Sponsored Thesis Project Competition on

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Season- 2

Project Title : **From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management the sacred River Lidder, along the way to the holy Amarnath Cave.**

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Mubashir Arshid

From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management of the sacred River Lidder, along the way to the holy Amarnath Cave

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LIST OF ABBREVATIONS AND SYMBOLS

ABBREVATION/SYMBOL	DEFINTION
BOAT	Benefit Opportunities Assessment Tool
WHO	World health organization
IS	Indian Standards
UT	Union Territory
U.S.EPA	United States Environment Protection Agency
AECS	Alliance For Environmental Conservation and Sustenance
J&K	Jammu and Kashmir
SWMP	Solid Waste Management Plan
E.M.F	Electro Motive Force
OTO	Orthotolidine
pH	Potenz de Hydrogen
TK	Traditional Knowledge
DO	Dissolved Oxygen
BOD	Biological oxygen demand
WWF	World Wide fund

Abstract

The hectic pace of urbanization among the indigenous people and the litter management nescience among the Tribal nomads living on the banks of river Lidder (a Hindu sacred precinct) is gradually turning it into a trivial waterbody, thus casting clouds over the pilgrimage. The study aims at engaging Tribal nomads and indigenous people in effective and sustainable management of water resources of river Lidder by transforming the barriers into enablers. Dumping of litter, wallowing or bathing of flocks of sheep or goats, defecation into the waters, offscouring laden tributaries etc are some of the prime modes of ham-handed management of the waters of river Lidder. Pahalgam, being the hub of tourist activities and base for holy Amarnath pilgrimage demands the fullest consideration when it comes to management of river Lidder.

The project has in view various management practices and activities that the Tribal nomads and natives of Pahalgam should be upskilled with for river appropriate behavior thereby paving a burnished way for Amarnath pilgrimage and tourist activities in the area. Urban river management mainly banks on the core factor of motivating and influencing public behavior. The project focused on various behavioral transformations achieved through diverse objectives guiding towards a well-managed and litter free river Lidder ergo re-modelling the spectators into actors.

The study also suggests that more thrust be given upon educating the younger sect of this community so that the knowledge of river management and conservation is sustained in future generations as well. The study also reveals that the water quality parameters deteriorate during the rainy season due to flow of inorganic and organic impurities that heap up the river banks, thus highlighting the voluntary cleaning and management of the river banks. With polythene and plastic topping the waste polluting the waters, the study emphasizes the reduced use of the stated materials in this case study area.

The study also engaged the tribals as the macro-plastic samplers, thus serving as a voluntary base for monitoring the river water quality. The meetings with the tribal people led to a four-pillar engagement program that focussed on the cultural, economic, health and well-being and shared benefits acquired by these tribals in return to managing the river Lidder. Some lacunas were highlighted by means of a questionnaire survey which included the employment of the polluted waters by the tribals for their use and exclusion of the tribals from meetings held over managing the river Lidder and lack of traditional knowledge in river management practices. The study also highlights the importance of sustenance of an organization that is involved in tribal engagement in tackling the environmental challenges.

Chapter 1

Introduction

1.1 General

Tribal people typically perceive themselves as having a close connection to the earth and the universe, where they believe that all elements and animals are holy. According to certain tribal people, harmony amongst people depends on taking care of the environment and giving back more than you take. Water is life, and water is holy to many tribals. These communities use water in their religious and cultural rituals, prayers, and numerous festivities. These communities use water in their religious and cultural rituals, prayers, and numerous festivities. Numerous living things on earth communicate with one another through water, which is seen as a relative with the duty to provide and sustain life. Water bodies are seen as having distinct personalities of their own. Humans have a specific duty to respect, protect, and promote the life-giving power of water.

India has around 705 ethnic groups officially designated as Scheduled Tribes (International Work Group for Indigenous Affairs, 2020). (Aggarwal, 2022) These groups each have own social structures, rituals, gods, and beliefs. The rural and tribal folk arts, crafts, and customs of the Indian subcontinent have given it a reputation for having a rich cultural legacy and liveliness. The tribal areas of our nation are rich in customs and traditions, as well as a variety of unique art and craft styles. The tribal people are connected to the water either culturally or religiously.

The UT of Jammu and Kashmir houses 1.19 percent of Indian tribal population. The majority of this figure is constituted by the Gujjar and Bakarwal communities residing in the Kashmir valley mostly. Bakarwals are a nomadic tribe that is dispersed throughout a wide area, from South Asia's Pir Panjal Range to the Hindukush to Ladakh. They go from one location to another with their herds on a seasonal basis since they are roving shepherds and goatherders.

The summer season sees these Bakarwals migrate towards the pastures along the rivers. Pahalgam situated on the banks of River Lidder serves as summer home for most of these nomadic people. Besides, the indigenous population of Pahalgam is generally dominated by the settled tribal people. Pahalgam is a famous tourist place in India, also the holy Amarnath yatra finds its route through Pahalgam to the sacred cave. The river Lidder flowing through Pahalgam directly or indirectly serves as the source of income for maximum population residing in the area. River Lidder is the sole source of lifeline for 2659 households around the area (Aashiq, 2012). Be it tourism related economy or income generated by the fishing and rafting services; this river finds a lot of importance in the lives of people living near it.

Contamination of the holy waters has been an issue lately. Recently, it has been observed that due to decrement in the water quality standards of the river Lidder around 18,000 people have stopped consumption of water from the Lidder river. The glacial river serves as the main water source in the Pahalgam region, owing to falling water standards of Lidder the Pilgrims of Amarnath Yatra may suffer the most. The contaminated waters from the river are consumed by the Yatris as potable water thereby increasing the chances of acquiring various contamination related diseases and acting as a hurdle in the smooth journey of Yatris back and forth to the cave, that needs an urgent addressal.

The study emphasizes on the challenges encountered while laying the focus on getting people involved in river management activities and the methods adopted to do away with these challenges.

1.2 Problem Statement

The Supreme Court of India has also declared Pahalgam as a very sensitive place from environmental point of view. (Aashiq, 2012).The banks of the river Lidder are camped mostly by the tribal nomads during the summers, the same period when the Amarnath yatra is at its peak. Lidder river is used as source as well the sink for various activities by these nomads. From drinking water to bathing animals, Lidder finds its importance in the lives of the nomads. The literacy rates among the tribal nomads hardly cross the single digit mark and as a result barely do they follow the proper river management practices. The lack of river appropriate behavior among the nomads can also be linked to lack of proper steps taken to engage them into various river management programs. The various polluting activities carried out by the tribal nomads in river Lidder are:

1. Wallowing/ bathing of animals in the river.
2. Open defecation and urination into the river.

3. Dumping of dead animals into the tributaries of the river.
4. Household waste dumping along the riverside.
5. Heaping up of animal excreta along the river banks.

The indigenous people and the hotels in the locality encompassing river Lidder also seem to be nonchalant when it comes to dumping off solid wastes. The maximum portion of the litter comes from hotels followed by households. The waste from the hotels is directly or indirectly dumped off into river Lidder while as it was observed that the locals dispose of their household wastes directly into the tributaries of the river as only one thirds of the population of Pahalgam enjoy door to door collection facilities and open dumping is observed to be a common practice. A survey conducted by Subzar Bashir (urban planner Srinagar development Authority) and Subhrangsu Goswami (A.P, CEPT University, Ahmedabad, India), shows that only 3% of general households are equipped with door-to-door waste collection system. (Goswami, 2015)

The macro-plastic elements have recently been found to be in increasing quantity in the waters of river lidder. Absence of polluter's-pay principle and lack of good vigil on mass dumping of garbage and especially plastics near the river sites adds on to the worsening cased day by day.

Besides the absence of tribal and local human resource base for overseeing the River Lidder has been found to be an important issue that needs the immediate addressal.

1.3 Objectives

Reclaiming River Lidder by implementing various ways of engrossing the tribal nomads and native people in diversified river management processes is the central theme of the project. The project focusses on training cum educating nomads related to litter management around the river Lidder. River Lidder is losing its water quality and also its holy significance due to contamination by either the nomads or the native people. Efficient river management aims at efficacious and long-lasting management of the river for sewing up sustainable development. The project emphasizes on the challenges encountered while laying the focus on getting people involved in river management activities and the methods adopted to do away with these challenges.

The various objectives adopted for engaging nomad tribes of Pahalgam in river management practices and the methods to deal with these objectives are pointed as under:

1. Educating the tribals about river management behaviour, health-related issues generated by polluted waters and training them for sampling and small-scale water quality testing.
2. Identification of litter swarmed areas and thereby solid waste sampling and analysis

3. Formulation of the 4-pillar engagement model.
4. Assessing the reason for non-participation of tribals and local people in river management practices.
5. Development of synergistic and sustainable framework.

1.4 Case study area

River Lidder is a 73 km long river in south Kashmir's Pahalgam town, originating from Kolahoi glacier and ends up flowing into river Jhelum at Mirgund, Anantnag. Lidder is a corruption of local Sanskrit name lambodari meaning "long beiled Goddess" thereby signifying its sacred value in the Hindu religion. Some of the tributaries of Lidder find their origin from the holy Sheeshnag lake as well. Pahalgam is a famous tourist spot of the Union territory (UT) with more than 70 percent of tourist flow in the Kashmir valley. It also serves as a base camp for Amarnath yatra. Words "Lidder" and "Amarnath Yatra" never end up separate, the river flows throughout the way to the Amarnath cave, thusly acting as a source of potable water for Yatris enroute Amarnath cave. The Pujan and Visarijan ceremonies for "Chari Mubarak" are performed on the banks of Lidder.

Figure 1 Hindu religious symbols on the rocks embanking the River Lidder

The River lidder water quality was analyzed for varied parameters at different sampling locations wherein the tribals are camped as depicted in the map. Besides, the macro plastic sampling and lab analysis was also carried out for different sampling sites highlighted in the map.(Fig 1.2)

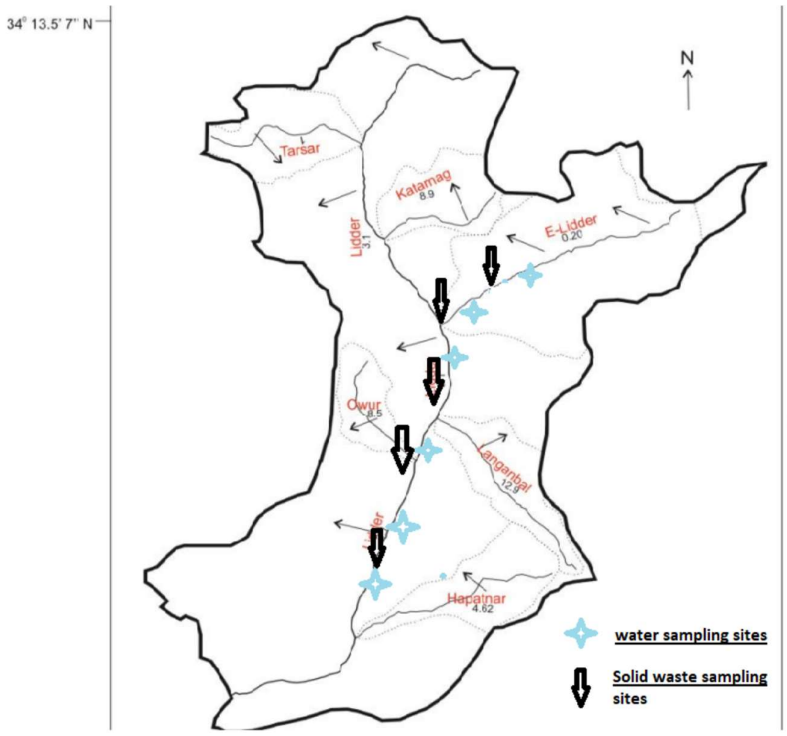


Figure 2 Map showing the water and solid waste sampling sites on River Lidder (source : google maps)

Chapter 2

Literature review

This chapters presents a brief review of literature on engrossing the tribal and local resource base in river management practices. The goal of the literature survey was studying a variety of recommendations, published articles, and reports. For the purpose of implementing various programs and policies various papers were assessed. The papers mostly include individual researchers who have written in reputable publications while researching in the field. Some of the reviews have been mentioned as:

Chief et al., 2016 conducted a study on tribal engagement in US for water mangement and conservation and came up with the suggesstion that with the urgent effects of drought, climate change, mining, and defining water rights, there is a strong acknowledgment of the significance of include tribal people in water management debates. It would be beneficial and fruitful to employ tribal linguists and facilitators to include and educate tribal members at the community level. (Chief et al., 2016)

Long at el., 2018 carried out a study on tribal ecoculture and engagement and concluded that with significant socioeconomic advantages including increased food security and employment possibilities associated to restoration, restoring expansive landscape regions that cross traditional territories still occupied by tribes can assist to assure long-term sustainability and resource availability. They also suggested that collaborations with tribes that take into account native knowledge while planning, studying, implementing, and monitoring treatments within a framework for adaptive ecosystem management help to develop the adaptive capacity of both the cooperating institutions and the tribes. (Long at el., 2018)

It is frequently said that strong community involvement may result in a variety of excellent project results. These results include more innovative decision-making, more public approval of choices, decreased disagreement, which results in faster project execution and fewer project delays, enhanced democratic procedures, and increased social learning (Newig and Fritsch, 2009).

Initiatives for participation that focus on human behaviour or attitudes may unintentionally define the problem as one of individual behaviour rather than acknowledging the significance and effect of social or technological environment. When preparing for change, individuals are only one factor to take into account (Weiss and Tschirhart, 1994).

The article published in the Water Life journal puts forth that people are interested in seeing their area flourish and frequently believe that this is where they can make a difference. Speaking about national issues and projects could be off-putting and prevent individuals from participating. Make a direct connection between the local river and a national issue or program. Many individuals are really concerned about their local river and are quickly turned off by the thought of having to fill out tonnes of paperwork without doing anything. Ensuring that activities are action-focused and that the benefit to the nearby river and environment is obvious can help to overcome this. (WWF , 2016)

A report by the USEPA focused on engaging the tribal people by allowing them to operate a river-rafting business that runs on sixty miles of the Colorado River, from Diamond Creek to Pierce Ferry. As a result, it would act as a source of motivation besides providing livelihood to the tribals. (U.S. EPA, 2006)

The transition from yearly to monthly water quality monitoring collection enables the tribes to demonstrate trends and advancements in water quality. The tribes are then be able to use this knowledge to modify the way that future management measures will be put into place to guarantee the success of their initiatives. In order to provide a more accurate picture of the health of the reserve waterways, the tribes also want to incorporate the data from biological monitoring and water quality measurements. (U.S. Environmental Protection Agency, 2006)

An article by Arshad, 2006 cited improper dumping as the issue of concern as far as River Lidder is concerned. He put forth that direct sewage and night soil discharge from lodging facilities, camping grounds, and nearby residential areas pollutes the Lidder River by entering open drains. (Arshad, 2006)

A study on effect of tourist inflow and agricultural activities on River Lidder was carried out by Irfan Rashid and S.A.Ramsoo. According to their study, the concentration of several water quality factors increased significantly in the months of July and August. This rise in pollution load may be linked to a high number of tourists visiting during these months. In order to protect Lidder Valley's pure water resource and ensure its sustainability, the valley's carrying capacity should be

considered while evaluating the considerable tourist inflow and agricultural operations there. (Rashid & Ramsoo, 2012)

A report by Australian government focused on recognizing the indigenous peoples as traditional proprietors and self-determining peoples through the inclusion of Indigenous representation in the water planning process. This representation would give Indigenous perspectives, values, knowledge, experience, and priorities a way to be heard and incorporated into the water decision-making process that involves planning. (AU Government, 2017)

Of course, not all forms of community outreach are the same. Water experts should approach each difficulty dynamically, based on considerations of the project, decision-making process, and stakeholders, in order to choose the right degree of participation. To select whether to inform, consult, involve, cooperate, or empower communities, one tool is the "Spectrum of Public Participation" from the International Association of Public Participation. (Ellis, 2018)

Participatory methods call for facilitators to spend a lot of time with the community, getting to know them, understanding their issues, and earning their confidence. Long timeframes, large expenditures, and inadequate supervision and expertise may result in poor execution that disillusions participants and endangers their future involvement. (Smyth et al., 2020)

Chapter 3

Material and Methodology

3.1 Educating and training the tribals

3.1.1 Educating the tribals about the river management practices benefits.

The tribals and local people of Pahalgam were taught about the benefits that can result out of the proper river management practices. Numerous open roof workshops were conducted to educate the tribals. Children were also engaged in river related drawing events so as to develop the understanding of river management in them at an early age.

Fortnightly river Lidder clean up drives were carried out in collaboration with the tribal people so as to develop the sense of management responsibility in them.

Calendars focusing on the theme of river conservation were distributed among these people. The calendars portrayed visual messages revolving around the theme of healthy and clean river.

The benefits resulting out of proper river management were taught under following headings:

a. Economic benefits
b. Social benefits
c. Ecosystem benefits

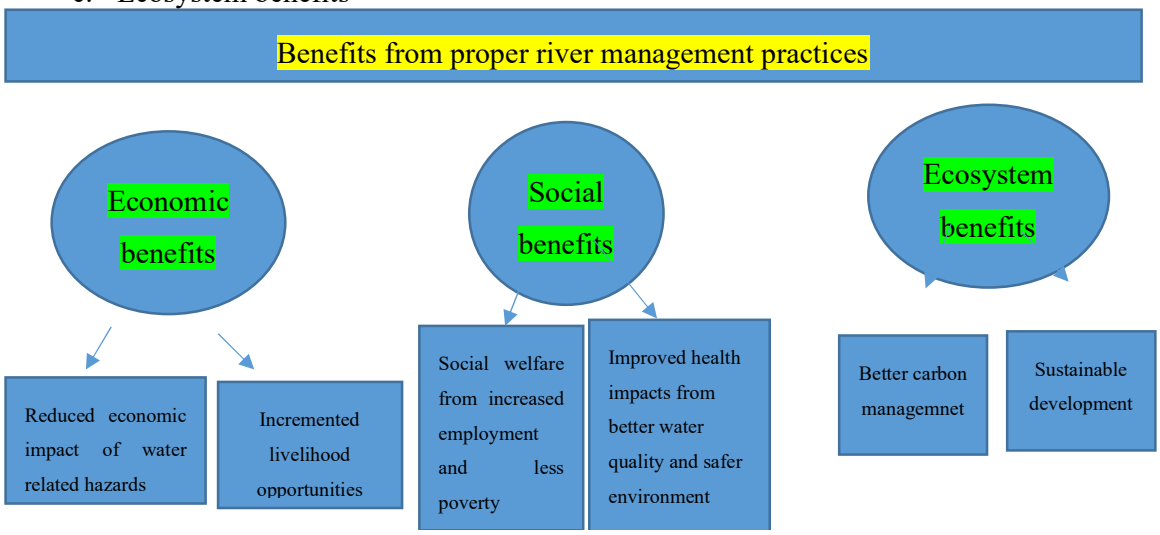


Figure 3 Diagram showing the benefits from good river management practices

3.1.2 Training the tribals for sampling and comparative water quality analysis.

A group among the tribal people was trained to collect water samples from the polluted stretches of the river and employing the Jal tara kit for small scale testing of various water quality parameters was also done.

Two sets of samples were taken from the six selected sampling sites. The samples included the ones taken during the dry weather season and the rainy weather season. A total of 12 samples were analyzed in the lab for the following physico-chemical parameters:

a. pH
b. Turbidity
c. TDS
d. Hardness
e. Nitrate
f. Residual Chlorine
g. Dissolved Oxygen
h. Sulphate
i. Ammonia
j. Alkalinity

The pH of water is determined by measuring the Electro Motive Force (E.M.F) of a cell comprising an indicator electrode responsive to hydrogen ions such as a glass electrode immersed in the test solution and the reference electrode using potentiometric pH meter.

Turbidity is measured using Nephelometer which detects scattered light at 90^{O} to the incident beam of light. Nephelometric measurement is based on comparison of the intensity of scattered light of the sample with the intensity of light scattered by a standard reference suspension (Formazin polymer) under similar conditions.

Dissolved Oxygen is measured using membrane electrode method. The membrane electrode has a sensing element protected by an oxygen-permeable plastic membrane that serves as a diffusion barrier against impurities.

Total dissolved solids are measured by conductivity method in which TDS is measured by electrical conductivity of water using device called TDS meter.

Hardness tests were done using titrimetric analysis. They were measured by titration with EDTA solution with Eriochrome Black T and murexide as indicators respectively.

Alkalinity was done using colorimetric analysis by titrating with sulphuric acid using phenolphthalein and methyl orange as indicators.

Free residual chlorine test was done using pool test kits using OTO (orthotolidine) that causes a colour change to yellow in samples having chlorine and comparing the colour with standard colour chart.

Sulphates and nitrates tests were done using uv-visible spectrophotometer which works on Beer's law. A sample with higher concentration of ions shows more absorption at some particular wavelength. Standard curves were prepared using known concentration solutions.

For nitrates wavelength used was 220 nm using hydrochloric acid as reagent. Sulphates test was done at 420 nm wavelength using Barium chloride as reagent.

3.2 Identification of litter swarmed areas and thereby solid waste sampling and analysis

Using the tribal resource base, many number of litter swarmed areas on the river banks were identified and the solid waste accumulated at these sites was sampled and analysed in the lab for various parameters as mentioned below:

a. Moisture content
b. Density
c. Ash content
d. Fixed carbon content
e. Biodegradable content

Solid Waste Characterization (physical and chemical)

Density (kg/m^3)

1. Take a beaker of 1 to 5 litres and weight it (W1).
2. The uncompact waste is placed in a beaker of 1 to 5 litre volume, ascertaining there are minimal empty corners.
3. Weight the beaker containing the waste (W2) and calculate the density by below equation.

Physical composition of the sample

1. Take sample of 5-10kg solid waste. Weight of sample should be higher if there is heterogeneity in the sample.
2. Segregate the sample at the site or in the laboratory into below physical components.

a. Food waste (mixed)
b. Paper
c. Cardboard
d. Plastic
e. Polythene / Food wraps
f. Rubber/plastic
g. Textiles
h. Wood
i. Glass
j. Tin cans
k. Metals
l. Inert (soil, ashes, etc)

Moisture content

The procedure is same as previously discussed for moisture content, except the difference in timing i.e. loss of moisture for 1 hour at 105^{O}C.

1. Take a crucible and weigh it (W1)
2. Pulverize some weight of waste by cutting, grinding or in a mixer. Take a sample of 1g of pulverized solid waste into the crucible and place it in the oven at 105^{O} C for 01 hour.
3. Weight the crucible again after taking it out from oven (W2).

Volatile combustible matter

1. Take the same crucible, cover it and place it in muffle furnace at 950 o C for 10 minutes.
2. Cool in the desiccator and weigh on the digital weighing balance as W3 (g).
3. Volatile combustible matter can be calculated by following formula.

Ash content

The remaining content in the crucible will be ash content.

Fixed carbon

The difference of moisture content, volatile combustible matter, and ash content from total weight of sample will be fixed carbon.

Biodegradable organic fraction

The organic content in the solid waste, (Food waste, wood, paper, cardboard and yard waste) should be checked for the volatile solids by taking the sample, dry it and put it in furnace at 550 ^{O}C for 10-15 minutes.

During site identification, it was found that some nomadic children use the litter disposal sites as theirs playing area thus putting their health at stake. Recent times have revealed increment in various litter borne ailments in these nomadic children. So, these people were also to be taught about the health hazards that could rise because of improper litter disposal.

3.3 Formulation of the 4-pillar engagement model.

Engaging people without fulfilling their vested interests is not practically possible. The 4-pillar engagement model describes the key outcomes for the tribal people with respect to river management theme.

The four pillar that are entailed in this engagement model are as (figure 3.3):

i. Cultural connectivity to the river:

Acknowledging the role of the river in the tribal culture and their interdependency with economic, social and environmental outcomes.

ii. Health and well Being of the tribals:

Recognizing that water is critical to sustaining healthy communities.

iii. Economic opportunities sought by the tribal people:

Seeking of opportunities to use the river to generate employment and business ventures thereby employing the tribals.

iv. Shared benefits:

Seeking of opportunities to use water allocated for environmental and recreational purposes to deliver tribal outcomes and benefits where synergy exists.

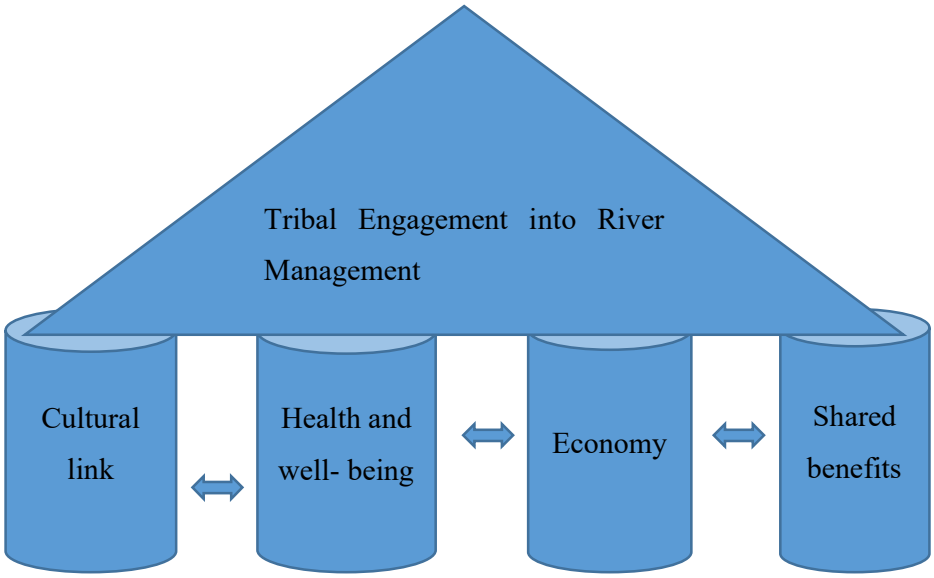


Figure 4 Four-Pillar engagement model

3.4 Assessing the reason for involuntary participation of tribals and local people in river management practices.

A survey was conducted in the form of a questionnaire asking the tribal people the reason that makes them involuntary when it comes to addressing and managing the river Lidder related issues. The heads from some selected places were chosen for the questionnaire survey. The questionnaire is attached as table 1.

Table 3 Questionnaire for assessing the involuntary tribal participation in river lidder management

Name	
From how many Years have you been migrating to Pahalgam in summers	

Any knowledge about the deteriorating condition of the river	
Ever participated in river management practices	
Approached by any organization in relation to river conservation	
What according to you could be done to safeguard the river lidder	

3.5 Development of synergistic and sustainable framework

The framework starting with educating a group of tribals about river management practices shall sustain and may be developed into an NGO so that if the govt. comes up with some schemes in river management in Pahalgam, these organisations shall be consulted for efficient management owing to their experience in this field. It should also compliment other city plans and ongoing national missions.

Chapter 4

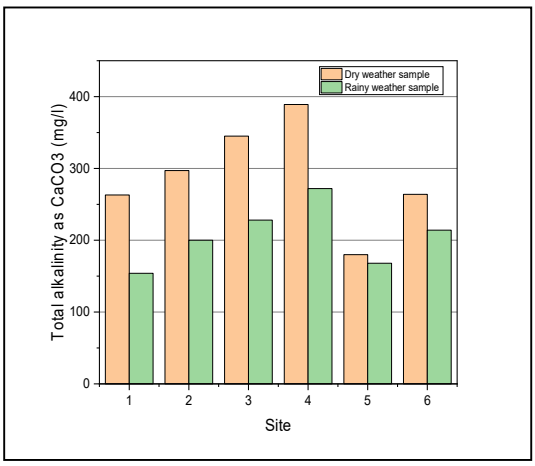
Results and discussion

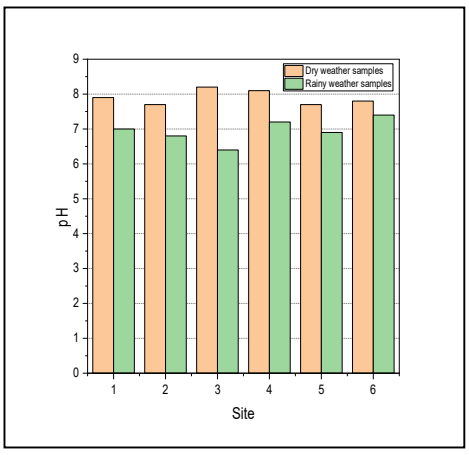
4.1 Educating the tribals and water quality analysis

The outcomes of educating the tribals; be it conducting of workshops, organizing river clean up drives, calendar distribution or evaluating benefits that can be sought from the river lidder, were mostly based on the theory of behavioral motivation. These people at first were reluctant to undertake any sort of participation given that all of this was a new thing and a practice for them. During the progressive workshops and drives, these people showed a lot of interest wherein they came forward voluntarily to take part in the stated ways of river related education. Besides, these workshops were instrumental in arising in them a sense of stewardship and being the stakeholders of the river.

From the above stated exercises, it can also be suggested that more thrust be given upon educating the younger sect of this community so that the knowledge of river management and conservation is sustained in future generations as well.

The water quality assessment during the rainy and dry periods of the season was carried out in the lab and the results are depicted in the form of bar graphs attached as figure 4





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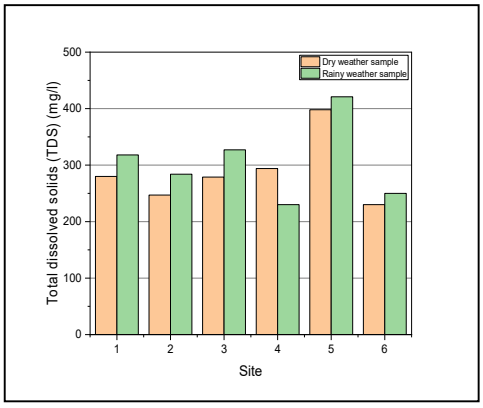

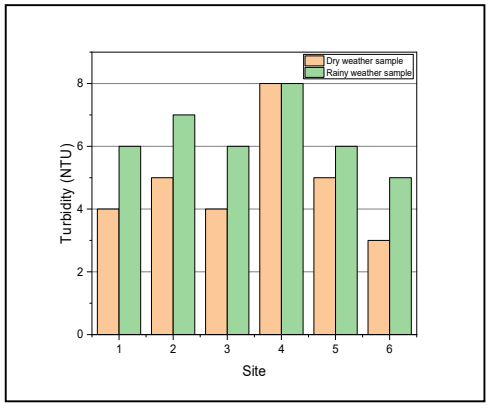

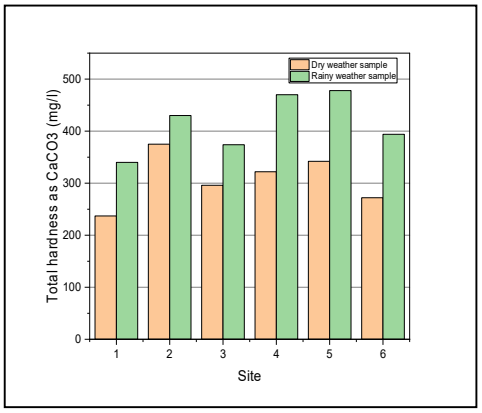

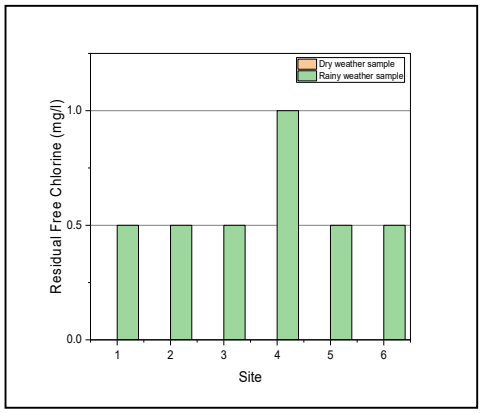

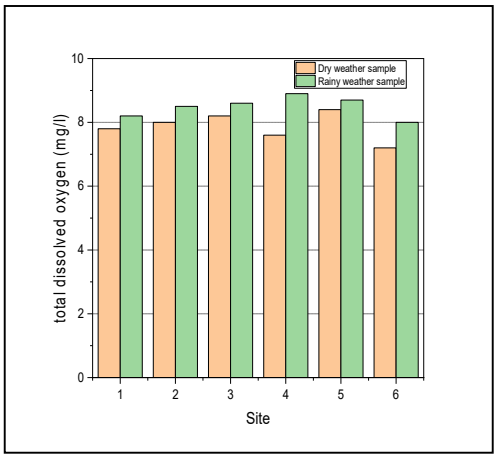

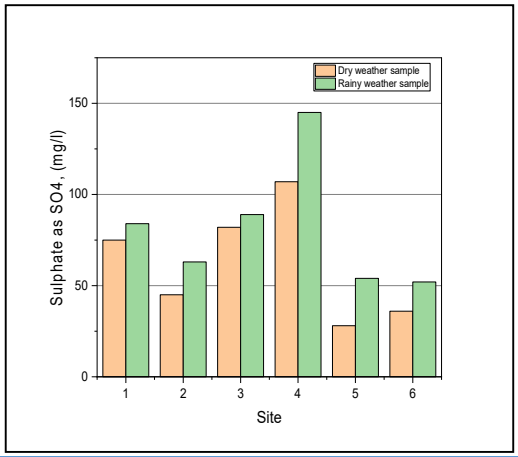

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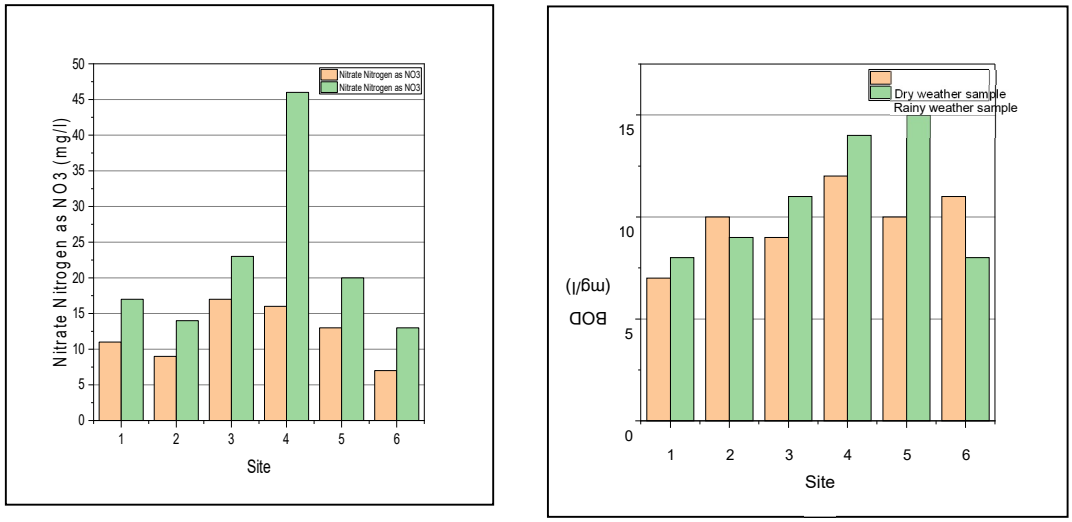


Figure 5 Graphical representation of water quality parameters during dry and rainy weather

The graphical representation of the pH values against the samples from different sites yields that the pH of the samples during the dry weather is within the acceptance limit for most of the samples but some sample cross the acceptance limit set by IS10500 and WHO. Also, it may be noted that the average pH of all the samples is in the high range very close to the permissible limit, so further pollution will take away the potability from the water. The pH during rainy season was found to decrease at all the sites and this decrement may be attributed to the presence of acidic impurities in the water during rainy season. These impurities are generally brought into the river from the banks by the rains in the form of either solid waste or any other impurity.

Graph of Turbidity against samples for most of the samples reveals that the values of the stated parameter are well above the acceptable limits set by IS 10500 and WHO. The rainy season samples find an increment in both these parameters which may again be attributed to the flowing impurities in the river water, washed into the river by the rains.

TDS of the water samples was well within the acceptable limits in both the scenarios however the TDS for rainy samples was found to increase when compared to that of dry weather water samples, this can be attributed to dissolution of soil salts by rain and washing of these salts into the river.

Chlorides, Hardness and Alkalinity were also under acceptable limits for both types of samples with variations reported during the rainy seasons leading to decremented water quality during the rainy seasons.

The organic impurities in the water were responsible for the high values of DO and BOD of the water samples. Both these parameters were found to increase during rainy seasons due to more inflow of organic debris into the river.

4.2 Identification of litter swarmed areas and thereby solid waste sampling and analysis

The tribal people live close to the river lidder. During the site visits it was found that these people dump their waste near the river banks. By educating these tribals, this very activity came to an end. The tribals were employed in identifying the heaps of litter around their camps and stop any further littering at these sites. This not only helped to stop the littering by these tribals rather these tribals now keep a vigil on litter swarmed areas and stop other people from further littering at these places, thus arousing the sense of being a stakeholder among the tribals.

The tribal people were also engaged in macro-plastic collection in the river waters. Special nets were made for the macro-plastic collection resembling fyke nets. The tribals now could collect the macro plastic polluted water and this water was analyzed in the lab. Thus, the tribals were transformed into the macroplastic-samplers through proper training.

The weight percentage of various types of wastes collected is presented in the form of graphs attached as figure 4.2.1.

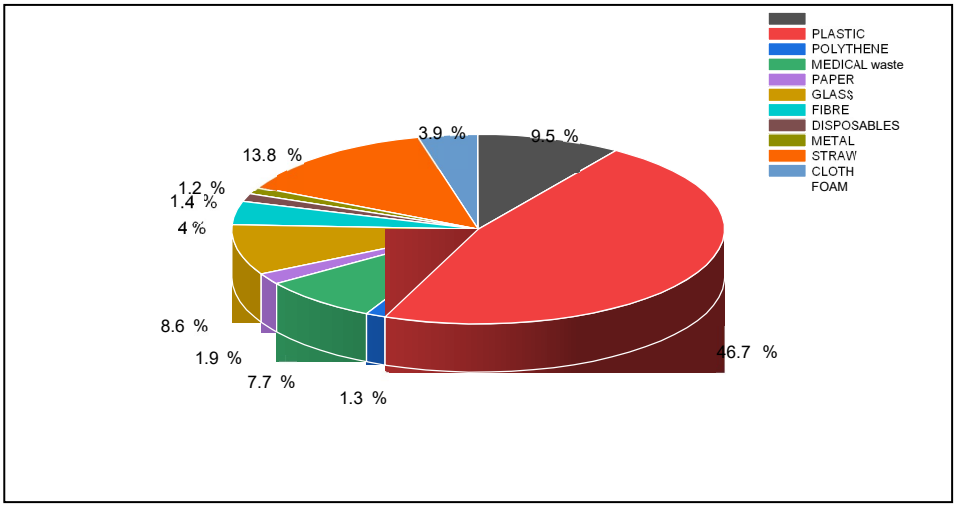
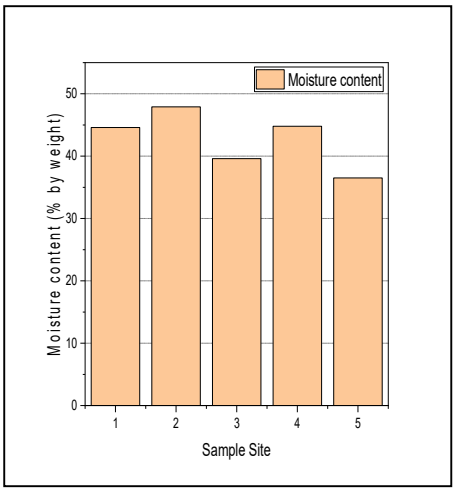
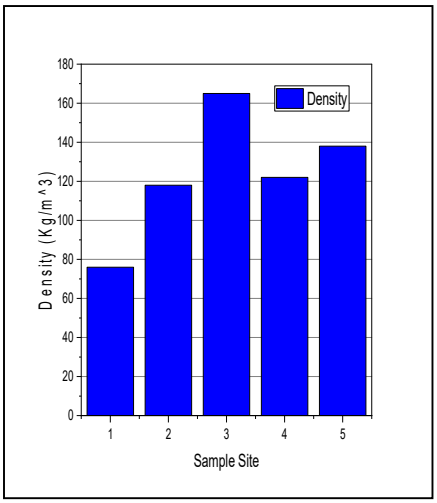


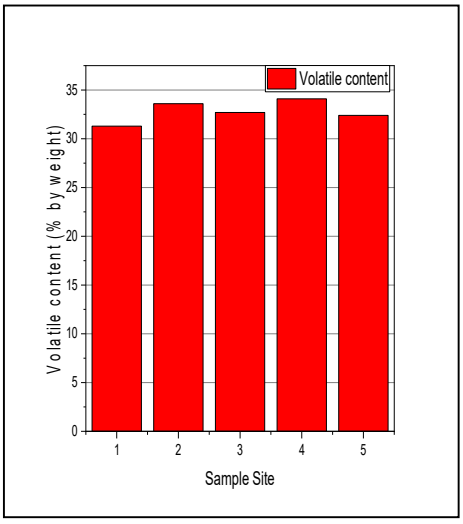
Figure 6 Average% wise composition of solid waste samples analysed

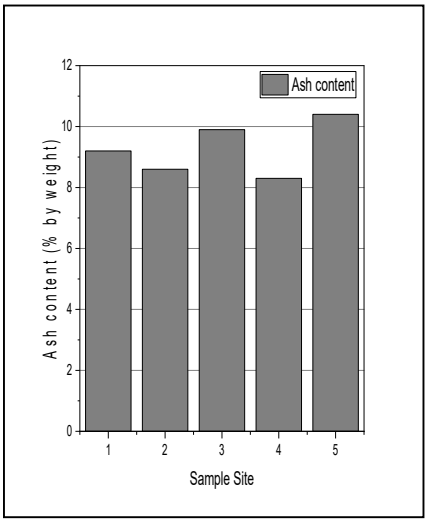
Plastic was found to form the major chunk of the waste at all the sites with 46.7% share to its name. Organic wastes were lesser in quantity at all the sampling sites.

The lab analysis of the solid waste samples is represented in the form of graphs as attached in figure 4.2.2









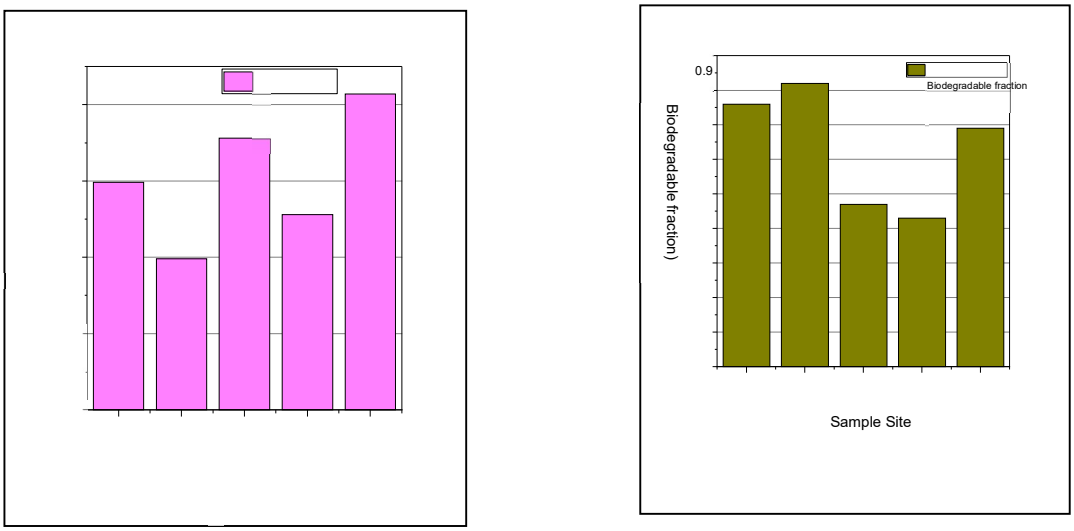


Figure 7 Graphical representation of analysis of solid waste collected from sites connected to River lidder

The lab analysis of the solid waste in or near the river banks revealed that the composition of all the five samples in decreasing order was constituted by the moisture content followed by volatile content, fixed carbon content, ash content and the least by the biodegradable fraction. This means that the already present litter can be treated simply by incineration due to very less amount of ash content left as the residue.

4.3Formulation of the 4-pillar engagement model.

The proposed 4-pillar engagement model as discussed under section 3.3 (figure 3.3) was also taken up during the workshops and meetings with tribals. The outcomes were discussed and based on the suggestions of these tribal people the possible outcomes have been tabulated in table 4.4.

Table 4 : 4-Pillar engagement model and its possible outcomes

Pillar	Outcomes
Cultural connectivity and dependencies	These tribals are generally Muslims and thus for performing ablution five times a day before offering the prayers, they bank on the water from this river. Besides water for feeding and bathing the animals, the water for domestic use makes them dependent upon this river. Providing special arrangements for these people to carry out the mentioned activities in harmony with the river health, a better and ecofriendly connection between the tribal and river could be developed. This may include constructing temporary small scale storage tanks for their use.
Health and well-being of the tribals	A verbal survey was carried out to know about most frequent diseases suffered by the tribal people (Bakarwals) and skin diseases and intestinal infections were found out to be most common among the tribal children. This can be attributed to the foul waters or improper recreational areas for the tribal children. Thus, providing better quality water and reserving small recreational areas for these children will help in developing a better and healthy tribal community.
Economic connectivity to the river	The Bakarwals living around the river Lidder at present do not generate any income from the river. This is either due to their non-professionalism or licensed activities regulated by govt. Rafting in Pahalgam is every tourists go to, training and employing the tribals about rafting, livelihood can be provided to them. Also,

	the fishing license charge for them could be reduced so as to develop in them the sense of stewardship as far as river Lidder is concerned.
Shared benefits	The vacant river banks can be used for recreational purposes. Artificial water markets can be made which generate revenue for the state as well as engage the tribals as the caretakers of these markets.

4.4Assessing the reason for involuntary participation of tribals and local people in river management practices

The survey conducted in the form of questionnaire to access the involuntary tribal participation in river management practices suggests that most of the tribals were not aware of the improper river management practices going on as far as River Lidder is concerned. Most of these people had never participated in any of these practices. The survey also put forth the fact that although the migration to the along the river Lidder banks has been ongoing from many generations of these tribals yet any organization has not reached out to them for either educating or engaging them in the river management practices. The survey highlighted some lacunas that concerned organizations have failed at. The resentment of tribal groups was a vital factor for their limited participation. The two reasons that came forth were; one, when water is contaminated, the contamination can be emotionally devastating and traumatic for local and tribal people, particularly when the water is connected to sacred sites, religious concepts, and maintenance activities. Second, tribal groups are often being left out of talks and agreements concerning water management strategies. Traditional knowledge(s) (TK) related to the management of water have often not been given equal standing.

4.5 Development of synergistic and sustainable framework

The framework of getting tribals on board as far as river lidder is concerned is to be sustained into either some organization or it has to be backed by funded initiatives from the government. Based on the verbal surveys with these people, they are ready to work hand in hand with other organizations during the summers for maintaining quality of the water in river Lidder, given they too acquire some benefits. So, it has to be a process of sustenance of shared benefits for a longer period of time so as to achieve a healthy and clean river Lidder.

As a initial step, an NGO "**AECS**" under registration process, that will work for the citizen-river connect practices especially when it comes to the tribals residing closer to the rivers

Chapter 5

Conclusions

The river management education of tribal nomads and indigenous people of Pahalgam suggests that more focus should be given to train and educate younger sect of this community for longer sustenance of the river management programs. It also suggests to engage the tribal people by moulding their behavior through workshops, river day celebrations etc.

The water quality analysis of the river water calls upon the need for cleaner and waste free banks of river Lidder, which can be achieved sustained by involving the locals and tribals living on the river banks in river management practices.

The solid waste analysis of the samples taken from sites connected to the river Lidder show that plastic and polyethene are the major contributors among the solid waste whereas organic wastes constitute a smaller share, which in turn suggests the ban of polyethene and plastics in the Lidder valley. It also highlights the impact of tourism generated anthropogenic activities on the river Lidder and call for a check on tourist in-flow.

The 4-pillar engagement model devised as suggested by the tribals would benefit both the tribals and the state in the fields of economy, tribal employment generation and shared social and economic benefits.

The survey conducted in the form of a questionnaire highlights the gap between the tribal people and the organization involved in river management when it comes to framing the river related laws and planning the management practices. They tribals feel like left out and this has been quoted as the main reason for their limited participation in river management.

An NGO 'ACES' which would sustain the project and work for tackling other environmental challenges is under registration process. The organization shall engage the disengaged under various issues of developing a healthier ecosystem.

References

Aashiq, P. (2012, july 28). Lidder river gets highly polluted during Amarnath yatra. Hindustan Times.

Addisie, M. B. (2022). Evaluating Drinking Water Quality Using Water Quality Parameters and Esthetic Attributes. doi:https://doi.org/10.1177%2F11786221221075005

Aggarwal, A. (2022). Revival of a tribal practice for water resource development. India Water Portal.

Arshad, P. (2006). Polluted Lidder river casts cloud over pilgrimage. DOWN TO EARTH.

BIS 10500. (May 2012). Indian Standard drinking water specification(2nd edition). Retrieved from https://www.indiawaterportal.org/sites/default/files/2020-11/bis_10500-2012_wq_standards_0_0.pdf

Ellis, J. (2018). Five smart ways to engage water communities. IWA.

Goswami, S. B. (2015). Tourism induced Challenges in Municipal Solid Waste Management in Hill Towns: Case of Pahalgam. Procedia Environmental Sciences .

Government, A. (2017). ENGAGING INDIGENOUS PEOPLES IN WATER PLANNING AND MANAGEMENT. Retrieved from https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/water/indigenous-engagement.pdf

Jonathan Long, F. K. (2018). Tribal Ecocultural Resources.

Karletta Chief, A. M. (2016). Engaging Southwestern Tribes in Sustainable Water Resources Topics and Management.

Karwa, M. (2019, DEC 14). RO purifiers: Less of a solution, more of a problem. Retrieved from

- https://www.deccanherald.com/opinion/ro-purifiers-less-of-a-solution-more-of-a-problem-785488.html

Outhman, O. A. (2014). Analysis of water quality (changes in physico-chemical parameters).

S.A.Ramsoo, I. R. (2012). Impact of anthropogenic activities on water quality of Lidder River in Kashmir. Environmental Monitoring and Assessment.

Smyth et al., 2. (2020). Engaging stakeholders across a socio-environmentally diverse network of water research sites in North and South America. Environmental Development.

U.S. Environmental Protection Agency. (2006). Tribal W ribal Water Quality ater Quality.

UNDERSTANDING WHAT MOTIVATES PEOPLE. (2016). Water life.

WHO. (2004). guidelines for drinking water quality. Retrieved from https://books.google.co.in/books?hl=en&lr=&id=SJ76COTm-nQC&oi=fnd&pg=PR15&dq=who+2004+drinking+water&ots=V9tXsaTdYb&sig=VWvwWmUny04zyXZZfjv-7RVRMzg&redir_esc=y#v=onepage&q=who%202004%20drinking%20water&f=false

WWF . (2016). UNDERSTANDING WHAT MOTIVATES PEOPLE TO ENGAGE WITH THE WATER ENVIRONMENT.

From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management of the sacred River Lidder, along the way to the holy Amarnath Cave

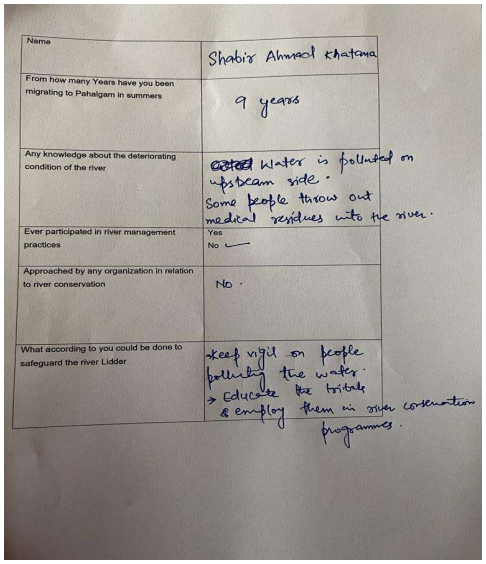
APPENDIX

Table 5 Sampling and lab analysis of water quality parameters

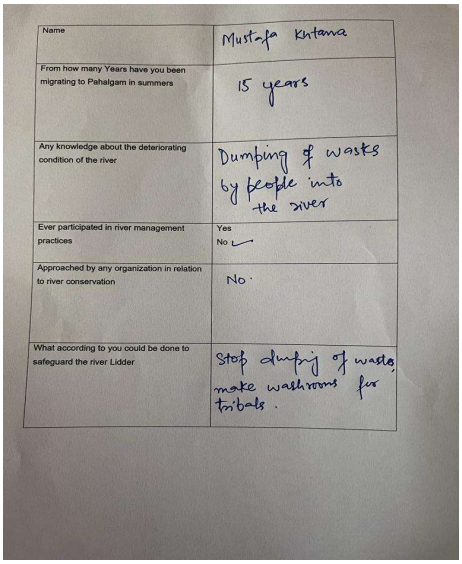
National Institute of Urban Affairs

From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management of the sacred River Lidder, along the way to the holy Amarnath Cave

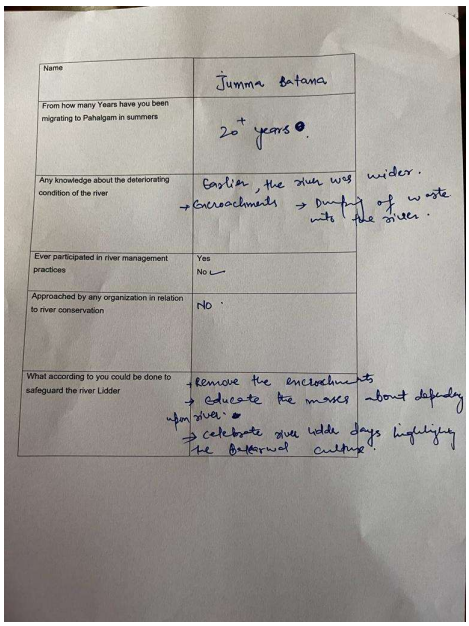
Table 6 Filled Questionnaire



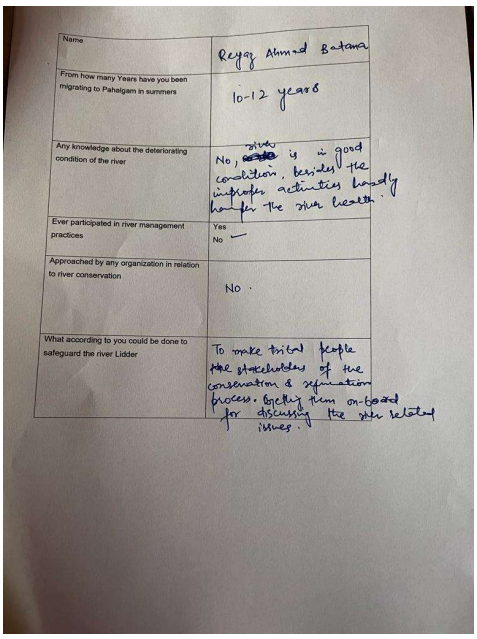
Name	Shabir Ahmad Khatana
From how many Years have you been migrating to Pahalgam in summers	9 years
Any knowledge about the deteriorating condition of the river	Water is polluted on upstream side. Some people throw out medical residues into the river.
Ever participated in river management practices	Yes / No ✓
Approached by any organization in relation to river conservation	No.
What according to you could be done to safeguard the river Lidder	Keep vigil on people polluting the water. → Educate the tribals & employ them in river conservation programmes.



Name	Mustafa Khtana
From how many Years have you been migrating to Pahalgam in summers	15 years
Any knowledge about the deteriorating condition of the river	Dumping of wastes by people into the river
Ever participated in river management practices	Yes / No ✓
Approached by any organization in relation to river conservation	No.
What according to you could be done to safeguard the river Lidder	Stop dumping of waste, make washrooms for tribals.



Name	Jumma Batana
From how many Years have you been migrating to Pahalgam in summers	20+ years
Any knowledge about the deteriorating condition of the river	Earlier, the river was wider. → Encroachments → Dumping of waste into the rivers.
Ever participated in river management practices	Yes / No ✓
Approached by any organization in relation to river conservation	No.
What according to you could be done to safeguard the river Lidder	→ Remove the encroachments → Educate the masses about depending upon river. → celebrate river Lidder days highlighting the Botanical culture.



Name	Reyaz Ahmad Batana
From how many Years have you been migrating to Pahalgam in summers	10-12 years
Any knowledge about the deteriorating condition of the river	No, river is in good condition, besides the improper activities harmful for the river health.
Ever participated in river management practices	Yes / No ✓
Approached by any organization in relation to river conservation	No.
What according to you could be done to safeguard the river Lidder	To make tribal people the stakeholders of the conservation & sensitization process. Getting them on-board for discussing the river related issues.

Table 7 River clean-up drive posters and pictures

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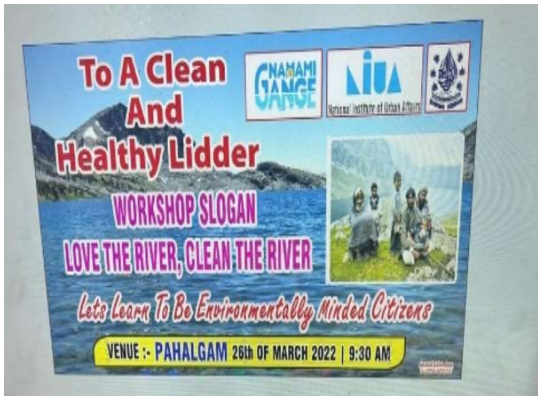
<td> 
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Table 8 Solid waste collection and lab analysis

Table 9 Calendar displaying messages for proper river management and net for plastic sampling and water sampling.

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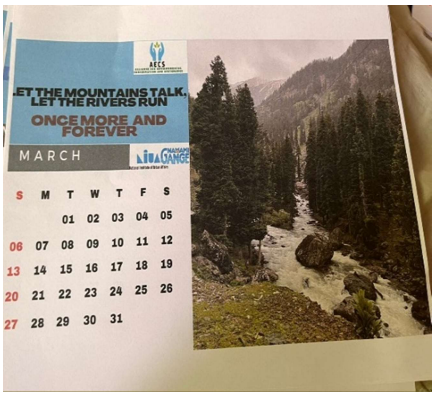
<td> 
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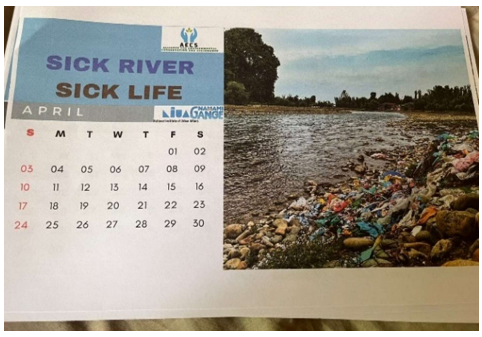
<td> 
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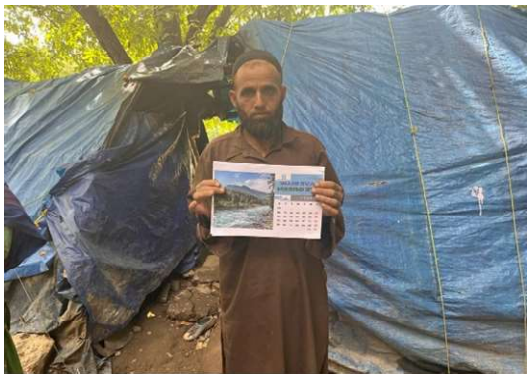
Table 10 Calendar distribution, meetings and drawing event held for tribal children

From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management of the sacred River Lidder, along the way to the holy Amarnath Cave



From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management of the sacred River Lidder, along the way to the holy Amarnath Cave

Table 11 Request letter for venue allocation and data acquirement

राष्ट्रीय नगर कार्य संस्थान
NATIONAL INSTITUTE OF URBAN AFFAIRS

Date: January 24, 2022

To Whom It May Concern

This is to certify that **Mr. Mubashir Arshid** is a finalist of **Sponsored Student Thesis Competition on "Re-imagining Urban Rivers", Season -2** (2021-22), jointly organized by the **National Institute of Urban Affairs (NIUA)** and the **National Mission for Clean Ganga (NMCG).** He is a 4th year student of **Bachelor's in Civil Engineering** at **National Institute of Technology, Srinagar.** He is working on his academic thesis project on **'From birds of passage to guardians of rivers: Engaging the tribular nomads and indigenous people of Pahalgam in management of litter, to reduce pollution in the River Lidder, along the way to the holy Amarnath Cave'**. This certificate is issued on his request for getting necessary support required from your kind office in order to carry on his thesis project.

Best Regards

Hitesh Vaidya
Director,
NIUA

कोर 4-बी, प्रथम तल, भारत पर्यावास केन्द्र, लोधी रोड, नई दिल्ली-110003, भारत
Core 4-B, 1st Floor, India Habitat Centre, Lodhi Road, New Delhi-110003, India
Tel: 91-11-24643284, 24658639, 24617517, 24617543 • Fax: 91-11-24617513
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11 Mar 2022

TO WHOM IT MAY CONCERN

Mr Mubashir is doing a Lidder river conservation project under my supervision from National Institute of Technology (NIT) Srinagar and National Institute of Urban Affairs (NIUA) Delhi. Under this project a one day awareness camp is to be carried out for the local tribal communities on **26 Mar 2022 from 10am to 4pm**. The awareness camp will be focused to engage local communities from Pahalgam region in the restoration of Lidder River and solid waste management in Pahalgam.

It is kindly requested to give us permission to use your premises as venue for the awareness camp. We will be highly thankful for that.

This project will contribute to development of Pahalgam in aspects of reducing litter in the Pahalgam area. Therefore, it is requested to waive off the charges for using the premises for the awareness camp. However, if it is not possible from your side, we will accommodate the charges as well.

Dr. Khalid Muzamil Gani
Assistant Professor
Department of Civil Engineering
National Institute of Technology
Srinagar (J&K)

Dr Khalid Muzamil Gani

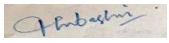
From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management of the sacred River Lidder, along the way to the holy Amarnath Cave

CERTIFICATE OF COMPLETION

This is to certify that this thesis project titled "**From birds of passage to guardians of rivers: Engaging and engrossing the tribal nomads and indigenous people of Pahalgam in overseeing and management of the sacred River Lidder, along the way to the holy Amarnath Cave**" was carried out by Sh. **Mubashir Arshid**, a student of **Civil Engineering Bachelors**, at the **NIT, Srinagar**. The research for this project was undertaken under the guidance of the afore-mentioned institute and completed during the period of **Nov.2021** to **June 2022**.

This project was shortlisted under the *Sponsored Thesis Project Competition on "RE-IMAGINING URBAN RIVERS" (Season- 2)* hosted by the National Institute of Urban Affairs (NIUA) and the National Mission for Clean Ganga (NMCG).

This report has been submitted by the student as a final deliverable under the competition. All parts of this research can used by any of the undersigning parties.

1. **Student**
   - Name -Mubashir Arshid
   - Signature - 
2. **Institute**
   - Name - National Institute of Technology, Srinagar
   - Department -Civil Engineering
   - Authorized Representative - Dr. Khalid Muzammil Gani
   - Signature - 
3. **Sponsors**
   - Name - National Institute of Urban Affairs
   - Authorized Representative - Hitesh Vaidya, Director
   - Signature - _____
   - Name - National Mission for Clean Ganga
   - Authorized Representative - G Asok Kumar, Director General
   - Signature - _____