

Indigenous Technology Knowledge in Nepal — A review

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Indigenous practices provide invaluable knowledge and aid in making best use of natural resources. In the modern days of technological advancement, this knowledge is often forgotten or neglected. In Nepal, negligible efforts have been undertaken in a systematic way to understand the scientific basis of this knowledge. It is recommended that the documentation of Indigenous Technical Knowledge (ITK) should be included in the curricula of environment and sustainable development as a cross-cutting issue. Understanding of ITK, their advantages and disadvantages, will help further strengthen the existing knowledge of professionals in this field. In the paper, ITK from water resource management, soil fertility management, indigenous knowledge on biodiversity and forest management, Indigenous Knowledge on pest management, biofencing, agricultural tools and implements, and traditional beliefs are documented primarily from Kavre, Dhading, Kaski, Baglung and Syanga districts in Nepal.

Keywords: Indigenous technology knowledge, Biodiversity, Forest management, Pest management, Biofencing, Agricultural tools, Nepal

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Nepal, in terms of indigenous traditional knowledge (ITK), is considered as one of the richest, due to its geographical diversities and many ethnic communities. All of these communities have some kind of traditional knowledge associated with their life from time immemorial. Indigenous peoples have contributed their wisdom on sound use of natural resources, conservation, and restoration. But, none of the national policies in Nepal has emphasised the documentation and study of indigenous knowledge and issues. Indigenous technical knowledge refers to the art of using natural resources, and is passed on from generation to generation. ITK practices are farmer-friendly, socially accepted, economic, environmentally sound, and suited to the specific local and environmental conditions. Despite their importance, ITK practices are neglected and often disregarded on the pretext of being unscientific. But, something unexplained is not necessarily unscientific and discarding ITK on the belief of being unscientific is not justifiable. Indigenous practices may have some weaknesses, problems and constraints, but it should not be forgotten that farmers have survived in past under extreme conditions based on the local knowledge they possess. Modern and advanced technologies have not reached many farmers in Nepal with the pace at which

they are developed. The wisdom possessed by local inhabitants that has emerged as a means to survive under remote, isolated and harsh climatic conditions in the mountainous region of Nepal is the only tool that offers a great potential for their survival.

Government of Nepal has prepared a draft national legislation 2002 (2059 BS) regarding biodiversity and traditional knowledge (access to genetic resources, right and benefit sharing). Based on this draft legislation, IUCN (World Conservation Union) Nepal has completed community registration and documentation programme on traditional knowledge about biodiversity in more than 20 districts in historical territory of indigenous peoples. Similarly, different INGOs and NGOs such as WWF (World Wildlife Fund), ICIMOD (International Centre for Integrated Mountain Development) are working within indigenous peoples' territories in the field of conservation, sustainable development and sustainable livelihoods of people. Researchers, development workers are also collecting indigenous information related to their field of study for the purpose of research. Unfortunately, none of the organisations or institutions or individuals working in this field is respecting the legal framework of censorships, co-authorship and ownership of the products and mechanism of benefit sharing, which are the basic ethical issues of ITK documentation.

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Nepal has ratified different conventions, e.g. wetland convention, Convention on Biological Diversity, Convention for the Protection of the World Cultural and Natural Heritage 1972, and United Nations Framework Convention on Climate Change. It is a provision that as a member of the convention, Nepal should build respective national legislation or the convention can serve as national law. As a citizen of a member country of the convention each individual, policy maker, researcher, and any organisation should respect and obey the rules and regulations of the conventions. UN indigenous peoples draft declaration 1993 has clearly emphasised that indigenous issues fall within human rights to maintain and strengthen their distinctive spiritual and material relationships with lands, territories, waters, coastal seas, flora and fauna and other resources they have traditionally owned or occupied or used. Indigenous peoples should have the right for restitution of lands, territories, bio and natural resources which have been confiscated or occupied, used or damaged without their free and prior informed consent.

Recently, the importance of documenting Traditional Knowledge Systems (TKS) is recognised. Some 48 salient features of indigenous technology practices for watershed management in Nepal have been compiled¹. A wide range of ITK related to natural water resources management from Nepal grouped under indigenous farmer-managed irrigation systems, drinking water sources management systems, diversion channels, and indigenous milling and grinding techniques have been described². About 80% existing irrigation systems in Nepal have been initiated and developed by farmers themselves³. Studies show that the area covered by farmer-managed irrigation systems is more than twice as large as government managed irrigation systems in Nepal⁴⁻⁶. About 90% of irrigation systems in the hills have been initiated and managed by farmers⁷. Indigenous grinding/milling techniques are widespread in the hills of Nepal⁸⁻¹¹. Indigenous knowledge in irrigation management: some lessons from farmer-managed irrigation systems in Nepal and peoples' Indigenous Technology Knowledge (ITK) for watershed management in Nepal including ITK on water conservation, irrigation canal management, and fishing have been compiled^{12,13}. ITK on water quality management from a midhill watershed in Nepal has also been documented¹⁴.

Indigenous water resource management practices

Indigenous system of irrigation, indigenous water mills, indigenous water conservation methods, five major farmers' managed systems of water resources management, and a system of water delivery have also been documented^{1,12-15}. Indigenous water resource management methods from different countries in the Hindu Kush-Himalaya have also been described¹⁶. The art of rainwater collection as a principal source of water has been in practice in Nepal since ancient times. This practice was most common among *Brahmin* community. Planting *Tulsi* plant in a specially built structure called, *Maeri* was considered an essential religious practice in every house and a small pond would always be built close to this for storing water. The soil excavated while constructing such pond would be used in building *Maeri* and every morning all the members of the family would use this place for bathing. The water wasted during bathing was stored in this pond and used for a kitchen garden close by or else used for cattle watering.

Evidence of traditional water collection ponds, especially in the hilly region, dates back to the historic period when Nepal was divided into several kingdoms. Many water collection ponds were built during that era. Where more flat plains were possible, bigger ponds were built with higher storage capacity and in steep places smaller ponds were built and during the dry season were used as a place to perform community religious activities. Water stored in the ponds during the rainy season was used in dry periods for many domestic needs including washing, bathing, and drinking. Using roof catchments mostly made of slate and storing run off from the hillsides for both domestic and agricultural purposes has been a practice, which came later in different parts of the country.

The technology of rainwater collection from rooftops in ferro-cement jars for domestic purposes is becoming more and more popular in the water scarce districts of Nepal, after its successful introduction in Daugha Village Development Committee (VDC) of Gulmi district- introduced as a pilot project by the Rural Water Supply and Sanitation Support Programme¹⁷. Thereafter, the project has replicated this technology to many other areas like Baletaksaar and Thanapati in Gulmi district and Chahara, and Madanpokhara in Palpa district. System of water conservation for growing vegetables during winter in Nepal has been documented¹³. Water from

swampy land is harvested, stored and used in irrigation. Utilizing rainwater is also becoming popular in Nepal, where people can afford to bring metal sheet to collect and divert the water into a tank through a gutter. Utilizing spring water for irrigation is a common practice in western part of Nepal, where a pond is dug about 6X4X2 m dimension and the water that is wasted from a continuously flowing spring is collected.

Parallel water diversion from the same stream at different elevations along the slope is a popular method of water delivery in the hills of Nepal. Farmers in Nepal design and construct channel head diversion for water abstraction using simple and indigenous technologies and locally available materials preferably shrubs and bamboos. In most cases, the intake is found located in a narrow section that makes diversion reasonably stable and cost effective¹. Where overhanging rocks are met, it is necessary to dig a tunnel, *Agris* are the group of people from Baglung and Dhading districts specialized in tunnel making. A system of water delivery through bamboo-made bridges, where there are gullies, cliffs or landslides enroute canals has also been documented¹⁸. People in the midhills of Nepal have to go long distance for collecting water for consumption. However, where sources of water are available, a bamboo split and a drain locally called *kulo* is used to carry water by gravity as indigenous method of water abstraction. Use of loose boulders for reducing the cutting effect of streams locally called as *bhakari* is used by farmers to protect their paddy fields in the hills of Nepal and India. Four pillars are used at four corners, which are mostly made of wood. Alternatively trees of *Salix* species are grown abundantly along the river bank, which act as buffer to improve the quality of river.

Drip irrigation is not common in Nepal. In most of the farmer-managed irrigation systems in Nepal, temporary and semi-permanent type overflow weirs are found to be performing satisfactorily. Brushwood temporary weir is the most common diversion structure built with locally available materials. The practice of irrigation by continuous flowing spring water in paddy is common in Nepal¹². In the mountains, this practice helps in increasing the soil temperature and in lowland to lower the soil temperature. Practice of tapping flash flood in the beginning of rainy season is also reported in Nepal. This brings fertile silt that helps in adding nutrients to

soil. In many farmer-managed irrigation systems in Nepal, for proportionate division of water share, device called *Sancho* or *Jhyal*, which is made of wooden blocks with rectangular notches is popular¹⁹. Where such devices are not in use, water allocations is dependent on *Kulara* meaning delivery through each branch canal ensured by the size of inlet opening.

Paalo baadhney is also a common method of water allocation, where whole community is divided on the basis of farm families and one family gets one full water day or limited to few hours to irrigate their fields turn wise. Traditional water mill (*Ghatta*) has been use in Nepal for grinding of wheat, maize, millet, etc. Stream is diverted into channels with piled up stones and brushwood twigs and branches. Last part of the channel leads into a chute at an angle of about 45° C. Usually there are 6-14 blades in a turbine¹. The methods, advantages and disadvantages of indigenous water mills in Nepal have been elaborated¹⁵. ITK related to water quality management besides others from Jhikhu Khola watershed and Galaundu-Pokhare Khola Sub-watershed, and High Himalaya, respectively have been documented^{14,18,20}. 'Water Shade' is also one of the national level traditional knowledge, which helps in the conservation of forest as well as keeping the source of water clean. People have the belief that they should not cut trees or woods surrounding the source of water. They should not throw litter around the water shade. If they do not obey, bad things may occur to them. This tradition or belief preserves the forest as well as helps keep the source of water clean. This is still practiced nowadays in the remote villages of the country. Since, some areas have been occupied by the National Parks, the tradition is slowly disappearing as people do not have access to these forests and water shades²⁰. As a convention, the tap is normally decorated with a statue of God. The presence of such idols encourages the folk to refrain from doing wrong or to maintain cleanliness to some extent around the water source. Moreover, an instruction with a figure of a woman washing the utensil provides an ample guide for the folk to come up with clean drinking water quality and storage. The instruction reads "keep the inside of the utensil clean". The indigenous practice was documented in Chisapani, Manabhanjyang, Dhading district¹⁸.

As an indigenous endeavor, the well established tap is entirely surrounded with barbed wire. The practice

averts the invasion of animals, which could otherwise make the source and surrounding dirty. This tends to keep the tap area clean. Besides, the wire provides a temporary hanger for the drenched clothes while s/he is busy washing the clothes. Wooden poles were used instead of barbed wire in places like Randanda. Moreover, the numeral on the tap represents the count of households using the point source. The judicious distribution curbs over exploitation of the point resource. The local know-how has been documented in *Chisapani, Manebhanjyang*. Folk were found to be keenly concerned on the cleanliness of the source. A written routine on the wall of the tap assigns one person a day from each household involved in resource consumption. The practice not only keeps the source clean but is in fact, a wise distribution of the work load among the users and thus, saves labor cost. The indigenous knowledge was documented in *Chisapani, Manebhanjyang*.

As a common practice, a conservation pond is established a little lower to the source. The pond serves as a reservoir to collect surplus water and a continuous irrigation supply to the bariland. Besides, the pond is shaded by the profuse crown cover of *Ficus religiosa (Pipal)* and thus, tremendously curtails the evaporation loss. The pond could either be cemented or traditional type however, frequent cleaning is carried on by the folk. The practice was documented in *Chisapani, Manebhanjyang*. Local people, who do not have enough time to participate in different training programs, could be made aware by the on-spot techniques. The wall is studded with the big writings, which tell the people to maintain cleanliness and remain hygienic regarding the resource use and conservation. The writings states remain clean and healthy. The local know-how was documented in *Neupane Gaon*.

Water oozes out at the different point sources or springs in the undulated topography of the catchments. In order to provide potable water to the local people, a cemented tank has been erected at the source or the spring. The practice is in contrast to the conventional one as it has averted the collection of water at not too distant reservoir. The practice indeed, curtails the sedimentation load and possible contamination during runoff, which may otherwise occur if water flows along the channel from the source to the distribution reservoir. Besides, the wall of the reservoir is studded with taps and two outlets. The upper outlet allows the flow of excess water during high water table and the

lower outlet is used for cleaning the interior. An alternative to the conventional practices has been documented in *Dharapani*. A local know-how to store water in the household was perceived in Dhodeni. A structure is made in a dark corner of the house popularly known as, *Gogreto*, in local lingo. The surface of *Gogreto* provides ample room for water storage and other household utensils. Moreover, poultry are kept inside the structure, which could be cited as a good example of space sharing in the house. As the storing is done in the dark area, evaporation loss is greatly reduced rendering the water cool for consumption. However, the poultry practice could contaminate the water in the long run. The indigenous approach was practiced by Ishwor Bahadur Thapa frlagar, a resident from Dhodeni. Farm pond with a log (*Maulo*) at the centre of the pond was observed at Malika VDC ward no 2 in Baglung. Harvesting surface runoff by constructing such farm pond is a common practice in this region. In order to protect water sources from human wastes, in Malika VDC ward no 2, temple of *Naga* (snake god) and *Kantharaj* (a kind of God) was built as observed. This would protect the sources from open defecation of human excreta for people would be afraid to dirty the place where the statues of deities have been erected.

Indigenous soil fertility management practices

The role of indigenous knowledge in soil fertility management in the hill farming of Nepal has been documented²¹. This study was conducted in Gulmi and Arghakhanchi districts to identify the types of soils in the ban land using PRA and RRA techniques. Farmers have developed indigenous soil classification systems mainly based on features which can be sensed such as colour, texture, soil fertility and other physical properties²². Soil fertility is related to the aspect of the land. Northern aspect is reported to perform better for mandarin orchards. Researchers documented indigenous *Tjyapoo* method of soil management and some 12 methods of indigenous soil fertility management¹. Use of farm yard manure, green manuring, *in-situ* manuring such as by keeping animals in sheds or in open fields and also by using migratory flocks of sheep and goats, mulching, use of nitrogen fixing plants, crop rotation, fallowing, terrace riser slicing, trapping flood water for fertigation, burning of trash, use of forest soils and black soils, and burying of dead animals and mobile toilets are recognised as indigenous soil fertility management practices common in Nepal.

Indigenous Knowledge on biodiversity and forest management

Indigenous forest management systems in Nepal are of diverse nature and community specific. Forest resources in the hills and mountains have been protected for years through local people's age-old technical knowledge²³⁻³⁰. Indigenous communal forest management system and the distinctive rules and regulations associated are documented, and are believed to be many generations old knowledge³¹. *Sing! Nawa*- this is one of the important community level traditional knowledge of the Himalayan people, living in the highest part of the world to conserve the forest and wildlife. *Singi*, in Sherpa language, means wood or trees and *Nawa* means to ask. So *Singi Nawa* means to ask someone before cutting any trees or woods. This is a custom the *Sherpas* have been practicing for many years. People choose a leader, old but an intellectual person, among them who can adeptly handle the community. The leader prepares a calendar, where it is mentioned that people are allowed to cut trees on that date only otherwise some dreadful things may happen in the community. The people of the community ask the leader when they are allowed to cut trees. Because of him, the people maintain their discipline and do not cut trees anytime. This, in the long run, conserves the forest. Nowadays, because of the system of Wildlife Reserve introduced by the government, this tradition has been endangered²⁰. People are not allowed to go to the forest and so it is difficult to follow the tradition.

Natural bamboo resources management is one of the most common indigenous knowledge possessed by farmers in Nepal. Bamboo is one of the most useful plants in Nepal and is used extensively as a source of income generation. Fodder tree plantation in the ban land is a very common practice in Nepal^{24,32-39}. Farmers' learn from their ancestors about appropriate tree species and its management^{35,40-42}. There is wealth of knowledge available in Nepal about farmers' practicing Agroforestry in their private lands⁴³⁻⁴⁶. Researchers have described some 19 wild plants and their uses as medicine in Nepal². In a field survey, conducted in the villages of Ramdi, firlalunga, Balam, Beltari, Mirmi, Burgha and Ridi in the Kali Gandaki watershed, Nepal, 48 medicinal plants belonging to 31 families, each with local names, traditional uses, methods of preparation and route of administration have been documented⁴⁷⁻⁴⁹. *Pongmar* is one of the national level traditional knowledge of the

country. *Pongmar* is a kind of herb found in the remote villages towards the Himalayas. Since the villages are remote and hospitals are out of reach of these villagers, people opt for this tradition to cure poison. For a person who has just taken poison, *pongmar* has been very effective. It is found to cut the poison and save the person's life if administered on time²⁰.

Yarsagumba literally means summer plant and winter insect in Himalayan community. Before the rainy season begins, spores of this herb settle on the heads of caterpillars that lives underground. The fungus gets transfixed into the body of the caterpillar and grows out through its head, draining all the energy from the insect, which ultimately dies. *Yarsagumba*, *Yarshagumba* or *Yarchagumba* is a rare and unique herb that grows in the meadows above 3,500 meters in the Himalayan region of Nepal. There are various types of famous medicinal plants found in Nepal but the popularity of *yarsagumba* is simply overwhelming. For the last couple of years, the trade of *yarsagumba* is increasing and it has been regarded as an expensive life saving tonic. Headache, toothache or any other disease - *yarsagumba* is the remedy. And not only that, it is also believed to be a cure for sexual impotency— a Himalayan herbal viagra²⁰. *Titepati* is plant meaning bitter leaves in Nepali language. It is also an effective TK at a regional level. The plant is used as herb in most of the communities of the South Asian region. It is a small green plant found in mostly hilly areas. *Titepati* is used as herb for many kinds of diseases. It is used as a paste for any cuts or bruises. It is also used a cleansing agent. The herb is boiled in water for few minutes and left to cool down. People drink this liquid as they believe that it washes away all the dirt or diseases inside the body. So this herb has a very important value in the communities²⁰.

Indigenous knowledge on pest management

The firlwahang Rai's have indigenous methods of pest management that are heavily relied on in areas where external inputs (e.g. chemical pesticides) are in short supply. In remote areas, common pests, such as stem borer (*Chillozonellis*), attack wheat and maize stocks. The grounded pulp of the *Khira* leaf is spread on the wheat crop and the scent of the pulp is sufficient to kill the pests. In the case of paddy, the pulp is introduced into the paddy field through the irrigation channel. In the case of specific pest attacks, like the rice moth which creates clusters of rice on

paddy, they are combed out with sticks and the moths deposited in the water; to ensure decomposition, the operation is carried out in sunlight. In maize, the dried disease infected stalks are manually removed. Originally, the traditional practice was that the maize cobs were kept dried by keeping them on the top floor where kitchen heat would facilitate drying of the seeds. Due to electrification of houses in Malika VDC, ward no 2, and no more heat being generated from kitchen, seeds have started to germinate in cobs. To prevent this, as an alternative, farmers have started drying the cobs in verandas facing the sun to facilitate the drying process. Other practices like grain storage with ash or neem is common.

Biofencing, agricultural tools and implements, and traditional beliefs

Biofencing with cactus is a common practice in Syangja district in ward No 1 of Phedikhol village. Cactus (locally called as *seewdi* and *khirro*) being thorny in nature protects crop from stray animals. These plants are also considered rich in nitrogen and used as a source of manure. Fencing, locally called as *tagaro* using bamboo as bars is a common practice in Syangja district in ward No 1 of Phedikhol village. This type of fencing is use to prevent animals from entering into villages. Traditional rice dehusking is done using a wooden pestle operated by leg usually by women, locally called *dhiki* is used to remove husk from rice. Traditional hand mill, locally called as *jato* is used to grind wheat and corn.

Farmers in Nepal have been using plough and yoke (locally called *halo* and *juwa*) since time immemorial. The basic components of plough are handle, body, and share. Yoke has a projection at the centre to which plough is fitted and secured by a rope. *Sew* is a common alternative to modern umbrella, made of leaves and woven carefully between bamboos, used extensively in Syangja district, while working in field. Farmers, mostly *Brahmins*, have a tradition of planting *tulsi*, which has medicinal value. This place, popularly known as *maeri* is considered sacred in Hindu religion and there are many religious beliefs tied up with this custom. It is believed that this herb has potentials to produce many times more oxygen than any other plants. Similarly, in *Bhagwati* temple, a sacred place where animals are sacrificed, shrub with sharp razor edged leaves, popularly known as *tarbarphul* are planted. It is believed that this shrub prevents damage to houses from lightning. Farmers in

Syangja district, bhatkhola village, ward no 7 (respondent: Gita Sharma, age 36) believe that prayer could prevent hails. Popularly known as *asina tarkauni* meaning change the direction of hailstone is a traditional practice where a holy man from a particular tribe will go fasting for months. This man is then offered grains from each household for the prayers he has performed.

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