: In Lahaul-Spiti and Mandi districts of Himachal Pradesh, in some *kuhls* irrigation turns are determined by drawing of lots. In Lahaul-Spiti, a cold desert, nothing can be grown without irrigation. The night time of an irrigation turn is given to watering grasslands and common pastures. The Shakoli *kuhl* in Lahaul–Spiti originally had eight rights holders each of whom had a 24 hr irrigation turn, even though they had different sized farms. All the descendents of the original eight rights holders now have to share the 24 hr turn – in effect 12 hr, since the night is for community pastures. Those descendents who have added new land to their inherited lot may have to build a new system.

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*Based on U.C.Pande (1991): *op.cit. and* U.C.Pande (1995): *op.cit.*

The Bhatnyaljula canal, owned and operated by the Irrigation department (ID) in Almora district is a modified FMIS system. Pande describes it as perhaps the most well-run ID systems in the entire Kosi valley.[49] Here, the local farmers hired two persons from their own village to run the system. This was in addition to the ID staff. In a comparative analysis, productivity levels in this system were the highest amongst all ID systems and compared favourably with the best-managed FMIS system.

State managed irrigation channels are expensive in terms of capital and operational costs. "Government departments seem to chase the illusive and unattainable ideal of permanency in a system," explains Pande.[50] But the Himalayan region being geologically unstable, damages are frequent – particularly during the monsoon season when farming activity is at its peak – and repairs have to be urgently undertaken. In traditional FMIS, the irrigators could themselves undertake the repairs because they used locally available materials to construct the system. Now the new and renovated channels are more expensive to maintain. Developmental funds are limited and the sanction procedures are tedious. This delays repairs, leading to loss of production. Often there is no significant increase in production as a result of state intervention.

Pande compared the performance, productivity and costs of four FMIS and four state-run systems in Kumaun, all of them operating under similar conditions. The FMIS provided more irrigation turns for the wheat and paddy crops and resulted in higher productivities in general[51] but the costs to the irrigators were lower in the state-run systems. In the Sirmaur district, however, Bon concluded that the cost effectiveness for the users in state managed systems is not 'automatically better'.[52]

Impact of Non-Farm Employment: A massive shift to non-farm employment (NFE) in recent years has seriously affected the management of traditional FMIS. NFE opportunities, particularly for rural males, have changed the traditional occupation structures in the villages. When a family's reliance shifts from agriculture to an off-farm source of income, its incentive to participate in the traditional voluntary chores, required to maintain common property resources, decreases. This reduces the supply of voluntary labour for communitarian tasks like the management and maintenance of *kuhls*. Traditional sanctions against such households are less effective, thereby eroding local norms and authority, e.g., that of the *kohli.* Families that are headed by women when the male head is away, have difficulty in obtaining their rightful share of water.[53] Inter-family disputes erupt on the return of the male(s), reducing the community's unity that is so essential for managing common property resources like *guhls*. If schedule caste families have access to NFE, they are less likely to be pliant participants in unequal water sharing arrangements.

NFE also has a cultural dimension. Government or office jobs are considered to have a higher status than that of farmers in rural areas. These days rural youth have their minds set on getting a government or an office job. They are not willing to toil on their farms. With better education

[49] U.C.Pande (1995): *op.cit*.,p.81-86.
[50] *Ibid*, p.26.
[51] U.C.Pande (1991): *op.*cit., p.87-98.
[52] E.Bon (2000): *op.cit*.,p.2571.
[53] R.Ahal & SRDA (1995): *op.cit*., pp. 22-23

and the increasing share of non-farm economy in the national economy, the potential for obtaining off-farm employment is growing rapidly. This is severely straining the traditional systems of managing common property resources, including *guhls*.

Baker has studied the responses of the communities of the 39 *kuhls* that take off from the Neugal Khad, to the impact of NFE.[54] Eleven out of the 39 *kuhl* regimes retained their traditional FMIS character, whereas in nine others the traditional system collapsed. In the latter cases, the village *panchayats* requested the state to take over the operation and management of the *kuhls*. Nineteen *kuhl* communities responded by changing their governing structure and/or their operating rules. These changes included the establishment of management committees – to support the *kohli* or replace him, shifting from voluntary labour to financial contributions for repair and maintenance of *kuhls*, and a greater reliance on written records of *kuhl* management. The effectiveness of these changes has varied from *kuhl* to *kuhl*.

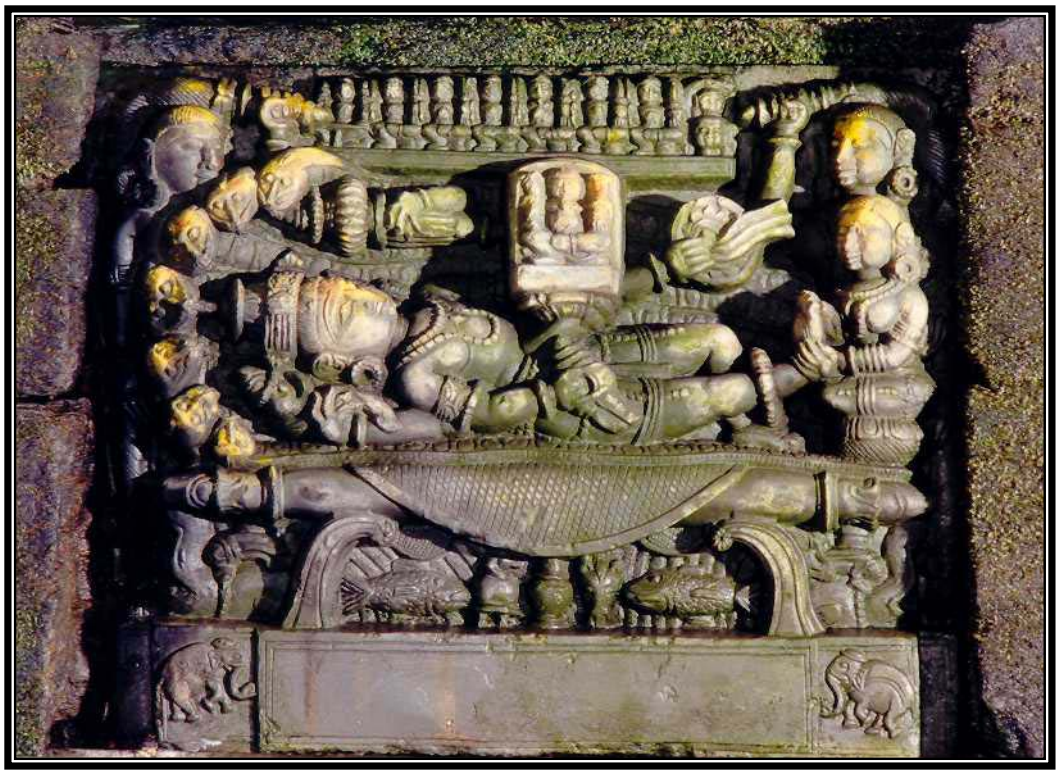
Baker proposed an analytical framework to predict the response of a *kuhl's* regime to the transformation in the rural economy.[55] He identified two variables as the determining factors. These are (i) the degree of dependence or 'reliance' on a *kuhl's* water supply and (ii) the socio-economic differences or 'differentiation' between the users of a *kuhl*. If the reliance is high and the differentiation is low, the traditional FMIS is likely to continue. In low reliance and highly differentiated regimes the traditional system will most likely collapse, forcing the villagers to negotiate for a state takeover of the *kuhl's* management. In cases of high reliance and high differentiation, there is a strong push to restructure the management and the operating rules so that the systems continue to be managed by the users. The model does not make any predictions about the impact of NFE on low reliance and low differentiation regimes. But in this case, it appears likely that the response will be determined more by the degree of reliance.

Conclusion

The inherent technological simplicity of gravitation flow irrigation systems makes them the preferred irrigation option in mountain areas. But social, economic, political, administrative, ecological and technological changes are altering mountain societies. While these changes are severely straining the traditional irrigation management systems, the alternative of state take-over does not appear to be adequate either. The foregoing review makes it clear that traditionally there have been a variety of management systems, each responding to the specific complexities of its own situation. These innovation arose from the autonomy that local communities had in natural resource management.

[54] J.M.Baker (2000): *op.cit*., pp. 202-207.
[55] *Ibid*, pp. 204-206.

III. The Sustenance of Tradition



The most remarkable feature of India's water harvesting traditions is their longevity. Many *naulas*, *baori*, *dharas, chharedus*, *guhls* and *kuhls* in use today are hundreds of years old. Clearly the traditional water harvesting structures and management systems have shown a very high degree of sustainability. These traditions were sustained over time by ***sanskar*** (precepts and rites), ***sanskriti*** (culture and customary practices) and ***niti*** (state policy and administration), as discussed in this section.

Scriptural Precepts

Perhaps the core value that sustained water related traditions was one that declared water to be sacred. In the *Srimad Bhagwat*, Lord Krishna – an incarnation of Vishnu -- says that water is his home. The implication is that water bodies, like temples, are sacred.

अपां नारा इति पुरा संज्ञा कर्मकृतं मया ।

तेन नारायणोऽप्यक्तो मम तत् त्वयनं सदा ।।

"From times immemorial, I have myself named water as Nār.
Since (my) home (*aayan*) is in this *nār*, I am named Nārāyan."

Reverence for rivers is clear from Bhishma's pronouncement in the *Mahabharat*:[56]

विश्वस्य मातरः सर्व सर्वश्चेव महाफलाः ।

[56] D.K.Mishra (2002): Living with the Politics of Floods:The Mystery of Flood Control, People's Science Institute, Dehra Doon, p.19.

इत्येता सरितः राजन् समाख्याता यथास्मृति ।।

"O, King ! all rivers are mothers of the world; they yield great benefits .
I am not aware of any one else capable of bestowing such benefits."

Personal rules of water use, codified in *Manusmriti*, led to sustaining the purity of water bodies:

नाप्सु मूत्रं पुरीष वाष्टवनं समुत्सृजत् ।
अमेध्यलिप्तमन्याद्वा लोहितं वा विषणि वा ।।

"Polluting substances like excreta, urine, spit or blood should never be released in water."

The *Brihatsamhita* on the other hand offers advice on how to clean polluted water:

कलुषं कटुकं लवणं विरसं सलिलं यदि वाशुभगन्धि भवेत् ।
तदनेन भ्वत्यमलं सुरसं सुसुगन्धि गुणैरपरैश्चयतम् ।।

"If water becomes polluted, bitter or salty, it should be cleaned by mixing a powder of collyrium (kohl), the grass *anaropogon nuricatum*, amla, etc."

To minimise the miseries of floods, the *Naradiya Purana* defined practical rules on how far settlements had to be located from river banks, in the plains.

सार्द्धहस्तशतं यावद्गर्भस्तीरं ततः परम् ।
तीराद् गव्युतिमारतम् तु परितः क्षेत्रमुच्यते ।।
तीरे त्यक्त्वा वसेत् क्षेत्रे तीरे वासो न चेस्यते ।
एक योजन विस्तीर्ण क्षेत्र सीमा तत् द्वयात् ।।

"The bank of a river stretches 150 hand measures (roughly 70m) from the river bed.
The area lying within one *yojana* (about 14.5 km) from the bank is the river's regime."

The *Naradiya Purana* forbade dwelling in the river bed zone or in the river banks, permitting it only in the river plain.[57] The modern flood plain zoning which defines a prohibited zone, a restricted zone and a warning zone is only a new version of this ancient wisdom.

The *Agni Purana* recommended the construction of water bodies as an act of worship:

विष्णुं च वरुणं च सम्पूज्य जलाशय निर्माण कारयेत् ।

"Along with the worship of Vishnu and Varun, water reservoirs should be constructed."

Customary Practices

Local cultural practices and customs evolved out of the scriptural precepts. The sanctity of water was often symbolized by the presence of trees like *peepal* and *banyan*, both of which were considered sacred, at the edge of a water body. Idols and images of Vishnu, and other gods and goddesses were usually installed in water harvesting structures like *naulas* and *baoris*. Temples of local gods or goddesses were constructed near *guhls*. The structures were thus accorded the reverence due to temples.

[57] *Ibid*, p.87.

Rituals and festivals sustained the spirit of reverence. Even today, a new Kumauni bride on first reaching her husband's home offers a ritual prayer at the village *naula*. At the Maletha *guhl* every year, before constructing the diversion weir, a 50 kg pancake of wheat flour and *gur* is baked on site and offered as *prasad* to the *guhl's* goddess at her nearby temple.[58] A piece of the *prasad* is given to each household who then have to send at least one member for constructing the weir. Once these rites are over, the villagers go to a nearby forest to select a suitable tree trunk which is used for the temporary diversion structure. The Baisakhi festival in Himachal Pradesh is an occasion when people clean their local *baoris*, in time for the hot summer months. Says Jagdish Chand, ward member of the Ganglauj gram panchayat, "One day before Baisakhi, we do a special cleansing of our *baori.* Some sweet dish is prepared and distributed among the people as *prasad*."

Common people, elites and rulers, undertook the construction of water harvesting structures. They were built not just to meet a need, but also because it was considered to be an act of piety or merit. Some examples from Solan district have been cited earlier. Childless couples built the Kunnu and Nai baoris in Nirmand village of Kullu district so that their wish to have children could be fulfilled. Islam also recognized the importance of water, and said that free water for all was a birthright. The construction of public water facilities was thus encouraged by most rulers with incentives like tax rebates.

Rivers symbolize divine life-giving forces and ritual bathing in rivers, for purification, and the use of water in religious ceremonies have been a part of Hindu culture for millennia. In recent years millions of people have taken purification dips in the Ganga river at Haridwar during the *Kumbh* and *Ardh Kumbh melas*. Many temples have *kunds* or tanks attached to them, e.g., the Guptganga tank at the Guptkashi Dham in Kangra and the Jahnvi *naula* in Gangolihat. Ritual bathing in such tanks by large assemblages are common in Himachal Pradesh during the Baisakhi festival.

Ecological principles as guidelines for water resources development were enunciated in ancient texts like Kautilya's *Arthashastra* and Kashyapa's treatise on agriculture. The *Manusmriti,* and several *sutras* and *shastras* contain recommendations on water management policies, the enforcement of rights and duties pertaining to water and descriptions of water management practices.

Kashyapa defined five principles of water resource development.[59] These are summarized below along with examples of their practical application in the mountain regions.

[58] U.C.Pande (1995): op. ital., *p.*57.
[59] V.Paranjpye, (1994): Preliminary look at ARUN III in the Light of Tehri Experience, Water Nepal,4 (1)

1. Water resources should be developed at the source or *Udgamsthana* of a river. These sources are sacred, and temples should be constructed at the source to protect it. In the central Himalayan region, this is true for the sources of many rivers and streams. The Gangotri and Yamunotri temples near the origins of the Ganga and Yamuna rivers are obvious examples. But there are hundreds of small temples dedicated to local deities, at the origins of small streams throughout the middle Himalayan region, e.g., the Chandrabadni temple in Anjanisain in Tehri-Garhwal, dedicated to Bhuvaneshwari Devi, is located at the source of a small stream called Chandrabhaga.
2. There should be minimal obstruction to the natural flow of water (*Nyunatam Gati-Avarodh*). There was an understanding of the importance of the hydrological cycle.
3. The *Suvarna Madhya* or Golden Mean: This principle refers to the relationship between the development of water harvesting and management structures and the economic, social, and organizational competence of the water users. In essence, this principle recommended optimal rather than maximal development of water resources, balancing the needs and abilities of the users. Upstream diversion weirs on streams from which a number of GFIS channels took off, were usually temporary and porous so that the flow to downstream systems would be only minimally affected.
4. While managing water resources, their ecology should be understood. Kashyapa refers to the interdependence of water, forests, land and biota. In accordance with this principle, sacred groves were established at the headwaters, confluence points and mid-regions of a watershed. Major rivers like the Eastern and Western Nayar, and the Ramganga emerge from the Doodhatoli range in Pauri-Garhwal. It also has some of the most well-preserved forests in the region. Sacred groves in the middle Himalayas are the recharge zones of many springs. To preserve the forests, springs and wildlife, local traditions enforced strict rules that not only forbade lopping or felling of trees, but also wearing shoes or brightly coloured clothes in sacred groves to main purity and to avoid disturbing the animals. The development of small-scale water harvesting structures interspersed with these groves was essential to the maintenance of ecological balance and the sustainability of the water source.

5. Participation and self-determination (*Sahabhag*, *Swabhava* and *Sanskara*) are also important elements of water resources development. Different social groups played essential and different roles. The king was responsible for commissioning and financing water projects,

fixing water rates and collecting user fees. The brahmins were responsible for supervision and advising the king on projects. The construction and maintenance of systems was to be done by village communities collectively, including the allocation of rights and responsibilities to specific groups and water users.

***Laws and Administration*[60]**

India's traditional legal administration was a set of parallel systems instead of a hierarchical one, with each level enjoying a high degree of autonomy. Local laws were not overruled by other "higher" institutions or political bodies. Systems at different levels constantly interacted and affected each other.

Traditional Indian law was derived from *dharma*, custom and royal order, as opposed to statute, precedent and doctrine, which underlie the modern legal system.[61] In the legal context, *dharma* could be defined as "a code of conduct supported by the general conscience of the people."[62] The rule of *dharma* became law only after it entered into social behaviour and was accepted by the general population as a customary rule. Thus, custom represented a special body of laws and rules which regulated the behaviour of different social and economic groups. It evolved as a holistic approach from relationships between individuals, society, the state, nature, religion and many other elements of human existence in the world. The role of a ruler was to maintain social order, and promote peace, security and prosperity for the subjects.

Dharma had legal authority and judges were called *Dharmastas* or "upholders of *dharma*." Custom was sustained by *dharma* and the king. Though a king had the power to pass royal orders, *dharma* and custom were usually inviolable. The ruler could intervene in the domains of *dharma* and custom only to prevent discontent and disorder. Under Islamic law, there was a pluralistic judiciary, with a hierarchical organization of courts, but there was little interference in the functioning of lower courts, and Hindu law was preserved and applied by Muslim rulers.

The administrative and political framework supported community management of natural resources. They were granted a large degree of autonomy. In the absence of state intervention, villages and rural society were primarily governed by custom and tradition. Very limited taxes were imposed on agriculture and resource use, and the state largely recognized the rights of local communities to independently manage, allocate and use their agricultural land, forests and water.

In the realm of law enforcement, there were penalties and punishments for the misuse or pollution of water. The *dharmasutra* of Apastamba, a treatise on civil and criminal law, the *Manusmriti* and the *Vishnusutras* all refered to punishments for stealing water, the destruction of embankments, tanks, ponds, lakes or rivers, and the pollution of any water body. The *Vishnusutras* even recommended capital punishment for the destruction of embankments, and heavy fines for the misuse of public tanks. *Kautilya's Arthashastra* gave a detailed system of penalties for failure to maintain waterworks.

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[60] Based on M.S.Vani & R.Asthana (1996): Law and Custom In Water Resources Administration: A Case Study of U.P.Himalayas, Development Centre For Alternative Policies, New Delhi.
[61] *Ibid*, p.34.
[62] S.Radhakrishnan (1936): The Heart of Hindustan, Madras.

But traditional systems also had severe inequities built into them. A common negative feature to all types of resource use was that social structure, caste, lineage and clan networks were major determinants of resource use. Inter-caste relations and customs maintained the interdependence and cohesion of social hierarchy, and shaped rights and duties of different groups with respect to natural resources. In the remote area of Lahaul-Spiti, the role of the social hierarchy is still distinctly preserved by the dominance of the *badaghars* in the share of irrigation water.[63] Cases where schedule caste communities are denied access to certain water sources are common in the central Himalayas.

Conclusion

Local communities built a variety of water harvesting structures based on their experiential knowledge and designed them to fulfill their needs. They did so, partly because no one else – not even the ruler – was likely to do so, and partly because they had the ownership, control and rights to their local resources according to traditional law. **The above review makes it evident that once these structures were built, they were sustained for centuries by *sanskar*, *sanskriti* and *niti*. The authority of individual *dharma* and social custom alone would not have been enough. It was supported by an administrative framework that recognized the ownership, control and rights of local communities over their natural resource base.**

[63] A.Agarwal & S.Narain (1997): *op.cit*, p.34-35.

IV. The Erosion Of Tradition

India's colonial and post-colonial governments systematically and almost completely transformed the *niti* – the legal and administrative framework – that had sustained the traditions of natural resource conservation. This transformation alienated communities from their resource base and eroded the related *sanskar* and *sanskriti*. This section reviews the changes in the traditions of the central western Himalayas, that have led to water shortages in a region that nature has endowed with massive water resources.

IV.I Colonial Water Policies [64]

Traditionally, natural resource use and management in India were governed by local customary rules. In principle, rulers had authority over all the land in their states but its exercise was nominal. The rulers did not generally exploit forests and water for commercial purposes. Local communities exercised rights of ownership and use, and powers of management over their natural resources.

The primary purpose of British colonial rule in the Indian sub-continent was to maximize the extraction of wealth.[65] Water laws drafted by the British subserved this overarching purpose. To ensure the sustained extraction of maximum revenue from water resources, they gradually established the state's monopoly over all water resources. The British governments legislated laws to acquire a range of powers – to tax, collect, distribute and adjudicate – over all water resources, almost totally transforming the traditional ownership, use and management systems (See box: Sovereign Powers). Some existing rights continued to be recognized to not only avoid unrest and disorder, but also increase agricultural production and state revenue.

The colonial rulers made territorial laws – which included natural resource management acts -- common to all subjects. At the same time, however, they left personal laws under the purview of the various religious communities. The effect was to separate natural resource use and management practices from customary social behaviour, religious precepts or ethical values. Colonial natural resource management laws gave precedence to private and state property rights over common property rights and related management practices. Natural resource management administration was not only centralized but it was separated into different departments, breaking the traditional Indian interlinkages of land, forests and water. Nowhere was the impact of this delinking as critical as in the Himalayan region, where deforestation and monocultures enhanced surface runoff, reduced recharge of springs and increased slope instability, severely affecting water availability. Finally, the links between rights over resource use and duties towards their preservation were also gradually eroded.

[64] Based on M.S.Vani & R.Asthana (1996): *op.cit*.
[65] B.Chandra (1991): The Rise and Growth of Economic Nationalism in India, People's Publishing House, New Delhi, Ch.1.

Sovereign Powers

During the British colonial period, the various regimes sought to legally acquired a range of powers, which included the following: *

1. Sovereign powers of the state over all water sources.
2. Power to levy rent, tolls and dues for irrigation and drainage.
3. Power to redistribute the water supply of districts.
4. Powers to notify water sources and prohibit construction of works on them by any person without official permission.
5 Powers of planning and implementation of irrigation works.
6. Powers of entry upon land for planning, construction, maintenance, repair, inspection and supervision of canals and other systems, whether government or private.
7. Powers to remove obstructions to construction, etc.
8. Regulation of the distribution of water in government as well as private canals and other systems.
9. Prohibiting activities, which disrupt construction, etc. of canals and other systems.
10. Prohibition of construction of canals and other systems by private persons without permission.
11. Powers to enhance rent of land; determine compensation.
12. Powers to order the transfer of land and watercourses by owners upon payment of compensation.
13. Powers to recover costs and rates from beneficiaries.
14. Powers to enforce the payment of rent.
15. Powers for requisitioning of 'customary' labour in special circumstances, or commuting labour into tax.
16. Powers to define offences and sanctions.
17. Powers to affect closure of canals, and impose other sanctions for offences committed or for disobedience to orders.
18. Powers to settle disputes.
19. Recording of rights.
20. Powers to take over management of private canals.
21. Powers to acquire private canals.
22. Powers to determine limits of irrigation in private canals.
23. Powers to determine the amount and character of water rates.
24. Powers to regulate the construction and use of water mills.
25. Powers to override recorded rights in scheduled canals – restrict, suspend or extinguish rights.

* M.S.Vani & R.Asthana (1996): *op.cit.*, pp 135-136.

Uttarakhand

Soon after a large part of today's Uttarakhand became a British territory, known as Kumaun and British Garhwal, their officials set about compiling land records, related resource rights and village customs. The land records were compiled as a tool for tax collection. The records of existing rights and custom were used to settle disputes relating to land and water.

In 1842, *gharats*, or water mills, were first assessed to collect rent -- converting the private monopoly of the *gharat* owners into a limited right – functioning only under license. It also established the principle of state sovereignty over water resources. Later, the British began to collect revenue from irrigated land but permitted the villagers to construct and maintain irrigation channels. Throughout the 19th century, the colonial authorities while making secure their sovereign power over all water resources, recognized local water rights to encourage continued local investment in water resource development. Farmers continued to develop new irrigation systems and maintain old ones while millers repaired their water mills or installed new ones. When necessary, the state limited or abolished such local rights.

In the 19th century, the colonial government did not enact any specific legislation for water in the Uttarakhand region. Uttarakhand's special character was recognized by enacting the Scheduled Districts Act in 1874 which permitted special rules of governance to be drafted for the region.

The Kumaon Water Rules 1917, statutorily transferred ownership of water resources to the state. The Rules state that "waters of all rivers, natural streams and of all lakes, natural ponds and other collections of still waters within the hill tract of Kumaon division were the property of, and subject to the control of the state."[66] These rules were applicable to Kumaon and British Garhwal. They made written permission a pre-requisite for construction of *guhls*. District Collectors were empowered to assess rents on *gharats* and close *gharats* that had not been sanctioned or to protect irrigation. They were also given the power to assess compensation in the latter case.The 1917 Rules separated customary water rights from similar rights to land and forests, as well as family law, contrary to the holistic traditional natural resource management approach. Rights were separated from duties, overturning another fundamental tenet of traditional law. The Rules (1917) were modified in 1930. The modified Rules (1930) empowered various district officials to object to irrigation channels if they were likely to damage a forest area, a road or other public works. The 1930 Rules also reaffirmed the rights of prior users.

Himachal Pradesh

The first state intervention in local water resources management systems in the British governed territories of the present Himachal Pradesh, may have been the alteration of the ownership of *kuhls* in the process of recording water rights during the Settlement exercises.[67] The *Riwaz-i-abpashi* of the large systems built earlier by ruling elites, identified the irrigators as co-proprieters. The name of the builder was not recorded as the owner. This change may have led to loss of revenue for the earlier builder-owners' families who may have then abandoned their supervisory

[66] U.C.Pande (1995):*op.cit*.,p.28.
[67] E.W.Coward,Jr (1990): *op.cit*, p.81.

and maintenance roles. Coward cites the following comment from the end of the 19th century in support of this possibility:[68]

"The management of the *kuhl* is yearly becoming difficult. In former times the *kohlis*, or distributors of water, were appointed by the Rajas and got certain dues. Now they are appointed by the rights-holders and there is not infrequently difficulty in getting them to agree. The Revenue authorities are not supposed to have any power in interference but the people still come to them and it is necessary to tender advance to the different parties if not to pass orders."

In any event, the recording of the then existing customary rights established irrigation rights which were protected by later governments.

Most of the present state of Himachal Pradesh was governed as a part of British Punjab. This region was affected by two important laws: (i) The Northern India Canals and Drainage Act 1873 and (ii) the Punjab Minor Canals Act of 1905. These statutes affirmed the sovereign rights of the state over water resources, empowered it to acquire private rights and regulate private irrigation works, and centralized administration of water through an irrigation bureaucracy.

The NICD Act of 1873 laid down the principles of state ownership of water resources. All later legislations followed these principles were based on this Act. It established the government's title to surface water and its entitlement to the use and control of such waters for public purposes.[69] Any natural water body could be notified by the government and used for irrigation and drainage works. The Act recognized prior rights but empowered the state to limit or abolish them after paying a compensation. It also conferred wide powers on irrigation officials for management of all the canals constructed by the government or whose administration had been taken over by it.

The Punjab Minor Canals Act (1905) extended the government's control to private canals by empowering it to levy water rates, to increase the tax on lands irrigated by private canals and to enforce 'proper management' of private canals, under the threat of a possible take over. The Act provided for recording water rights but held that the government could restrict, suspend or extinguish such rights altogether in the 'larger interest' by paying compensation. The government could acquire private canals with or without the consent of the owners, and regulate the construction and use of mills.

The colonial rulers almost completely eliminated the traditional rights and powers of local communities in their territories of Himachal Pradesh and Uttarakhand. Only state and individual rights were recognized. **The second distinctive feature of all the colonial water regulations in this region was that they did not apply to drinking water resources. As a result, village communities continued to look after their *naulas*, *bawris*, *dharas*, and other water harvesting structures, used to obtain water for domestic use, without any sense of alienation.**

[68] *Ibid*

[69] M.S.Vani (2002): "Customary Law and Modern Governance of Natural Resources in India – Conflicts, Prospects for Accord and Strategies", Development Centre for Alternative Policies, New Delhi, p.34.

IV.2 Post-Independence Water Policies

As mentioned earlier, water management for food production was a high priority for independent India's policy makers. The country also adopted a centralized model of planned economic development and governance. This led to a highly centralized approach to water resource management with a primary focus on the construction of big dams – multi-purpose projects and large irrigation systems. Later, groundwater exploitation for irrigation, with little thought to its recharge, became a secondary focus of water resources development.

A comprehensive approach to water resources planning was first considered in the Fourth Five Year Plan (1970-1974). The National Water Policy adopted in 1987, called for water resources planning, development and conservation "on an integrated and environmentally sound basis". For allocation of water resources, it gave priority to domestic water needs followed by irrigation, hydropower, navigation, industrial and other uses. It adopted planning at the central and state-levels and recommended a river basin or a sub-basin as the unit of resource planning. But this policy largely remained on paper.

Thus the governments of independent India totally ignored the nation's rich heritage of water resources harvesting and management by local communities. The basic approach of the Indian State was to adopt, expand, and amend the colonial legal and administrative framework. The colonial laws were rarely repealed nor were bureaucracies abolished. The most dramatic changes were made during the Emergency period (June 1975-March 1977) when several states passed legislation affirming the states' total ownership of water resources.

To reinvigorate the third tier of government, i.e., local bodies in rural and urban areas, the Union government enacted the 73rd and 74th Constitutional Amendments in 1992. In addition to various mandatory directions regarding the term of office, elections and finances, the 73rd Amendment recommended 29 subjects – including drinking water supply, minor irrigation, water management and watershed development – to be transferred to *Gram Panchayats*. These enactments require all state governments to amend existing local self-government related laws so that they are in consonance with the constitutional amendments. Uttarakhand is still to enact its legislation for the purpose.

Uttarakhand

The Kumaun and Uttarakhand Zamindari Abolition Act (KUZA) of 1950 conferred the ownership of *naulas*, *naulis, baoris,chaals,* etc on the person(s) to whom the land belonged. It also empowered *gram sabhas* or other local authorities to manage state-owned water source.

In 1975, for the first time the U.P. government took upon itself the responsibility to provide water supply for domestic use. Along with the U.P. Water Supply and Sewerage Act, it passed the draconian Kumaun and Garhwal (Collection, Retention and Distribution) Act 1975 which covered the mountain areas of Uttarakhand, but excluded the *terai* and *bhabar* regions. It terminated all individual and customary rights and brought all water sources under state control. Prior permission in writing became necessary to establish any irrigation system including pumps, pipelines, canals or tanks.

In the first two decades after Independence, individuals and communities created small irrigation systems under the community development programme. Thereafter the irrigation bureaucracy spread itself in the mountain region of Uttarakhand, with the establishment of the Irrigation Department (ID) and the Minor Irrigation Department (MI). The collapse of the community development programme and the heavy out-migration of men from the region left the local people and communities without adequate resources to invest in new irrigation works. They now looked to the rapidly expanding irrigation departments to do so. The staff and the budgets of the irrigation departments grew enormously but the irrigated area in the mountains did not increase proportionately. Pande has argued, "actually not much irrigated acreage has been added as a result of the efforts of the various government departments and areas being brought under government created systems were already being served by the FMIS." [70]

The Kumaun and Garhwal Water Act (1975) and the U.P.Water Supply and Sewerage Act (1975) represent the current state policy on water resources. The former legislation abolishes all rights except state rights. It thus contravenes earlier acts, e.g., KUZA(1950) and some forest laws, that continue to recognize individual and community water rights. By separating laws on different water uses, the state has abandoned the traditional integrated approach to natural resource management. In fact, there is no inter-sectoral coordination of water resources. Conflict resolution over water has been centralized. Such conflicts have become pervasive and endless. The alienation of the users from their water resources is nearly complete, leading to a rapid deterioration of the traditional water harvesting structures. The abolition of rights by the 1975 Act has been a contentious issue. This is revealed in an analysis of water related disputes brought before the courts in Almora district during the period 1910 to 1996.[71] In the pre-1975 period, only 10 out of 128 cases were related to domestic water supply. In the post-1975 years, 28 out of 34 were related to domestic water supply. In the pre-1975 period, all the 121 cases analyzed were conflicts within a village or between villages, none with a government agency. In the post-1975 scenario, 12 out of 38 disputes were with government agencies.

Himachal Pradesh

The most significant post-independence water act in the state is the Himachal Pradesh Minor Canals Act of 1976. It recognizes government and private irrigation systems and lists them separately in Schedules I and II respectively. It empowers the government to notify any natural source of water and construct canals from such notified sources. Any one else wanting to do so requires a written prior permission from the government. The Act gives powers to the government to control or manage Schedule II (private) irrigation systems with or without the consent of the owners. In effect, the government has equal control over Schedule I and II systems. The rights of irrigators in Schedule I canals are limited to receiving compensation for any damages caused by the state's actions, but they have no right to an assured supply of water. They have to pay water rates as well as enhanced land revenue. Practically, therefore, the state's control over the irrigation systems is total.

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[70] U.C.Pande (1991): *op.cit* p.25.

[71] M.S.Vani & R.Asthana (2000): "Water Rights, Law and Policy in Uttaranchal: Empowered State and Eroded Public Rights", in Water in Kumaon: Ecology, Value and Rights, G.K.Kadekodi, K.S.R.Murthy & Kireet Kumar (Eds), Gyanodaya Prakashan, Nainital, Ch-9.

Water Laws

The substantive water related laws in Uttarakhand and Himachal Pradesh are listed below.

Uttarakhand*	Himachal Pradesh**
Indian Penal Code, 1860	The H.P.Minor Canals Act, 1976.
Indian Easements Act, 1882.	The H.P. Land Revenue Act, 1953.
U.P. Land Revenue Act, 1901.	The H.P. Land Acquisition Act, 1994.
Northern India Canal and Drainage Act, 1873.	The Indian Forest Act, 1927.
Cantonment Act, 1924.	The Forest Conservation Act, 1980.
Indian Forest Act, 1927; Kumaun Forest Panchayat Rules 1931, U.P. Panchayati Forest Rules 1972/1976; U.P. Village forest Joint Management Rules 1997.	The H.P. River Rules, 1981.
U.P.Village Panchayat Act, 1947.	The H.P.Panchayat Raj Act, 1994.
U.P.Kshetra Panchayat & Zilla Panchayats Act, 1961.	The H.P. Tenancy and Land Reforms Act, 1972.
U.P.Minor Minerals Concession Rules, 1963.	Indian Penal Code, 1860.
U.P.Soil and Water Conservation Act, 1963.	Code of Criminal Procedure, 1973.
Kumaon & Uttarakhand Zamindari Abolition Act, 1960.	Code of Civil Procedure, 1973.
Forest Conservation Act, 1980.	The H.P. Minor Minerals Concession Revised Rule, 1971.
Indian Evidence Act, 1872.	Indian Easements Act, 1882.
Civil Procedure Code, 1908.	The H.P. Municipality Act, 1994.
Criminal Procedure Code.	The H.P. Land Revenue (General) Assessment Rules, 1984.
	Kisan Pass Book Rules, 1882.
	The Northern India Canal and Drainage Act, 1873.
	The Environmental Protection Act-1986.
	Water (Prevention and Control of Pollution) Act-1974.

* M.S.Vani & R.Asthana (undated): Water Resources Management Through Watershed Approach – Legal Framework for Uttaranchal State, A Concept Paper, DCAP, New Delhi, p.10.

** DCAP (1996): *op.cit*, p.15.

The Himachal Pradesh Panchayati Raj Act (1994) and the Himachal Pradesh Municipalities Act (1994) are amended versions of earlier legislations on the subject.[72] The former holds the *Gram Panchayats* responsible for maintaining domestic water supply systems to the extent that their finances permit. They are also responsible for maintaining and operating those minor irrigation systems that the state government has transferred to the *Gram Panchayats*. While substantial taxation, judicial and administrative powers for *Gram Panchayats* are envisaged under the Act, they cannot exercise them unless the works themselves are transferred to the *Panchayats*.

In the erstwhile U.P. hill districts (Uttarakhand) and Himachal Pradesh successive state governments took the responsibility for supplying water for domestic consumption according to national norms. From the mid-1970s onwards an extensive administrative structure and network of piped water supply systems was established in both the states. Local communities shorn of their ownership and rights over local water resources became dependent on the government departments and began to neglect their traditional water structures, as described earlier. But the frequent failures of the official agencies to ensure adequate and regular supplies are forcing many communities to fall back on their traditional water bodies.

The effects of government intervention and social changes on traditional irrigation systems in the two states have been extensively discussed in the previous section. While the governments have shown little reluctance in expanding and taking over crises-ridden traditional irrigation systems, the changes have not led to significant improvements in their maintenance, management or productivity. Given the priority of water supply for domestic consumption over irrigation in the National Water Policy, the concerned departments have repeatedly extracted water from streams that are already being used by local communities for meeting their water needs including irrigation, leading to numerous conflicts

IV.3 Conclusion

Legal and administrative changes during the colonial and post-colonial periods have gradually but systematically replaced community management of water resources with state management. Despite massive investments in the physical and administrative structures after Independence, the increase in the amount and reliability of water supplies for domestic use and irrigation has not been significant or in keeping with the norms. At the same time, there has been a steady decline in the functioning and maintenance of the traditional water management structures and systems in the Central-Western Himalayan region. But despite the weakened condition of the traditional structures, many mountain communities consider their functioning sources to be more reliable than the newly installed government systems.

[72] DCAP (1996): Legal Framework For Rural Water Supply (Drinking Water and Irrigation) In Himachal Pradesh, Development Centre for Alternative Policies, New Delhi, p.27.

V. Survival Lessons

The longevity of the traditional water harvesting structures is proof that they are sustainable technologies. This review makes it clear that what has sustained them is not just their engineering, but *sanskar*, *sanskriti* and *niti*. Individual *dharma*, and social custom were the necessary conditions, but the autonomy of local communities to manage their own resources was the critical sufficient condition for the sustenance of the traditions of resource management.

In terms of action, the first step is to enumerate the water bodies, structures and systems, to find out which are still functioning and which are not. Traditional water harvesting structures, wherever they are still in use, need to be renovated, restored and protected. Many exist in remote areas where government structures hardly reach and barely survive when they do reach. They may still continue to function for a few more centuries, if the revival takes into account basic ecological principles, like the ones defined by Kashyapa.

Life and civilizations are dynamic – they have beginnings and ends. Traditions too have finite life spans. There is no need to hang on to traditions simply to maintain them. But traditions that serve useful functions, and the knowledge associated with them, need to be preserved and built upon. The second step, therefore, is to upgrade useful traditional water technologies. Some of them can be used as they are, e.g., *chaals,*or *talaais* can be dug to harvest rainwater and surface runoff. If the shallow *naulas* and *baoris*, however, are no longer adequate, deeper structures can be made by using the same principles of tapping subsurface flows. Kashyapa's advice to intersperse scared groves and water harvesting structures – the modern watershed development concept – is an excellent basis for dispersed utilization of natural resources.

Besides these physical works, there is a critical need to reinculcate the *sanskars* – particularly the reverence for water, to revive the *sanskriti* of yore and to restore local autonomy to sustain the built resources. People and the policy makers must realize that no government department can match the creative minds and experiences of tens of thousands of local communities. People have to learn to again take initiatives and reduce their dependence on the government. Administrators need to give up belief that they know best. Traditional management systems need to be upgraded too, particularly in the changed social context. Women perform a major share of agricultural operations and fetch most of the domestic water supplies in the mountain areas. They need to be actively involved in the management of water resources along with socially weaker communities.

The *Panchayati Raj* and the urban local bodies constitutional amendments offer opportunities to move away from choosing between government or private – individual or corporate – ownership of resources, by considering local communities as an option. These amendments can be the basis for restoring ownership, control and management of water resources to local communities. But it will not be easy to do so. Other state and national laws will have to be amended. It is also true that local communities are not very united today. Communities that have sharp social antagonisms or that are weakened by migration find it difficult to manage their resources. But the experiences reviewed earlier show that communities do devise solutions to resolve their own specific problems.

Finally, we must learn to use the eternal principles of nature, hidden in our traditions, to prepare for future challenges. Urbanization will perhaps be the most significant change that will take place in the mountain regions in the coming decades. There will be massive out-migration from rural to urban areas within the mountain states. Many rural areas of today will become urban centers, as commerce, government and tourism expand. Tourism and transportation needs will lead to a major expansion of road networks. How will we cultivate or irrigate small terraced fields when labour in rural areas becomes scarce? Should we become totally dependent on market forces and produce fruits to exchange for food grains? Should we look for communitarian approaches to cultivation? Should we take another look at innovations like the *hara* system? Should we prioritize the irrigation systems that are worth sustaining, using Baker's analysis? Shall we let tourism become another necessary evil, or shall we preserve our natural resources – in all their splendour -- to attract tourists and make tourism a positive good ? Who will answer these questions? A handful of decision-makers or the thousands of communities? Shall we let thousands of flowers bloom?

The wisdom of our traditions has a lot to teach us. Are we ready to learn?

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