

## Impact of water mills on rural livelihood: A study of Arunachal Himalaya

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Received 03 February 2023; revised 13 October 2023; accepted 16 November 2023

The Himalayan people have a rich ancient tradition and heritage of utilizing water mills (*Chhoskor*) for grinding purposes. The Shertukpen inhabits in the western and south-western parts of the West Kameng district of Arunachal Pradesh, Eastern Himalaya. It is an indigenous tribal group. They are carvers and experts in carving wood and stone. The purpose of this paper is to examine the rich culture of grinding practices through water mills (*Chhoskor*) by the Shertukpen hence, the practices of traditional watermills have an immense influence on the socio-economic and livelihood aspects of the society. It also examines how this traditional grinding practice is impacting the livelihood of rural areas. The major grinding products are food grains, fruits, vegetables, and other related products. The methods used in this study were interview, focused group discussion, and observation. A field visit was made in July 2022. The study shows that the tools of grinding are now become endangered and vulnerable. These require attention and study for preservation, whereas, the grinding practices have a huge socio-economic impact on rural areas.

**Keywords:** Arunachal Pradesh, Eastern Himalaya, Livelihood, Shertukpen tribe, Water mill

**IPC Code:** Int Cl.<sup>24</sup>: F03B 7/00, F03B 17/06

Water is a precious resource, used for various purposes. Apart from its various domestic uses, it is also significantly used to rotate huge slabs of stones to grind cereal, known as a watermill. A water mill is used to turn a wheel or turbine for grinding wheat, sawing lumber, and for the production of textiles and controlling the kinetic energy of water flow<sup>1</sup>. The Shertukpen community has a long history of using watermills as watermills hold a pivotal space in their culture. In the meantime, a few numbers of people are engaged in using watermills recently. The advancement in technology and innovative grinding equipment has impacted the use of traditional grinding materials largely. It is therefore, there is vital need to document and address the issue of traditional water mills.

Gharats, also known as Chuskors, are the traditionally designs watermill, used by the native people of the Himalayan region. The Gharats are environmental friendly<sup>2</sup>. These are locally made using limited natural resources. Water is plenty mainly available from the glacier-fed rivers, streams, and rivulets. Traditional watermills have been using by the people of the hilly terrains of the Western and Eastern Himalayan region for centuries and for

grinding grains<sup>3</sup>. The indigenous people use water mills through developing traditional skill and technology with is nature friendly. The construction of traditional water mills is cost-effective, participatory, and sustainable. These water mills are centuries-old systems and experiences, which has been practicing in the entire Himalayan region. There are thousands of water mills still used for grinding in Arunachal Pradesh in particular and in the Himalayan region in general<sup>4</sup>.

The information about the technical design of these water mills is lagging. However, the archaeological evidences from Europe Continent provide insights to the evolution of water mills. Meantime, it is extremely rare<sup>5</sup>. In many parts of the world, water mills are disappeared. Therefore, it is just impossible to gather data on the ancient technology and their types. Further, the traditional water mills have lost their importance due to the introduction of electric mills<sup>6</sup>.

In the traditional water mills, the energy is generated from flowing water<sup>7</sup> by local people through traditional knowledge. The water mills are generally used for grinding grains and pulses. Water mills were the major source of livelihood along with agriculture in the Himalayan region. The Himalaya has many glacial-fed perennial rivers and streams provide suitable base for

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water mills. Chakki an attrition mill consists of two circular stones mounted on a vertical axis which consists of a stationary stone cylinder upon which a smaller stone cylinder rotates<sup>8</sup>. The bigger ones are operated by two people and for larger ones; livestock are used to rotate the upper cylinder. It uses for community or commercial purposes<sup>9</sup>. The traditional water mills are cost effective, environmentally friendly, and easily handled. It has significant socio-economic significance<sup>10</sup>.

Arunachal Pradesh, located in the Indian Eastern Himalayas has a rich diversity. It has 26 major tribes and 100 sub-tribes. Shertukpen is not the only tribe that is engaged in watermill practices whereas, there are many other tribes in the Himalayas region that have been involved in practicing traditional water mills since ages. Now, only a few water mills are working. This makes Arunachal Pradesh distinct from other Himalayan states.

The changes in the pattern of livelihood among the people have resulted in a huge impact on the agricultural practices of the study area. As in the present-day context, people are transcending their food habits from traditional processing to modern grinding and processed commodities, which affects the indigenous practices of grinding process of cereal crops through traditional water mills, therefore there is a dearth of awareness on the importance of this grinding practices symbolizes an epitome of sustainable resource utilization as the grinding and manufacturing process is very rigorous, which requires proper attention and examination of the problem.

The Shertukpens are the small tribal communities. Their habitats are found in the West Kameng district Arunachal Pradesh. Agriculture is the main occupation and major source of income of the Shertukpens. They practice both shifting and permanent agriculture. These community people have a tradition of using water mills to grind cereals like wheat, maize, and millets are the subsidiary source of livelihood. This paper examines the significance of grinding practices, their role in sustaining livelihood, and suggests strategies for conservation of the traditional water mills.

#### **Study area**

The West Kameng district is located in Arunachal Pradesh, Northeast India (Fig. 1). Tibet and Bhutan share their border areas with the West Kameng district. The districts are mostly mountainous with snow clad peaks and river valleys. The main rivers flowing through the district are Bichom, Dirang Chu, and Tenga. Forest varies from sub-tropical semi-evergreen to temperate

and alpine with rich biodiversity. About 500 floral species are found in this district. Annual rainfall in this district was noted 1743 mm. The mean monthly maximum and minimum temperature is 21.44°C and -1.24°C. This district has a total population of 87,013<sup>11</sup>. Aka (Hrusso), Bugun (Khowa, Monpa), Sajolang (Miji), Sartang, and Shertukpen ethnic groups are the main habitants. People are dependent on agriculture and animal farming for their livelihood. It has 260 villages, 5 administrative blocks, and 13 administrative circles. The administrative circles of the district are Balem, Bhalukpong, Bomdila, Dirang, Jamiri, Kalaktang, Kamengbari-Doimara, Nafra, Rupa, hergaon, Singchung, Thembang, and Thrizino<sup>12</sup>.

#### **Methodology**

This study is based on the collection of primary data gathered from May to June 2022. First-hand knowledge on various aspects of the watermills was collected through a comprehensive field survey covering all the Shertukpen inhabited circles namely Rupa Circle, Shergaon and Kamengbari-Doimara Circles. The three circles comprised 15 villages followed by Birpur, Rupa, Brokpublang, Thongre, Gorbaw, Dikshipam, Mukhuthing, Membachur, Chillipam, Lingbaktang, Jigaon, Musakshing, Shergaon, Doimara and Kamengbari (Table 1). A structured questionnaire was developed by keeping in view of the objectives of research and filled up through a door-to-door household survey with a 50% capacity of the total number of households present in the village. A total of 15 villages were surveyed and in all villages Shertukpen tribe inhabited. The respondents were selected from both men and women to derive balanced information. The study was also based on personal observations and focus group discussions with the villagers. Finally, participant observation formed an essential source of supplement and to analyze the collected data.

#### **Results and Discussion**

##### **Socio-economic analysis**

##### **Education**

Educational attainment is a vital indicator of development in society. Hence, during the field survey, the study found that the literacy rate of the community is trending toward a poor inclination. The tentative study of all the 15 villages found that the male educational rate is much higher than that of females, which requires attention and encouragement to the younger generation to improve the quality of

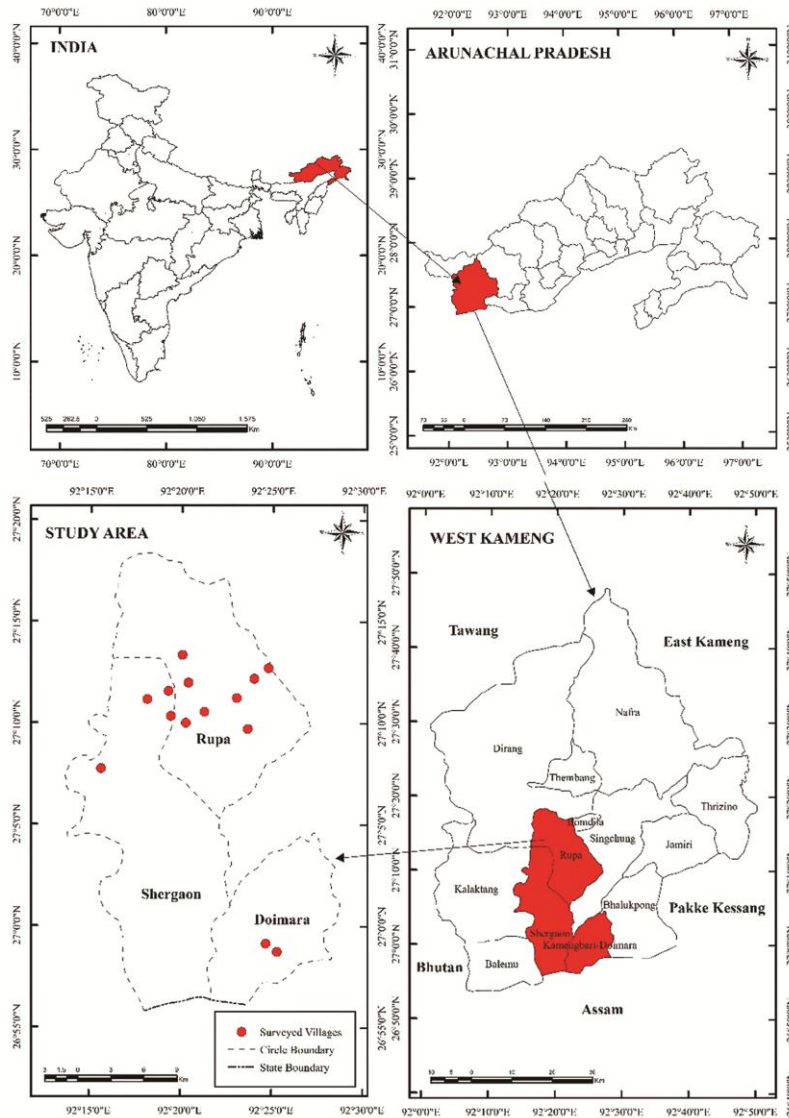


Fig. 1 — Location map of the study area in Arunachal Pradesh, Northeast India

education and integration of balanced education to both the male and female population of the community. Hence, the decreasing level of education in rural areas is compelling them to either opt for practicing agricultural activities or daily wage-earning occupations. Table 2 and Figure 2 depict the numerical and analytical data of the degree of educational qualification and literacy percentage among the respondents of respected surveyed households of the study area.

#### Occupation

The study comprehended that the economy of Shertukpen is generally 'agriculture-based, as the maximum number of people are engaged in the

primary activity *i.e.*, agriculture (Table 3 and Fig. 3). Many crop races/cultivars are grown every year such as barley, ragi, millets, corn, rye, etc. The climatic condition of the region is very much favorable for the growth of these crops. These crops are sown during the month of September-October and the crops are successfully harvested during the month of late November and mid-December. Apart from these cereal crops, various kinds of vegetables are grown in the region such as tomatoes, potatoes, capsicum, cauliflower, cabbages, fresh beans, etc.

The Shertukpen tribe has an affable and old tradition with the cultivation of cereal crops especially maize and other cereal grains like ragi, millets, barley, etc. Cereal crops have been the staple food of the

Table 1 — Number of households surveyed

Sl. No.	Name of village	Total households	Households surveyed	Latitude and longitude	Elevation (in metre)
1.	Birpur	48	24	27°13'01" N 92°25'34" E	1400
2.	Dikshipam	18	9	27°13'16" N 92°19'28" E	1620
3.	Mukhuthing	28	14	27°12'17" N 92°17'27" E	1974
4.	Gorbow	28	14	27°13'01" N 92°20'22" E	1817
5.	Membachur	36	18	27°12'09" N 92°16'57" E	2119
6.	Brokpublang	34	17	27°11'24" N 92°23'57" E	2040
7.	Thongre	68	34	27° 09'58" N 92° 23'39" N	1748
8.	Chillipam	54	27	27°11'13" N 92° 23'06" E	2096
9.	Lingbaktang	22	11	27° 10'46" N 92° 21'23" E	2089
10.	Jigaon	58	29	27° 11'10" N 92° 19'40" E	1729
11.	Musakshing	24	12	27° 10'12" N 92° 19'13" E	2084
12.	Shergaon	106	53	27° 07'20" N 92° 15'23" E	1949
13.	Rupa	140	70	27°12'24" N 92° 24'12" E	1408
14.	Doimara	14	7	26°57'49" N 92°25'21" E	301
15.	Kamengbari	14	7	26°55'48" N 92°25'54" E	341.4
<b>Total</b>		<b>692</b>	<b>346</b>		

Source: Accredited social health activist (ASHA), Rupa and field survey, 2021.

Table 2 — Level of education in the study area

Sl. No	Village	Total number of HH surveyed	Level of Education	Total population	Percentage (in %)	Average % of literacy
1.	Birpur	24 <i>(Data of all the respondents comprised of both male and female, one respondent from each household)</i>	Illiterate	10	41.66	33.33
			Primary	9	37.5	
			Secondary	5	20.83	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	
2.	Dikshipam	9	Illiterate	2	22.23	33.34
			Primary	2	22.23	
			Secondary	5	55.56	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	
3.	Mukhuthing	14	Illiterate	3	21.42	28.57
			Primary	8	57.14	
			Secondary	NIL	0	
			Higher	NIL	0	
			UG	1	7.14	
			PG	NIL	0	

(Contd.)

Table 2 — Level of education in the study area						
Sl. No	Village	Total number of HH surveyed	Level of Education	Total population	Percentage (in %)	Average % of literacy
4.	Gorbow	14	Illiterate	2	14.28	33.33
			Primary	11	78.57	
			Secondary	1	7.14	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	
5.	Membachur	18	Illiterate	3	16.66	33.33
			Primary	15	83.33	
			Secondary	NIL	0	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	
6.	Brokpublang	17	Illiterate	6	35.29	19.99
			Primary	3	17.64	
			Secondary	4	23.52	
			Higher	3	17.64	
			UG	1	5.88	
			PG	NIL	0	
7.	Thongre	34	Illiterate	14	41.17	18.82
			Primary	12	35.29	
			Secondary	2	5.88	
			Higher	3	8.82	
			UG	1	2.94	
			PG	NIL	0	
8.	Chillipam	27	Illiterate	18	66.66	24.99
			Primary	5	18.51	
			Secondary	2	7.40	
			Higher	NIL	0	
			UG	2	7.40	
			PG	NIL	0	
9.	Lingbaktang	11	Illiterate	6	54.54	33.6
			Primary	4	36.36	
			Secondary	1	9.09	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	
10.	Jigaon	29	Illiterate	14	48.27	19.99
			Primary	7	24.13	
			Secondary	2	6.89	
			Higher	5	17.24	
			UG	1	3.44	
			PG	NIL	0	
11.	Musakshing	12	Illiterate	11	91.66	49.99
			Primary	NIL	8.33	
			Secondary	1	0	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	
12.	Shergaon	53	Illiterate	9	16.98	19.99
			Primary	9	16.98	
			Secondary	15	28.30	
			Higher	16	30.18	
			UG	4	7.54	
			PG	NIL	0	

(Contd.)

Table 2 — Level of education in the study area

Sl. No	Village	Total number of HH surveyed	Level of Education	Total population	Percentage (in %)	Average % of literacy
13.	Rupa	70	Illiterate	20	28.57	19.9
			Primary	23	32.38	
			Secondary	15	21.42	
			Higher	4	5.71	
			UG	8	11.42	
			PG	NIL	0	
14.	Doimara	7	Illiterate	2	28.57	49.99
			Primary	5	71.42	
			Secondary	NIL	0	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	
15.	Kamengbari	7	Illiterate	3	42.85	33.33
			Primary	2	28.57	
			Secondary	2	28.57	
			Higher	NIL	0	
			UG	NIL	0	
			PG	NIL	0	

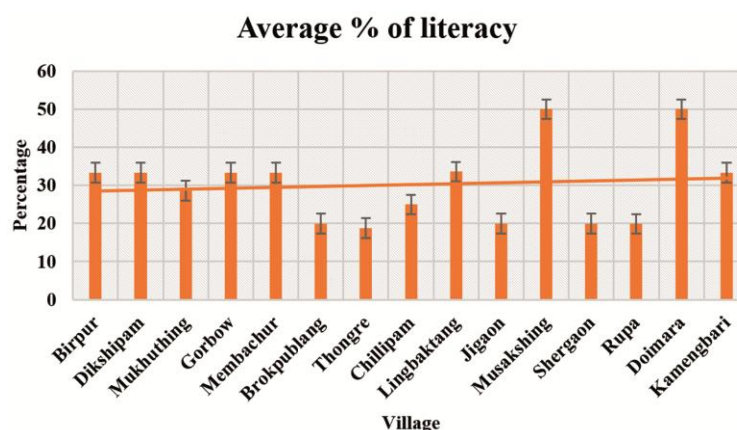


Fig. 2 — Figure shows the average literacy rates of households surveyed (in %)

Shertukpen people since time immemorial. Paddy and wheat are not grown due to Geographical constraints.

Data show that most of the respondents who were randomly selected for the survey were engaged in agriculture activities. Jobless redundancy goes higher during the winter season due to severe cold and snowfall, thus in some villages, people are not engaged in any agricultural activities, which decreases the income and economy.

**Watermills and their significance**

The socio-economy of Shertukpen is highly dependent on agriculture. Agriculture is subsistence and

**People engaged in various economic activities**

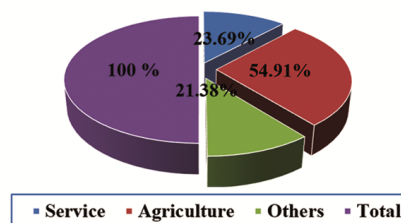


Fig. 3 — Figure displaying the percentage of varied occupation traditional cereals are grown, which are the staple food of the rural people. The cereals are processed and grinded using watermills. The Shertukpen people have a long history of utilizing watermills for grinding purposes. The study depicted that each and every village

Table 3 — People engaged in various economic activities

Sl.No	Village	Service (Govt/private)	Agriculture (Primary)	Others	
1.	Birpur	6	14	4	
2.	Dikshipam	1	5	3	
3.	Mukhuthing	1	10	3	
4.	Gorbow	3	10	1	
5.	Membachur	0	17	1	
6.	Brokpublang	2	14	1	
7.	Thongre	6	20	8	
8.	Chillipam	2	22	3	
9.	Lingbaktang	1	10	0	
10.	Jigaon	9	15	5	
11.	Musakshing	0	10	2	
12.	Shergaon	20	23	10	
13.	Rupa	27	13	30	
14.	Doimara	0	3	4	
15.	Kamengbari	3	2	2	
	Total (in %) =	81 (23.69)	190 (54.91)	74 (21.38)	Total percentage = 100 %

has at least one watermill, whereas, the watermills also use for community grinding, which all the households can access. Moreover, this practice is more sustainable in nature because the grinding process is fully done through the energy generated from the streams and making it very nominal manual interference, hence making this water milling practices an efficient utilization of natural resources (Fig. 4). It makes an affable ambiance of eco-friendly practices and utilization of the natural water resources.

The utilization of watermills has several advantages. The study revealed that earlier it was very feasible for young people to travel to town for grinding but now, the young people have out-migrated and for old people, it is very difficult to travel which is a matter of concern for the villagers. Therefore, having watermills will solve the problems of grinding cereals. It is less time-consuming and more efficient as well as feasible activity. Moreover, no charge is levied for grinding in the watermills as it is free of cost which makes this watermill practices a prominent component in the livelihood of the rural society.

#### Present status of watermills

One of the primary objectives of this study was to examine the availability of watermills in the targeted study area. Whereas, the study found that ten to twelve years back, every village used to have at least one operational watermill used for grinding by the villagers (Table 4 & Fig. 5, 6). This study shows that now only two villages have operational watermills and the rest of the villages have abandoned their

watermills, which are now non-operational and most of them are in a dilapidated state.

The study shows that very few villages are still engaged in watermill practices. Figure 6 shows that there are about 10-12 watermills, now only few are in operation. There were drastic changes in the number of watermills and these were declined drastically. It was observed after discussion with the local people that the decline is also due to lacking professional crafts people, decline in the agricultural practices and cultivation of cereal crops, changing pattern of livelihoods, lack of awareness of the significance of watermills.

#### Utilization of *Chhoskor* and its impact on rural livelihood

The sustainable use of indigenous tools and techniques is a vital part and partial of the rural people in mitigating the essential requirements. Shertukpen is one such epitome of sustaining the indigenous and environmentally friendly practices of grinding cereals through the traditional *Chhoskor* or water mill since time immemorial (Table 5). There are two types of grinding one is known as Ran-thok (rotary quern) which is smaller in size and is performed manually to grind a small number of grains and cereals. Whereas, another one is bigger in size and is driven by the kinetic energy generated by streams (*Chhoskor*), which is used to grind grains and cereals in large quantities (Table 6).

Traditional practices of milling through the watermill are a vital part of the livelihood of the Shertukpen people since their main occupation is





Fig. 4 — Characteristics of operational watermill

Table 4 — Showing the number of present-day operational and number of operational watermills prior to 10-12 years

Sl. No	Name of Village	No. of operational watermills prior to 10-12 years	No. of present-day operational watermill
1.	Birpur	1	0
2.	Dikshipam	1	1
3.	Gorbow	1	0
4.	Mukhuthing	1	0
5.	Membachur	1	0
6.	Rupa	2	0
7.	Brokpublang	1	0
8.	Thongre	2	0
9.	Chillipam	1	0
10.	Lingbaktang	1	0
11.	Jigaon	2	0
12.	Musakshing	1	0
13.	Shergaon	1	1

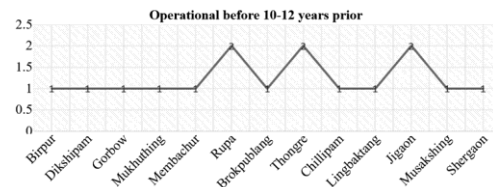


Fig. 5 — Chart showing the number of operational watermills prior to 10-12 years back

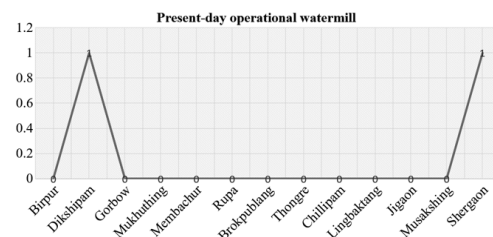


Fig. 6 — Chart showing the number of present-day operational watermill



Table 5 — Commonly grown crops and cereals.

Sl.No	Local name	Common name	Scientific name	Status of cultivation
1	<i>Gaa-Cham</i>	Ragi	<i>Eleusinecoracana</i>	SC
2	<i>Bukung-ahék</i>	Amaranth	<i>Amaranthus</i>	SC
3	<i>Zumu</i>	Sorghum	<i>Sorghum bicolor</i>	NC
4	<i>Dchak</i>	Foxtail millet	<i>Setariaitalica</i>	SC
5	<i>Pheng-tong</i>	Maize	<i>Zea mays</i>	SC
6	<i>Pham-phla</i>	White beans	<i>Phaseolus vulgaris</i>	SC
7	<i>Bukung-jze</i>	Millets	<i>Pennisetumglaucum</i>	NC
8	<i>Mong-ahék</i>	Bell pepper	<i>Capsicum annum</i>	SC

Abbreviations used; SC=still cultivating, NC= not cultivating

Table 6 — The average size of the watermills

Parts	Mean sizes (in cm)
Lower stone	Diameter=55
	Thickness=17
Upper stone	Diameter=54
	Thickness=16
Wooden plank	Length=126
	Breadth=138
Propeller	Length=64
	Height=14
Adjuster	Length=29

based on agriculture and its products. So, this milling practice has a huge economic impact on livelihoods because most of the grounded cereals are being sold in local markets and some are stored for their consumption. The Shertukpen have a long legacy of the utilization of watermills as the primary sources for their food requirements. This tool has constituted a pivotal role in the livelihood of the rural people because the people were solely dependent on the watermills for grinding cereal crops consumption in the past. There are various cereals and grains which are grown in the study area (Fig. 7).

Most of the households are engaged in primary activities Due to their dependency on agricultural products which are suitable for grinding activities through watermills. It depicts the importance of traditional grinding practices have immense socio-economic importance in sustaining the livelihood.

#### Causes of declining grinding practices culture

Over the years, the grinding culture of the Shertukpen society experienced many changes due to the impact of modernization. The undergoing changes in social, economic, and cultural aspects of the community reflect deep impacts on the age-old grinding practices in the society. According to villagers, these factors are mainly responsible for the vanishing of traditional grinding practices culture in society.

#### A decline in the number of professional experts

The number of professional experts (*Zyopos*) has largely declined in most of the villages. In some of the villages, there were no professionals left while those living ones are also getting old. The low vision and aging of the professionals had largely affected the manufacturing process of watermills. As a result, new *Chhoskor* had been rarely produced and the old ones are in dilapidated condition.

#### Change in livelihood activities

The change in livelihood activities significantly contributes to the declining utilization of water mills in the study area. Although agriculture is the primary occupation of the people, it is gradually shifting towards the service sector and business activities. Moreover, the agricultural pattern and crops grown are also changing in the area. Nowadays, the villagers are mostly interested in the commercial cultivation of fruits and vegetables and pay less attention to the cultivation of cereal crops. The utilization of watermills is intimately associated with the production of food grains. However, the production of food grains in the study area has significantly declined due to shifting priorities in the selection of agricultural crops. The affordable access to readymade flours in the markets and the food preferences of the younger generations also contribute to the changes in cropping patterns. Hence, the traditional grinding tools are rarely utilized by the villagers owing to the lesser stock of food grains. On average, 2 out of 15 villages were found to use watermills for grinding grains. People are seeking jobs, businesses, and other diurnal activities for easy earning and livelihood and escaping the laborious work of agriculture.

#### Access to modern grinding technologies

Many of the traditional societies are experiencing transformations due to the impact of modernization and globalization. Today, the world is driven by new and sophisticated technologies in every sphere of human life. Change is inevitable but certain changes are unhealthy for society. For example, a remarkable



Fig. 7 — Types of cereal crops that are grown in different villages

shift from traditional culture to modern grinding technologies was noticed among the Shertukpen community. Such changes have led to the declining usage of traditional tools which is an environment-friendly and cost-effective technology. The study noticed that the traditional water mill has been replaced by modern mills and grinders in most of the villages. According to villagers, due to the easier and quicker grinding process, they are shifting to modern mills and grinders as the traditional grinding tools are time-consuming and laborious. However, the villagers are unaware of the nutritional and gustatory advantages of flour produced by traditional grinding tools over mechanical mills.

***Changing perceptions towards traditional watermills***

Human beings are dynamic in terms of their thinking ability and decision-making process. Nowadays, the ideas, lifestyles, food habits, and dressing patterns of people are largely influenced by external factors. The changing perceptions have led to the negligence of traditional practices particularly watermills in the Shertukpen society. Once upon a time, they were known to be good craftsmen and artisans but the continuity of such rich culture has been threatened to a great extent. They have changed themselves from stone tool users to technological bearers. The study reveals that the villagers are paying more attention to mechanical mills and other

electronic devices compared to traditional tools. Hence, the importance of such a sound and healthy culture is losing its relevance in society. Therefore, the changes in people's perception towards traditional practices coupled with the influences of modern technological innovations have led to the declining usage of traditional grinding practices in the Shertukpen society.

#### ***Lack of interest among the younger generations***

The study depicts a lack of awareness and interest in traditional grinding culture among the younger generations of the Shertukpen community. They are more oriented towards modernity and unwilling to know about traditional practices. Such developments have led to a decline in the number of professional experts and the overall usage of watermills in the study area. The manufacturing of watermills requires precise skills and hard labor which can be acquired through rigorous training and continuous participation. However, such enthusiasm is lacking among the younger group of people as they have changed their perceptions and adopted a new and easy way of living. The present study found that the watermills are in few households which can be attributed to the lack of interest among the people, particularly the younger age group. They even do not possess adequate knowledge about the significance of traditional grinding tools and other uses of stones.

#### **Future prospects of *Chhoskor* and preservation strategies**

The sustainable use of natural resources is an important component of environmentally friendly activities that thrives the human society. The study reveals that the utilization of stones in the Shertukpen society occupies a pivotal role in their socio-cultural life. It is vital in determining the various social activities of the community. Hence, there is an urgent need to stress the preservation of grinding practices and culture. Therefore, based on the findings of the study, the following specific suggestions need to be addressed to encourage and help in furthering the preservation of the rich traditional grinding practices:

1. Indigenous institutions should be established to impart training and knowledge about the manufacturing procedures of the fading traditional grinding culture.

2. The expenses incurred on grinding cereal crops through modern mills could be lowered through the utilization of *Chhoskor*. The water mills are cost-effective and environment-friendly compared to

modern mills. Therefore, the villagers should be encouraged to construct water mills wherever feasible for community use.

3. There is a necessity to document such vulnerable cultural practices through research and case studies. The stone culture is not only specific to the document Shertukpen tribe; it is also practiced by other tribes of the state. Therefore, substantial studies are essential to document such sound and sustainable practices at the earliest. The timely intervention of the government could play a significant role in the documentation and preservation of the rich traditional practices of the state.

4. Awareness programs and financial assistance for the cultivation of cereal crops will increase its production and use of watermills. Such efforts could encourage the local population to cultivate cereal crops and continue the utilization of watermills for grinding purposes.

The study exhibits that the villagers are responsible to the maintenance of the existing watermills. There are no provisions from the government to help the villagers who are involved in practicing watermills. Therefore, due to the lack of alternative options, the villagers maintain watermills.

The Shertukpen has a long history of using this watermill for grinding purposes. Due to changes in occupational structure, the practice has been declining. On the other hand utilization of a watermill is a boon to the economy. It is also environmentally sound. It is cost-efficient and does not require more manpower as all the grinding process is automatically done by the watermill itself.

Thus, the use of watermills has immense importance in the livelihoods of Shertukpen. Mainly those households belong to the economically weaker section. Most of the Shertukpen villages are economically underdeveloped. The watermills can enhance the livelihood of the people.

#### **Conclusion**

The Shertukpen are still practicing water mills for grinding grains. Grinding grains through water mills are century-old practice. It provides livelihood and opportunities for social upliftment. Owing to new technology, the traditional water mills are mostly disappearing from the district in particular and from the state in general<sup>13,14</sup>. In the meantime, the traditional watermills are eco-friendly. These have the potential to enhance the livelihood of the rural poor

equally. Therefore, the use of traditional water mills can be ensured. This can be carried out through some improvement in the tools. The depleting grinding culture is on the verge of extinction which needs to be preserved<sup>15</sup>. Mills in general and watermills in particular are strongly associated with rural areas and their transformations over centuries. Adding up modern elements, sometimes justified by an increased and legitimate need for comfort, and the advances in working technology, have all affected the traditional equipment. Another parameter related to water mills' evolution concerns the deterioration of some components of the mill-related industrial heritage. On the other hand, having a new role as an element of cultural heritage leads to their functional necrosis<sup>16,1</sup>. Their restoration to the original function is not the only solution; any form of protection in situ by putting them to different uses is also valuable; this heritage, if rediscovered, restored, and protected, can play an essential role in the socio-economic regeneration of the area<sup>17</sup>. Hence, there is an urgent need to take the initiatives to document the depleting grinding practices in order to preserve the rich culture of the indigenous tribes, which has been an integral part of the culture, tradition, and cultural heritage.

### Acknowledgement

The authors are thankful to Department of Geography and Resource Management of Mizoram University (Central), Mizoram for encouragement and providing infrastructural facilities for conducting research. The authors also acknowledge the wise people of Shertukpen tribes for providing information regarding the watermills and other prevalent information. Also thankful to Gaon Bura's and Gram members of respective villages for their permission and due cooperation.

### Conflict of Interest

The authors of this article declare that they have no financial conflict of interest with the content of this article.

### Authors' Contributions

The authors confirm their contribution to the paper as follows: study conception and data collection: Norbu Jamchu Thongdok. The data analysis and interpretation of the results: Prof. Vishwambhar Prasad Sati and Norbu Jamchu Thongdok. The authors confirm sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript

preparation. Both the authors reviewed the results and approved the final version of the manuscript.

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