PROGRAM OF OPEN STUDIES – SANITATION, WATER AND SOLID WASTE FOR DEVELOPMENT [POS-WASH]

CAPSTONE PROJECT REPORT

ON

"A COMPARATIVE ASSESSMENT BETWEEN RURAL DRINKING WATER SUPPLY AND SANITATION SCHEMES THAT DO OR DO NOT IMPLEMENT WATER SAFETY PLAN++ TO ENSURE SUSTAINABLE WATER SERVICES"

SUBMITTED TO

KATHMANDU UNIVERSITY

PROGRAM OF OPEN STUDIES – SANITATION, WATER AND

SOLID WASTE FOR DEVELOPMENT [POS-WASH]

SUBMITTED BY:

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Acknowledgement

This research "***A Comparative Assessment between Rural Drinking water Supply and Sanitation Schemes that Do or Do Not Implement Water Safety Plan ++ to Ensure Sustainable Water Services"*** was carried out to partial fulfillment of the Program of Open Studies on Water, Sanitation and Solid Waste management for Development (POS-WASH) , a collaborative course of Kathmandu University (KU) of Nepal and Swiss Federal Institute of Aquatic Science and Technology (EWAG) of Switzerland. I extend my sincere thanks to my research supervisor Dr. Sanna-Leena Rautanen, Chief Technical Adviser, Rural water Supply and Sanitation Project in Western Nepal, Phase II (RWSSP WN-II) for her incessant support, astute suggestions and guidance that she provided during this research project. Similarly, I extend heartfelt thanks to Ms. Aura Maria Liski, Junior Technical Adviser/ Field Specialist, Rural water Supply and Sanitation Project in Western Nepal, Phase II (RWSSP WN-II) for her hands-on support and guidance to complete my research work.

I would like to express my wholehearted gratitude to Rural Water Supply and Sanitation Project in Western Nepal, Phase II (RWSSP WN-II) and WASH Unit, Harinas Rural Municipality, Syangja for providing me with this research opportunity.

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Similarly, I would like to express my sincere thanks to all the scheme users, Water User and Sanitation Committee (WUSC) members, Water Safety Plan++ (WSP++) team members, Village Maintenance Workers, Pump Operators and Harinas Rural Municipality family. I also thank Bidur Pokharel, MIS officer, RWSSP WN-II and all the team members of RWSSP WI–II for their valuable suggestions and encouragement.

I felt strengthened a lot from the cordial co-operation of all above mentioned people and parties. I am still in a learning phase in context of research-related works. Therefore, I might have made several mistakes during my research works. In fact, no one is perfect, and perfection is an illusion that can never be translated into reality. Thus, I entirely bear all the possible errors in this research work.

Min Prasad Basnet

30 October, 2018

Abstract

This study, ***A Comparative Assessment between Rural Drinking Water Supply and Sanitation Schemes that Do or Do Not Implement Water Safety Plan ++ to Ensure Sustainable Water Services*** *was carried out in Harinas Rural Municipality of Syangja district. Specific objectives of the study are to; assess the technical functionality, reliability and service level of drinking water supply schemes, assess water quality at source, at taps and at storage pots inside households (P/A vial test for E-Coli), asses climate-induced and environmental risks that threaten water supply and mitigation/adaption practices in communities, asses household water treatment and storage knowledge and practice (Point of Use), assess knowledge of water borne diseases and institutional capacity and functionality of the Water Users and Sanitation Committees (WUSCs) to compare scheme that did or did not implement Water Safety plan++ (WSP++). The overall objective is to study the effectiveness of Water Safety Plan++: does its implementation show in better scheme functionality and water safety.*

This study employed both exploratory as well as descriptive research designs. The analysis uses data that was collected from 532 households in Harinas Rural Municipality in in June-July 2018 as part of Municipality Water, Sanitation and Hygiene (WASH) plan preparation. In September 2018, 88 households were again sampled using stratified sampling from the universe of 532 households for focus group interviews. This study is mainly based on primary information. The quantitative and qualitative primary data was collected though household surveys, interviews, focus group discussions (FGD). Management Information System (MIS) of RWSSPWN-II was used to gather water supply scheme specific secondary data.

Based on the findings, schemes with WSP++ were found to have more sustainable institutional setting. Users of schemes with WSP++ seemed to have better knowledge on water-borne disease than users of schemes without WSP++ but unfortunately this had not led to the practice of household level water treatment. WSP++ implementation did not seem to improve much the scheme maintenance. Close follow-up and monitoring after the WSP++ training is needed to make both WUSC and scheme users truly change their behavior for improved scheme protection and maintenance.

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1. Background

National Management Information Project (NMIP) implemented by the Department of Water Supply and Sanitation collects nationwide data on the coverage and functionality of rural and urban water supply and sanitation in Nepal. Based on the latest report published in 2014, the estimated country-wide water supply coverage in Nepal is 83.6%. Still, the report estimated that only 25.4 % of the water supply schemes are well-functioning, 36.1 % need minor repair, 9.2 % need major repair, 19.8 % need rehabilitation and 8.6 % need reconstruction. However, it has been acknowledged that official figures of water supply coverage and functionality do not reflect the actual situation in the field as systematic monitoring and data collection on the scheme performance, water quality and service level are lacking. Altogether, rural water supply systems suffer from major functionality challenges in Nepal.

To address both the physical and institutional functionality of community-based rural water supply schemes, RWSSP-WN II, a bilateral development cooperation project between Nepal and Finland, introduced the WSP++ concept. By now, the concept has been applied to 382 water supply schemes, of which 288 are gravity, 37 are electric lift, 32 are solar lift, 15 are electric overhead tank, 7 are solar lift overhead tank and 3 are Point Source Improvement water supply schemes in Western and Mid-Western regions of Nepal (Gandaki Province and Province number 5)

WSP++ ensures the safe supply and safe quality of drinking water using a comprehensive risk assessment and risk management approach that covers the whole water supply system from the catchment area to the consumer. WSP++ addresses several risks including the possible areas and causes of physical damage of the scheme as well as water contamination. The Plan considers both direct and indirect environmental and climate-induced hazards. The objective of WSP++ is to ensure continuous water supply of adequate quantity and quality and to mitigate or adapt to any possible risks. The Plan considers both scheme operation and the implementation of several mitigation and adaptation measures ensuring a continuous distribution of safe drinking water.

1.1. Objective of the study

The objective of the research was to compare rural community-based water supply schemes that either have or have not implemented WSP++. The points of interest are:

- Technical functionality of scheme
- Reliability of water supply
- Drinking water supply service level
- Water quality at source, at taps and at storage pots inside households (P/A vial test for E-Coli and storage practice
- Climate-induced and environmental risks and mitigation/adaptation practices of water users
- Knowledge and practice of household water treatment (PoU) and water storing

- Knowledge of water borne disease
- Institutional capacity and activeness of the WUSCs
- Finally, the objective is to give recommendations that would benefit all stakeholders working with rural water supply in Nepal

1.2. Limitations of the study

Every study has some kinds of limitations because of time, space and situation and this study does not make an exception. Present study is only for the partial fulfillment of the Program of Open Studies on Water, Sanitation and Solid Waste management for Development (POS-WASH) , a collaborative course of Kathmandu University (KU) of Nepal and Swiss Federal Institute of Aquatic Science and Technology (EWAG) of Switzerland . Extensive research was not possible mainly due to the lack of resources and time. This study was limited 10 drinking water supply schemes of Harinas Rural Municipality, Syangja. The findings and conclusion drawn from this study may not be widely generalized.

1.3. Study area

The research was carried out in Harinas Rural Municipality, Syangja district, Gandaki Province of Nepal. Following table-1 shows the location and sample details of the study.

Table -1: Sample detail of Study

SN	Name of Scheme	Ward No.	Scheme Type	Completed FY	Total Number of House holds	Nos. of Sample Households	
						During RM WASH Plan survey	WSP++ Comparaitve survey
WSP++ Implementing schemes							
1	Ramche DWSS	4	E. Lift	073/74	125	125	13
2	Biddyalaya Gairakhola Sewak DWSS	6	Gravity	071/72	86	86	9
3	Chapswara DWSS	6	Gravity	068/69	13	13	5
4	Hatiya DWSS	6	Gravity	068/69	37	37	10
5	Kutumsha B DWSS	7	Gravity	068/69	29	29	7
	Sub Total				**290**		**44**
Non WSP++ Implanting schemes							
6	Chuikuna Khairikot DWSS	1	E. Lift	073/74	73	73	10
7	Maiyachhhara Badhare 'C'DWSS	3	Gravity	071/72	19	19	5
8	Gairiswara Chuikuna DWSS	3	Gravity	068/69	38	38	8
9	Kalikath DWSS	1	Gravity	068/69	87	87	14
10	Kelapur Aagridanda DWSS	5	Gravity	068/69	25	25	7
Sub Total					**242**		**44**
Grand Total					**532**		**88**
Samples for Water Quality Testing P/A vial test							

SN	Test Point	With WSP++	Without WSP++
1	At source/ intake	5	5
2	At taps	25	25
3	Inside households (storage pots)	44	44
	Total	**74**	**74**

1.4. Methodology

The study uses both quantitative and qualitative methods. Research methods include desk study, literature review, field data collection through questionnaires, interviews, focus group discussions and observations, data analysis and presentation and reporting. Secondary data from RWSSP-WN II MIS and from household level survey for the Harinas Rural Municipality WASH Plan was used. The sample size is 532 households that were interviewed as part of the Harinas Rural Municipality WASH Plan preparations in June-July 2018. In addition, 88 households were interviewed again in September 2018 to gather WSP++ specific data of 10 water supply schemes of which 5 are supported by RWSSP-WN II and have implemented WSP++ and 5 are supported by other agencies and do not apply WSP++. Similar scheme age and scheme technologies were also considered when selecting the sample schemes for comparison. Out of 10 drinking water and sanitation schemes 2 are electric lift in technology and rest are gravity schemes. 6 schemes were constructed in FY 068/69 BS, 2 schemes in FY 071/72 BS and 2 schemes in FY 073/74 BS. All schemes has public tap connection and also all has spring sources. The research was guided fully by the supervisor.

2. Findings

Technical functionality status of schemes

427 households, out of 532 total households from the scheme coverage were responded " No need scheme repair ", that means 80 % households were getting water from well functional scheme, only 20 % households needs minor repair and no need of major repair in their scheme.

Following figure: 1 gives the scheme functionality status of the schemes implemented water safety plan (WSP++) and

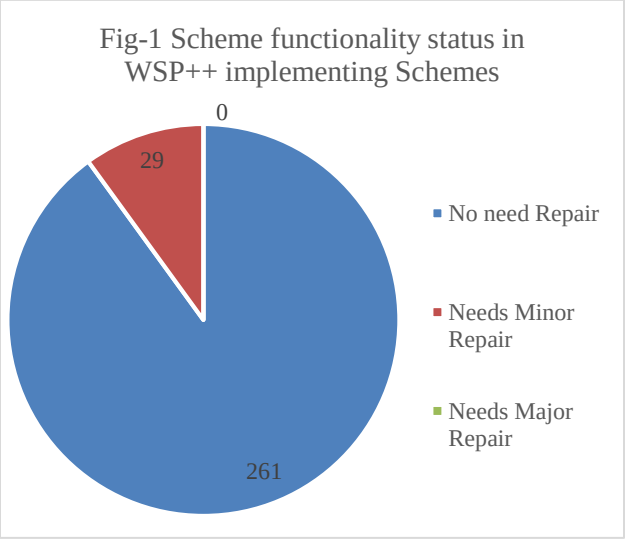
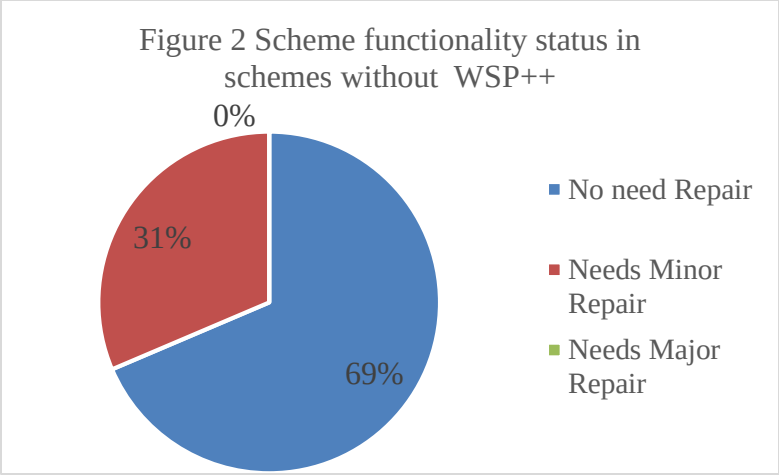
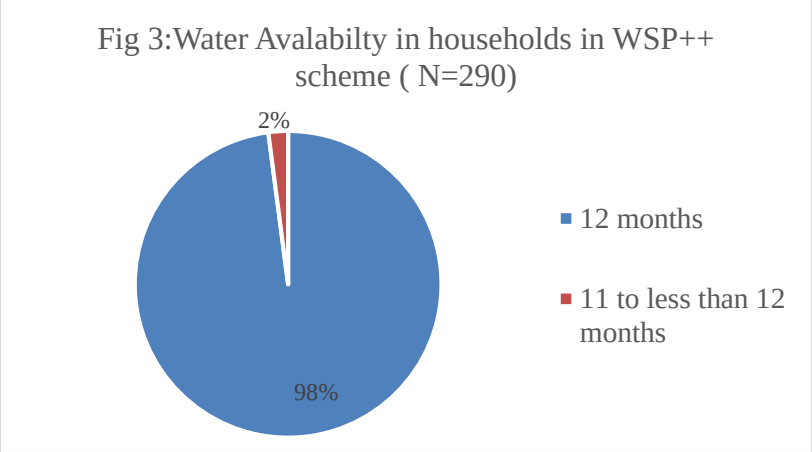


figure 2 gives the scheme functionality status that do not implemented WSP++. 10 % of households seeking minor repair in WSP++ scheme and the 31% of the schemes without WSP++.



2.1. Reliability of water supply from the water supply system (Quantity of water)

In total 485 households out of 532 are getting drinking water from their sources. Only 3 % households are getting water 11 to less than 12 months and households getting water below 10 to 9 months are 5%.



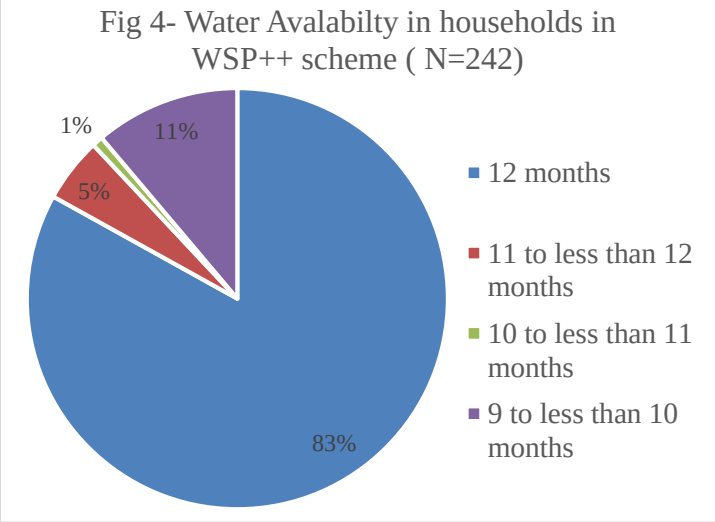


Figure 3 gives the status of reliability of water from the water supply system having WSP++ plan and figure 4 gives the status of the reliability of water from the scheme without WSP++ . 2% (6 ,out of 290) household who reported what they were not getting less than 12 months water from the scheme were from the schemes with WSP++ and 17% (41, out of 201) were found from schemes that do not implementing WSP++.

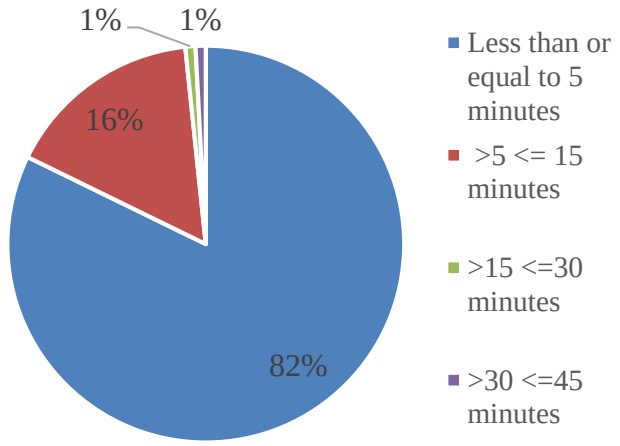
2.2. Assessment of drinking water supply service level in community as an impact of scheme

Service Level in community as an impact of scheme was assessed during the household survey while collecting the data using KOBO Collect mobile application tool in June-July 2018 covering all households of the scheme area. Assessment focuses over all service level as per the households' response and time required for single trip (one trip, go-wait-collect-return) of water.

2.2.1. Water fetching time a trip of water

In total 489 households are getting water within 5 minutes, 39 households are getting water above 5 and below 15 minutes, 2 households are getting water above 15 and below 30 minutes, 2 households getting water above 30 minutes. Figure 5 shows status in water fetching time for a round trip in the schemes without WSP++ which has 18 % (43, out of 242) households getting water above 5 minutes but 100 % households were getting water within 5 minutes from the schemes with WSP++

Fig 5-Fetching time for a trip of water in households of Schemes without WSP++ (N=242)



2.2.2. Water Service Level from the schemes

480 households out of 532 are getting safely manage water services from the schemes, 50 households getting basic services and 2 households getting limited services. Non of the households are getting water from unimproved sources and open surface water sources for drinking purpose. Figure 6 and 7 show the differences in both type of schemes. 1 household out of 290 is getting basic services and 2 out of 290 are getting limited services from WSP++ schemes. In case of non WSP++ schemes, 49 households (out of 242) are getting basic water facility. Box shows the definition of service level categorization.

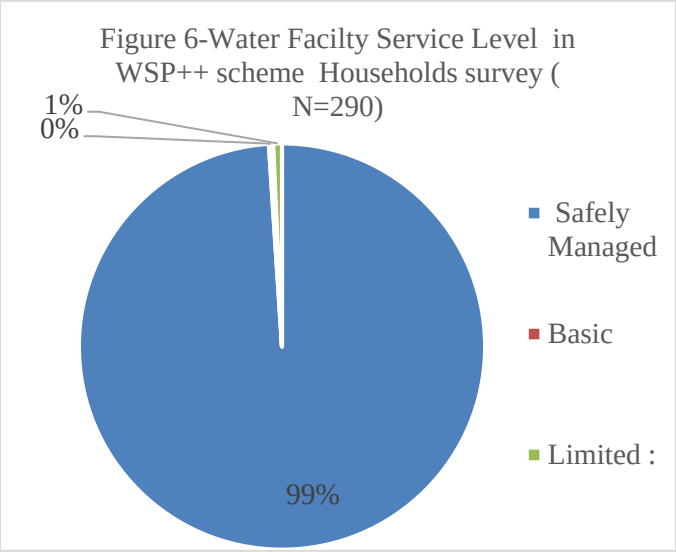
Safely Managed =(1. Private Connection, Public Tap, PSI with in 5 Minute 2. Water Available for 12 Months 3. Water Source is free from E-Coli)

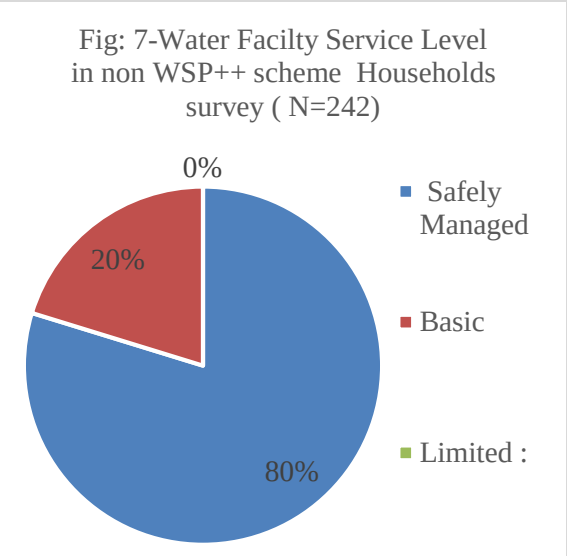
Basic = (1. Private Connection, Public Tap, RWH, PSI with in less than 30 Minutes 2. Water Available less than 12 Months 3. Water Source is not free from E-Col

Limited =(more than 30 Min)

Unimproved =(unprotected spring)

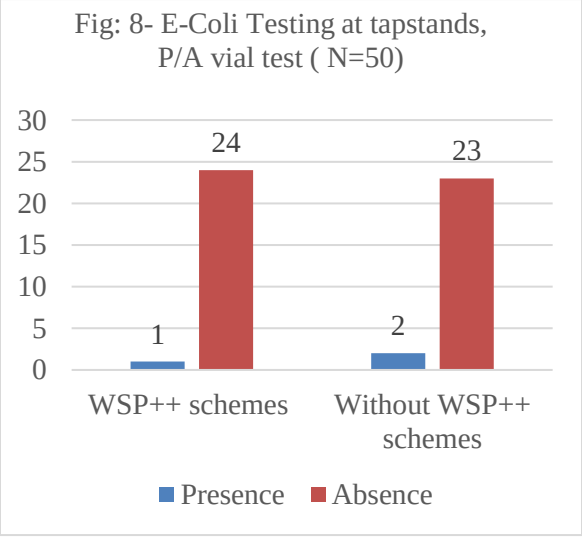
Open Surface water= (river, pond, stream, irrigation canal)

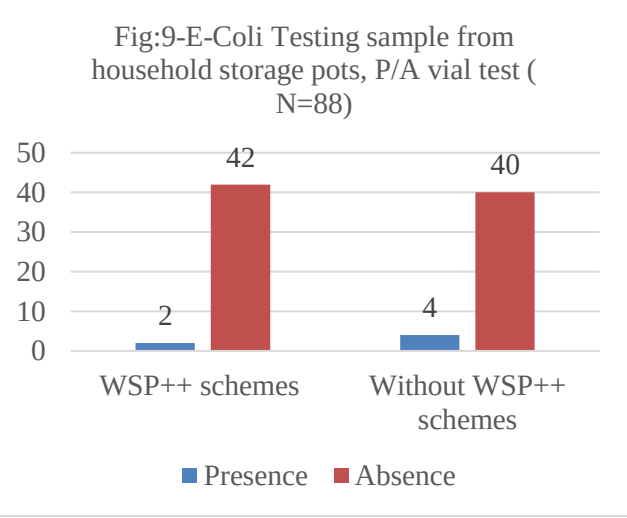




2.3. Assessment of water quality at source, at taps and at storage pots inside households (P/A vial test for E-Coli and observation of storage practice)

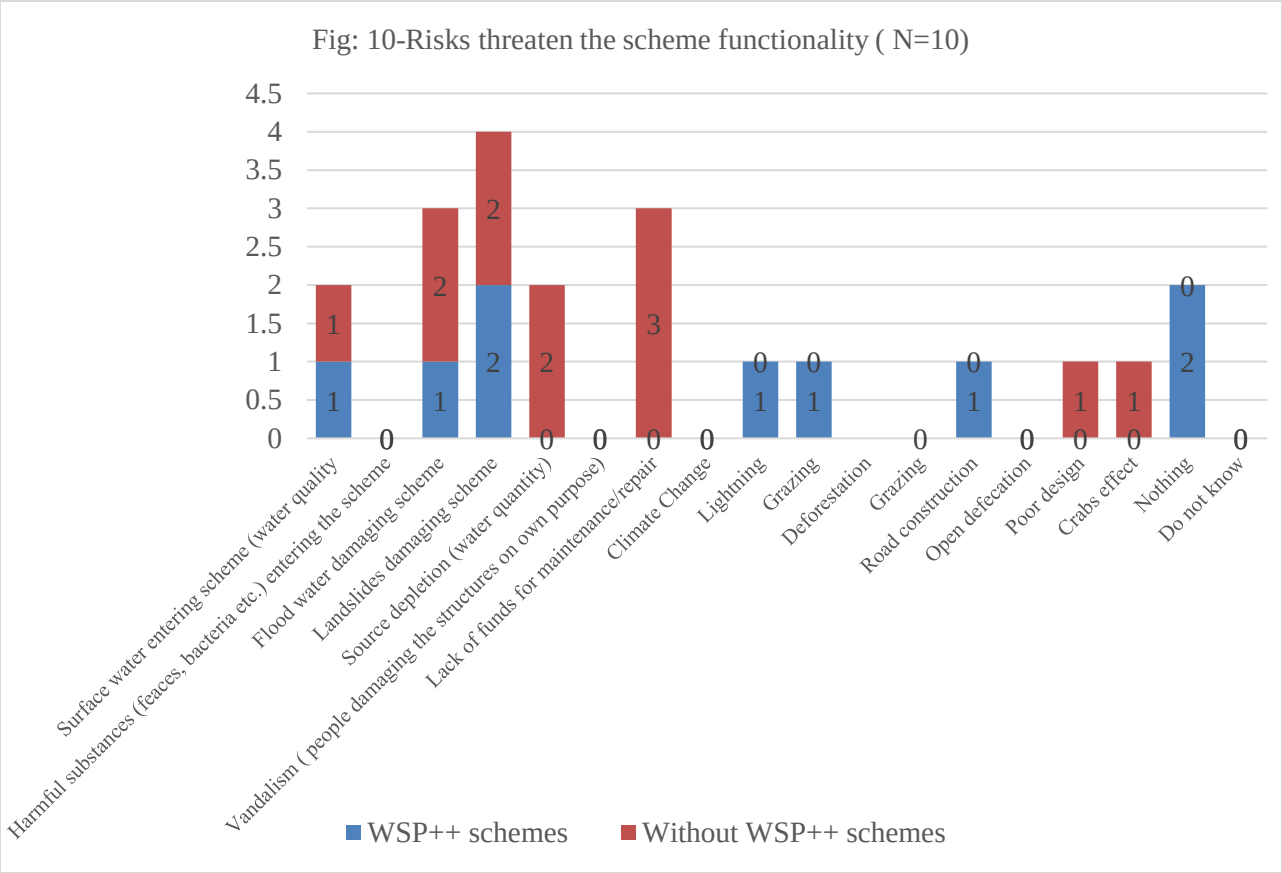
In this study P/A vial tests for E-Coli were done in three points, i) at source (10 nos), ii) at sample tap stands (50 Nos) and ii) at households (88 Nos). All samples taken from water sources were found free from E-coli. Only 3 sample tap stands out of 50 were found "contaminated and 6 household samples (out of 88) taken from water pots inside the house were contaminated with E-Coli. Altogether the result is very positive and there is no difference shown between schemes that implement and do not implement WSP++. Following figures 8 and 9 show the comparative status in P/A vial testing.





2.4. Climate -induced and environmental risks and mitigation/adaption practices

Scheme level observation and focus group discussions were used to assess climate–induced and environmental risks and mitigation and adaption practices. The Figure 10 shows that in schemes that had implemented WSP++, the main risks reflected by the WUSCs were water quality problem due to surface water entering the scheme, flood water and landslides, lighting, grazing and road construction. Among the scheme without WSP++ water quality problem due to surface water entering the scheme, flood water and landslides were also mentioned in addition to which source depletion, lack of fund for maintenance and repair, poor design and crabs were told to threaten the scheme functionality.



2.5. Risks, Harms faced and Adaptive/ Mitigate measures.

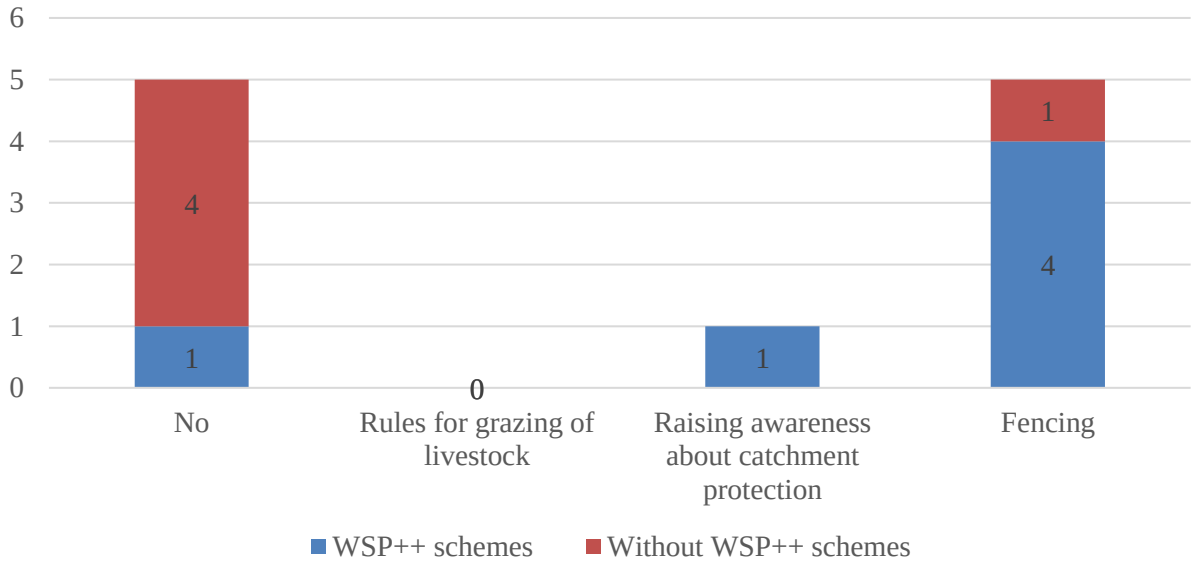
2.5.1. Deforestation

No deforestation problem was found in any scheme.

2.5.2. Grazing

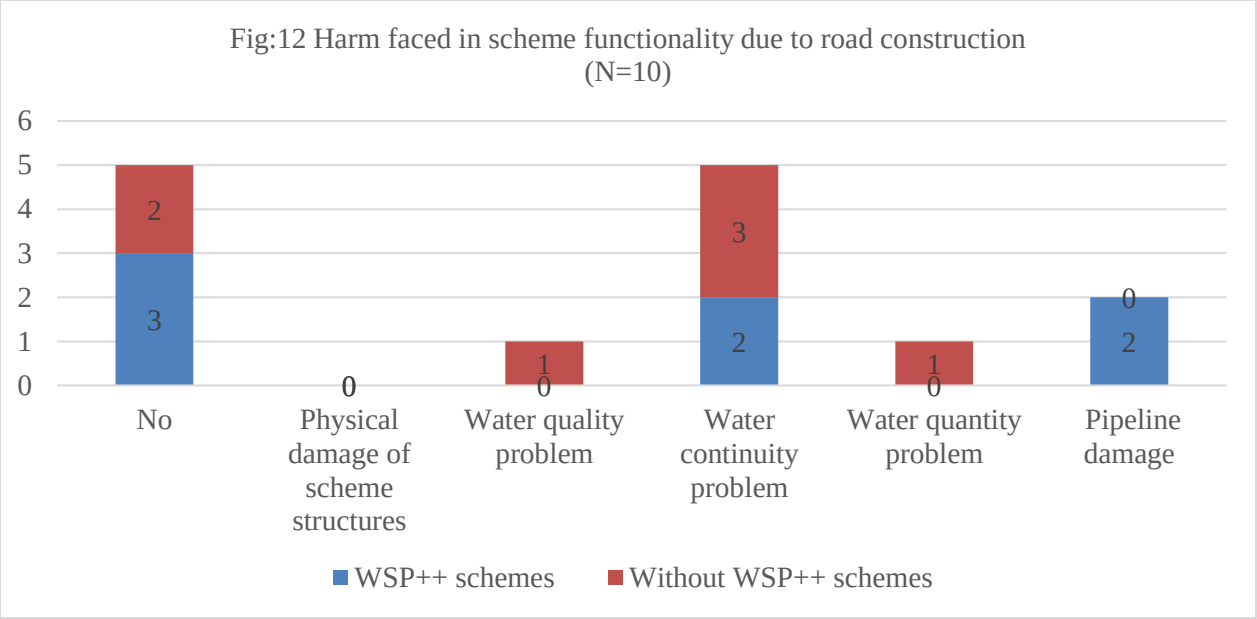
Grazing is practiced around the source area of half of the schemes (2 with WSP++ and 3 without WSP++). Still, none of the schemes with WSP++ had suffered from any functionality challenges due to grazing. One scheme without WSP++ had suffered from physical damage of structures due to grazing and one had suffered from water quality problem due to grazing. Figure 11 shows that even though none of the schemes with WSP++ had suffered from functionality challenges due to grazing, these schemes had still taken proactive measures (raising awareness about catchment protection and fencing) to prevent open grazing in the source area. Only one out of give schemes without WSP++ had taken measures against grazing (fencing).

Fig:11 Measures taken against open grazing (N=10)



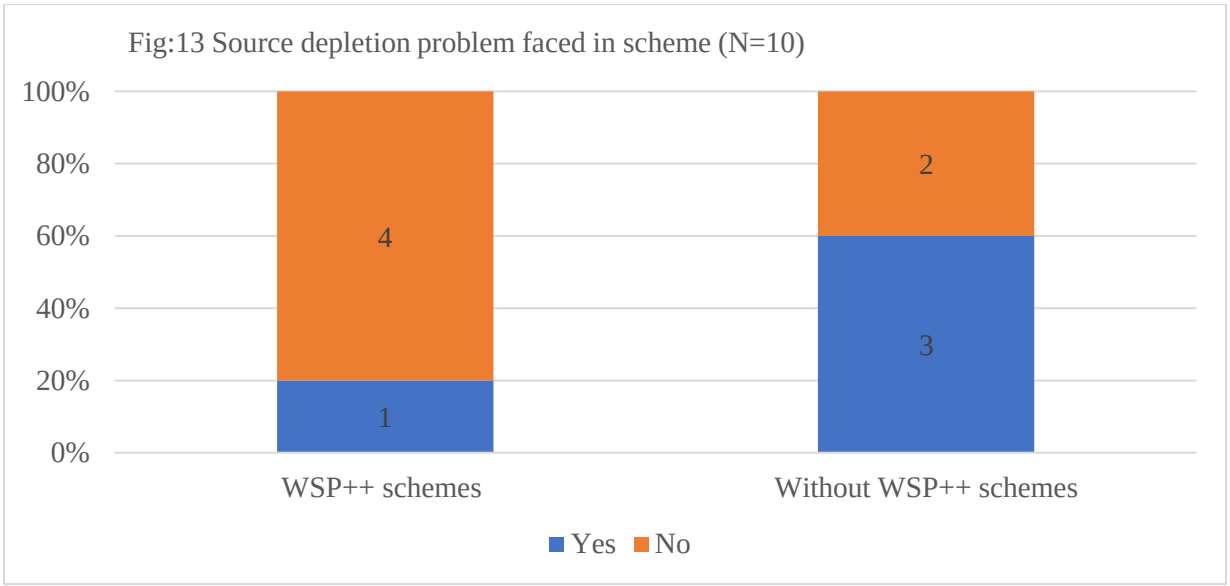
2.5.3. Road Construction

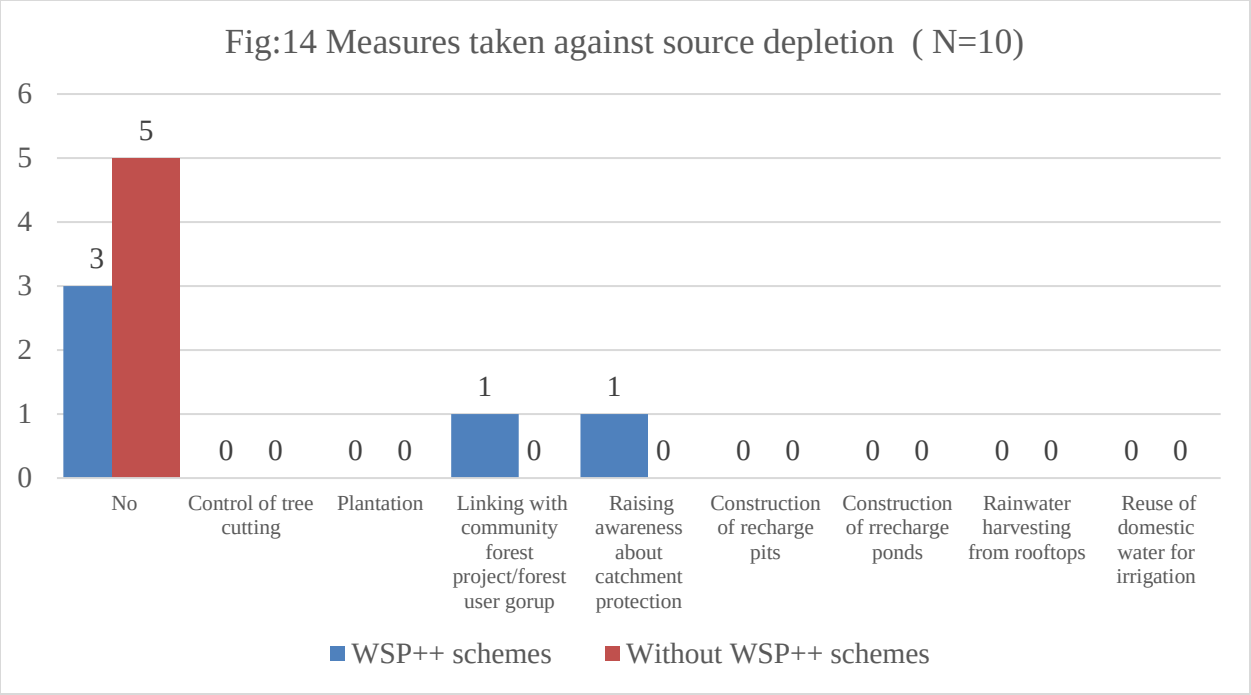
Road construction was found to harm scheme functionality in 7 out of 10 schemes. Figure 12 shows that road construction had mostly caused water continuity problem.



2.5.4. Source Depletion

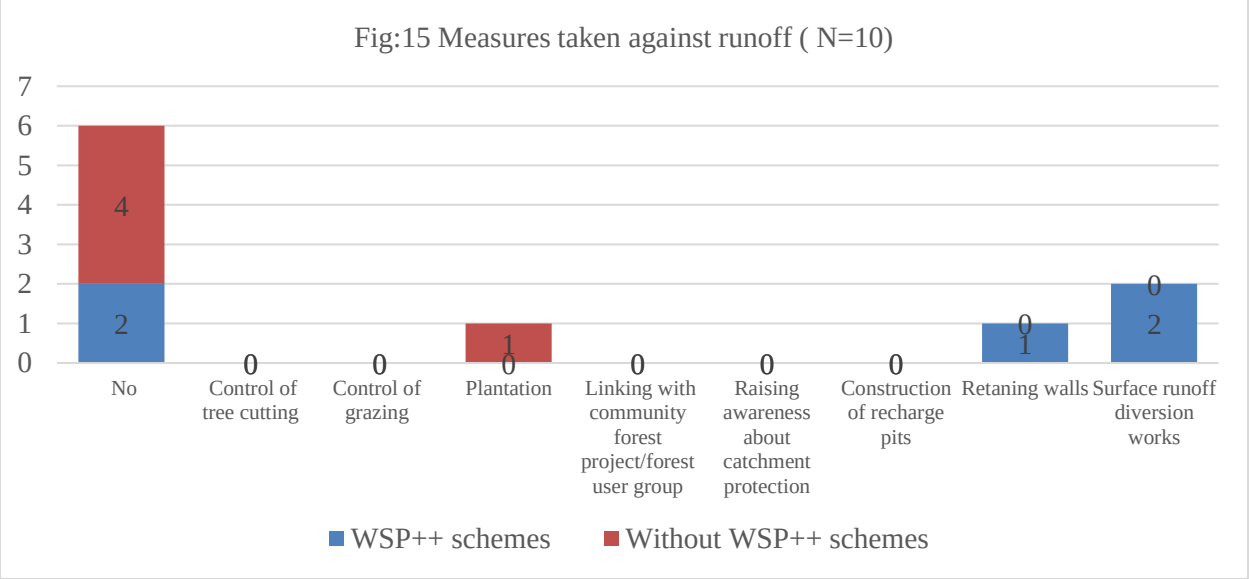
Source depletion had been faced in one scheme with WSP++ and three schemes without WSP++ (Figure 13). Figure 14 shows that only schemes with WSP++ had taken measures against source depletion (linking with community forest group and awareness raising).





2.5.5. Runoff

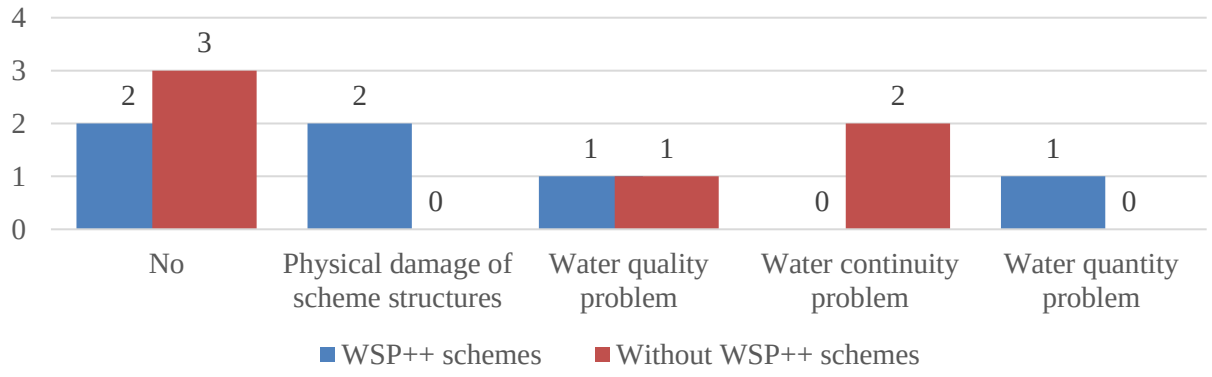
Runoff waters were told to risk scheme functionality in 9 schemes out of 10. Still only 3 schemes with WSP++ (retaining walls, surface runoff diversion) and one without WSP++ (plantation)had taken measures to protect the scheme against runoff waters (Figure 15)



2.5.6. Landslides

Out of 10, 5 schemes (2 with WSP++ and 3 without) reported landslide risk having harmed scheme functionality. Figure 16 presents problem landslides had caused on the scheme functionality. Only one scheme, Biddyalaya Gairakhola Swwak DWSS (with WSP++) had taken measures against landslides.

Fig:16-Harms from landslides in scheme functionality (N=10)



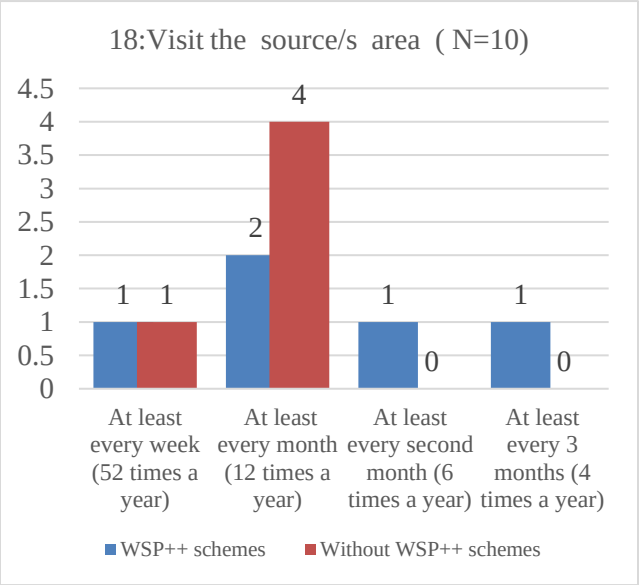
2.6. Poor water quality (turbidity) problem

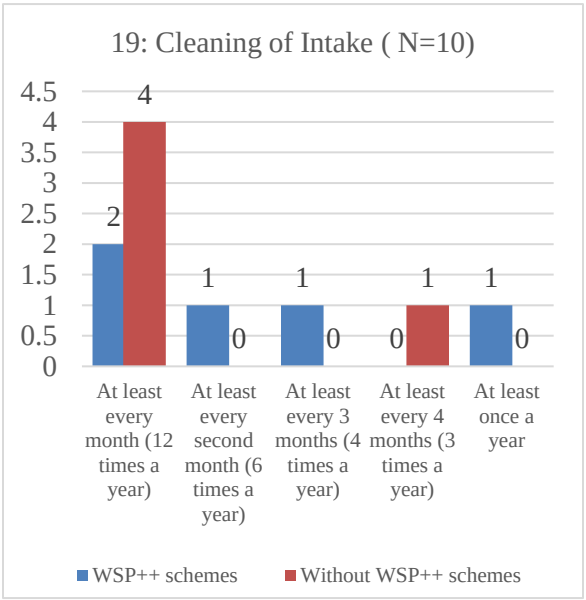
Out of 10, 7 schemes had experienced from poor water quality (turbidity) since the scheme construction. Following figure 17 shows the frequency of turbid water quality problem after the scheme completion.

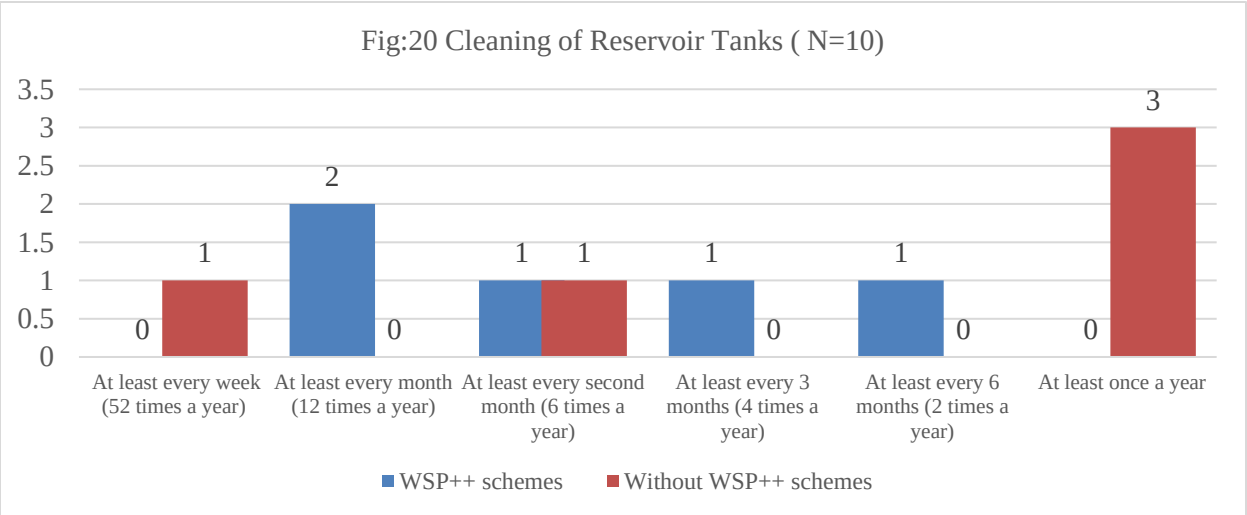
Fig:17-Suffered from poor water quality since the scheme completion (N=10)

2.7. Regular scheme maintenance

Following figures 18, 19 and 20 presents frequency of source visit, cleaning of intake and cleaning of reservoir tanks in a year. Figure 18 shows that in scheme without WSP++, the source is visited more often than in scheme with WSP++. Figure 19 shows that in schemes without WSP++ also scheme intake is cleaned more frequently than in schemes with WSP++. On the other hand, reservoir tanks are cleaned much seldom in schemes without WSP++ than in schemes with WSP++ (Figure 20).



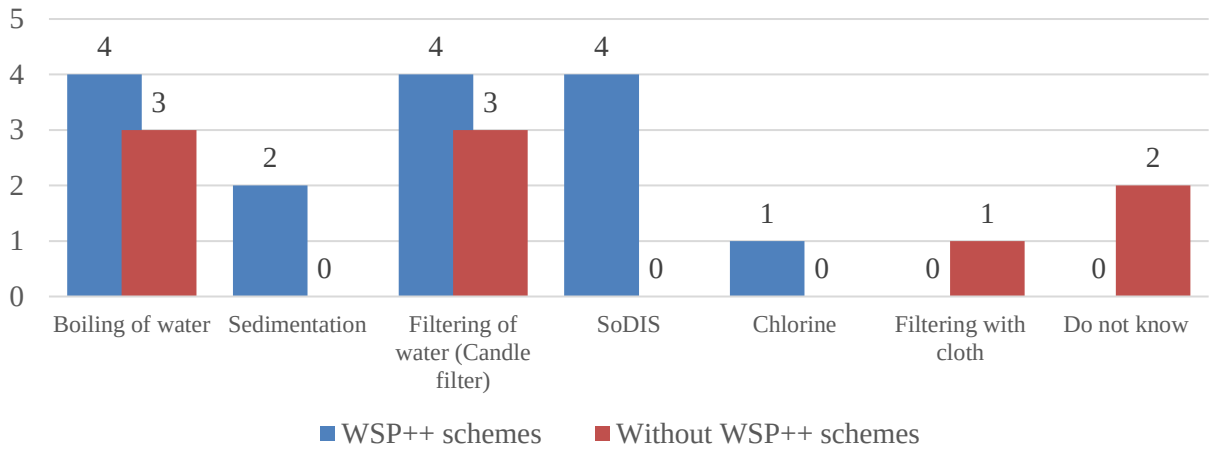




2.8. Knowledge and practice of household water treatment (PoU) and water storage practice

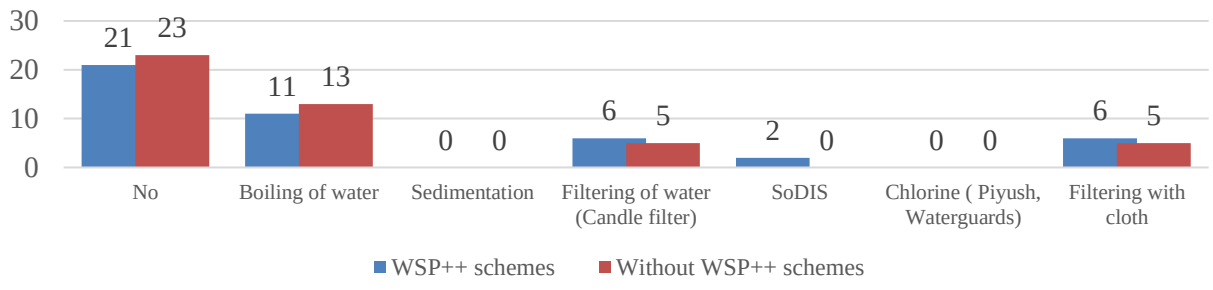
Knowledge and practice in household level water treatment was assessed in two ways. It was first asked in focus group discussions with WUSCs as well as in households during the household survey. Figure 21 shows the results from the WUSCs interviews. Two schemes without WSP++ could not name any water treatment methods and one scheme without WSP++ mentioned the inefficient water treatment method "filtering with cloth" as an adequate method to treat water. On the other hand, schemes with WSP++ seemed to have a good knowledge of water treatment methods.

Fig:21-Knowledge on household level drinking water treatment from scheme level FGDs (N=10)



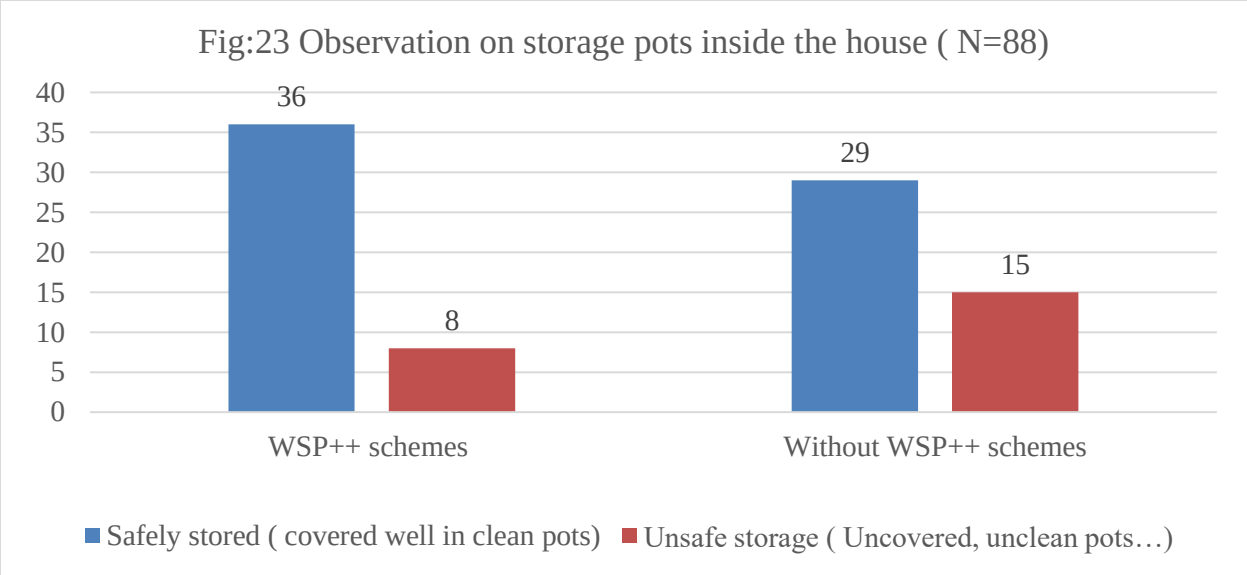
Even if WUSCs of schemes with WSP++ seemed to have a good knowledge of water treatment methods, this was not shown in practice. Figure 22 shows that approximately 50 % of the households that use water from WSP++ schemes, did not practice any water treatment method. The figure was the same with schemes without WSP++. The result show that the information given during the WSP++ training does not necessarily trickle down to the users. Six households thatuse water from WSP++ scheme were even practising water filtering with cloth that should be known to be an inadequate treatment method.

Fig:22- Husehold level Practice in any household level water treatment method (N=88)



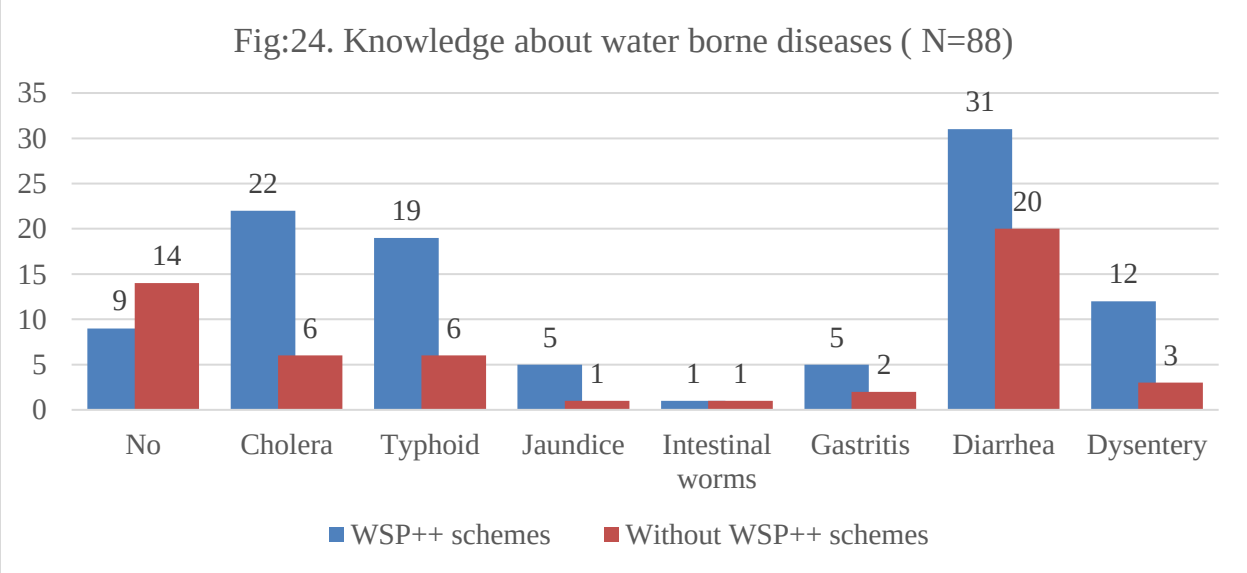
2.9. Water storing practice

Water storing practice inside home was observed in all 88 households. Household that use water from WSP++ scheme seemed to practice more hygienic storing of water than household that use water from a scheme without WSP++ (Figure:23)



2.10. Knowledge of water borne disease

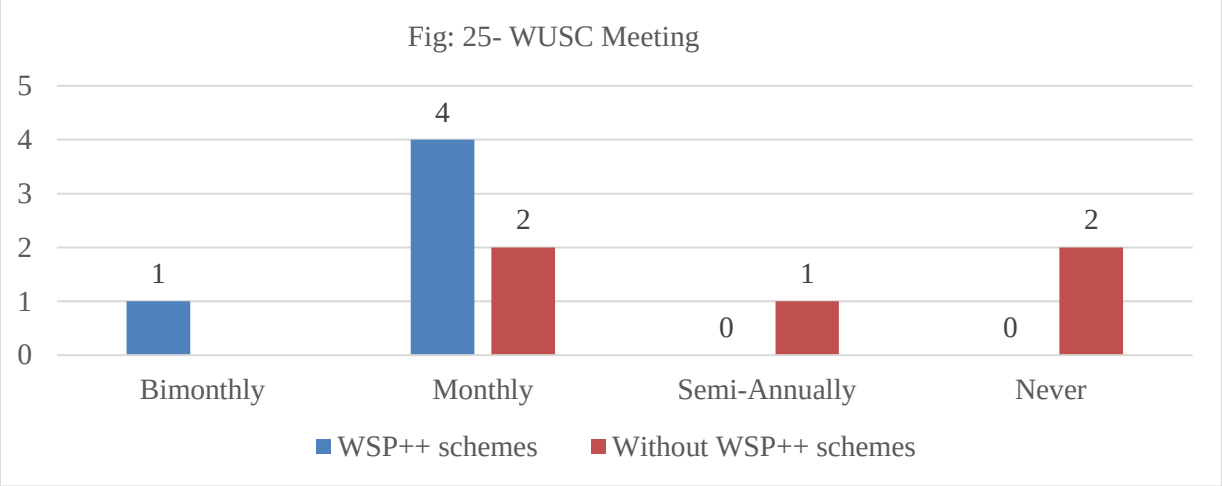
Out of 188 respondents, only 23 respondents had no knowledge of water borne diseases. Figure 25 shows that users of schemes with WSP++ had better knowledge of water borne disease than users of schemes without WSP++.



2.11. Institutional capacity of WUSCs

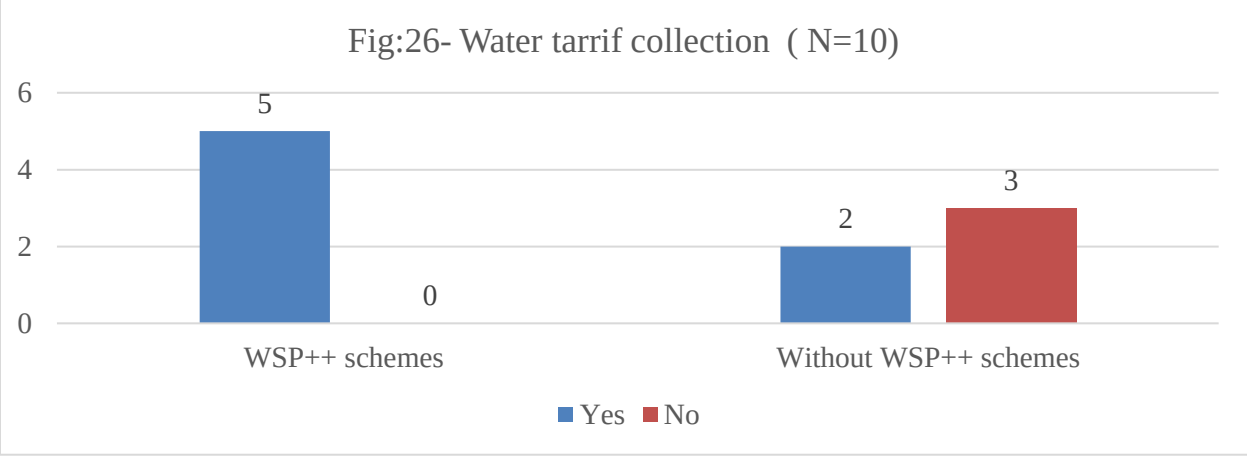
2.11.1. WUSC meetings

As per the findings, schemes with WSP++ were practicing WUSC meetings more actively than schemes without WSP++ (Figure 25).



2.11.2. Water tariff collection system

Water tariff collection system was found in 7 out of 10 schemes. Figure 26 shows the details of water tariff collection practice. Water tariff was being collected in all WSP++ schemes but not in all of non WSP++ schemes.



2.11.3. Provision of operation and maintenance (O&M) fund

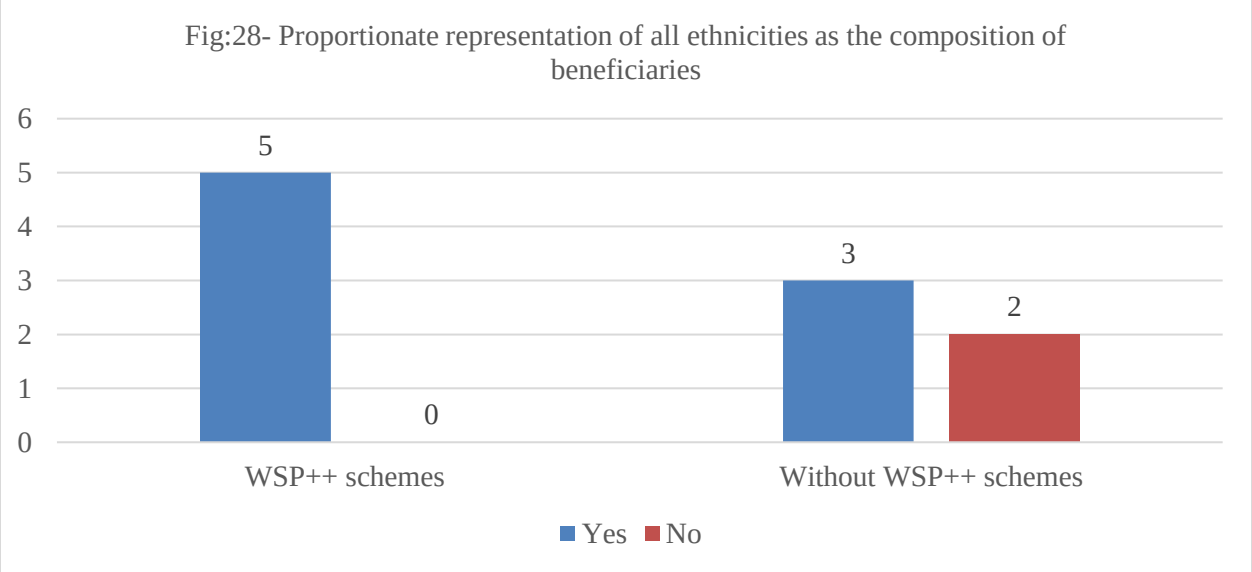
All schemes with WSP++ had O&M fund in use but only one scheme without WSP++ had. O& M fund ranged between NPR 50,000 and NPR 268,000.

2.11.4. Women's participation in WUSC

All schemes implementing WSP++ has 50% women participation but only 1, out of 5 schemes without WSP++ had (Figure 27).

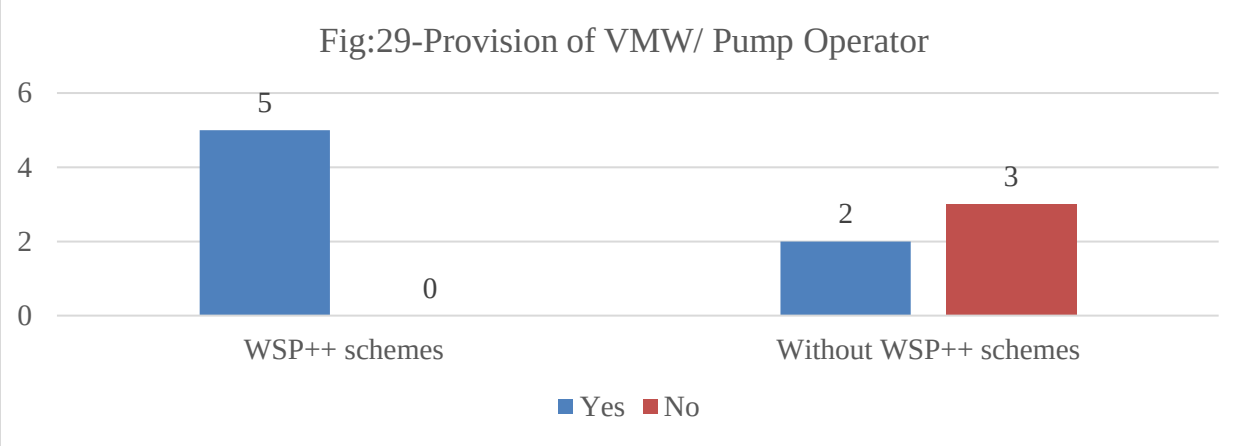
2.11.5. Proportionate representation of ethnicities as the composition of scheme beneficiaries

All schemes implementing WSP++ has proportionate ethnic representation, but only 2 out of 5 schemes without WSP++ did (Figure 28).



2.11.6. Provision of Village Maintenance Workers/ Pump operators

All schemes with WSP++ have VMWs/Pump Operator but only two schemes without WSP++ have VMWs/Pump Operator working (Figure 29).



All VMWs/Pump Operators that work for WSP++ schemes have received a training but no single VMW/Pump Operator that work for schemes without WSP++ have received a training.

3. Conclusion and recommendations

Based on the findings, schemes with WSP++ were found to have more sustainable institutional setting (frequent meetings, gender balance, ethnic balance, water tariff, O&M Fund and trained VMW/Pump Operator) working compared to the schemes without WSP++. The difference has not to do only with WSP++ training and its implementation but probably with the fact that the schemes with WSP++ have gone thought a full set of trainings as per the Step-by-Step approach of RWSSP-WN II. Those schemes have usually got intensive hands-on support from the Project staff to ensure scheme sustainability compared to schemes supported by other agencies. Users of schemes with WSP++ seemed to have better knowledge on water-borne disease than users of schemes without WSP++ but unfortunately this had not led to the practice of household level water treatment. WSP++ implementation did not seem to improve scheme maintenance – actually schemes without WSP++ seemed to visit their source area and clean their intakes more often. Schemes with WSP++ seemed to have taken slightly more preventative measures against hazards but there was no notably difference between schemes with and without WSP++s.

Based on the results, it seems that close follow-up and monitoring after the WSP++ training is needed to make both WUSC and scheme users truly change their behavior for improved scheme protection and maintenance. Only well functional, inclusive and accountable WUSCs can ensure the sustainability of water supply services. WSP++ concept recognizes these needs but may not ensure their implementation to the needed extent.

Based on the major findings from the research study, the recommendations are as following,

- WSP++ should be a continuous process but as the study finding show, it is too often practiced as a onetime event. As per the results, local level capacity in WSP++ implementation should be enhanced. Local government should take the lead to enhance the capacity of communities and establish effective monitoring system to ensure scheme sustainability in long-term.
- In WSP++ trainings, a strong focus should be given to raising knowledge of water borne diseases and house hold level water treatment methods.
- Clear message should be delivered to the communities. In this research, it was found that water users had understood that they should drink filtered water and as a result they had started filtering water with unsafe cloths (reason for presence of coliforms in tap stand and households of Ramche DWSS).
- Human interventions like road construction causes problems to drinking water sources in hills including source depletion, source migration, damage of scheme structures, landslides and erosion. A detailed study before any road construction project is recommended.
- Integration of recharge structures such as pits, energy dissipating structures to control runoff and recharge drains along road construction will be beneficial to recharge the downhill spring sources and control the soil erosions and landslides.
- Gender equality and social inclusion, good governance, accountability and participation should be considered throughout scheme life cycle.
- Regular meetings, mass meetings and annual assemblies are very important for democratic exercise and motivation of users in issues such as water tariff collection and O&M fund use.

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