

Women Centric Study of Water and Forest Conservation in Lesser Himalayan Region of Uttarakhand

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ABSTRACT

The present women centric study was conducted in lesser Himalayan region of Nainital district of Uttarakhand. Data were collected personally from 150 women from eight villages of Dhari and Oakhalkanda blocks to identify the conservation activities for water and forest resources. Majority of women considered complete environmental balance as benefit from the forest and take part in forest management activities like plantation and shrub cutting. Traditional water resources like naula, gadhera and dhara are the main sources of water, however naula, gadhera, stand post and water pipeline are the most frequently used sources of drinking water in the study area. Water shortage was the very serious problem in the study area as depicted by highest weighted mean score (WMS) of 2.74 and ranked as I whereas air pollution was considered as not a problem to be addressed seriously (WMS 1.71, rank VII). Need for waste water treatment was felt by inhabitants residing in acute water shortage areas whereas majority of women felt no need of waste water treatment as water pipe line has been installed in majority of villages. With respect to development of other sources for fulfilling the water shortage, majority of women cited construction of 'tanks' followed by stand post and naula recharge. The Government agencies provided training on skill development in water and forest conservation to majority of women.

Key words: Women centric; Water and forest conservation; Lesser Himalayan region; Traditional water sources;

The term conservation came into use in the late 19th century and referred to the management, mainly for economic reasons, of such valuable natural resources as water, forest and watershed areas. Conservation of natural resources is now usually embraced in the broader conception of conserving the earth itself by protecting its capacity for self-renewal. The importance of reconciling human use and conservation of water and forest has become another important issue. However, the advancement of modern civilization has had a great impact on our natural resources. So, conserving natural resources is very essential today. In recent years, the depletion of natural resources has become a major focus of governments and local organizations. Depletion of natural resources is associated with social inequity. Considering most biodiversity are located in developing countries

(UNESCO and UNEP, 2002), depletion of this resource could result in losses of ecosystem services for these countries (Nellemann and Corcoran, 2010). Deforestation and degradation affect 8.5 per cent of the world's forests with 30 per cent of the Earth's surface already cropped ((Nelson, 2005). Water is another most important natural resource, and is at the same time becoming an increasingly scarce commodity in many parts of the world. In 1990, 28 countries with a total population of about 335 million experienced "water stress." This figure is expected to grow, to around 50 countries affecting some 3 billion people by 2025. The affected population could increase between 800 million and 1.1 billion people by 2025. In addition to water scarcity, the problem of access to safe water supplies and sanitation is also intensifying. The depletion of natural resources is caused by direct drivers of change

(Nelson, 2005) such as forestry as well as indirect drivers of change such as demography, economy, society, politics and technology. The current practice of Agriculture is another factor causing depletion of natural resources. The depletion of natural resources is a continuing concern for society. In 1982 the UN developed the World Charter for Nature, which recognized the need to protect nature from further depletion due to human activity. It states that measures need to be taken at all societal levels, from international to individual, to protect nature. To look at the importance of protecting natural resources further, the World Ethic of Sustainability, developed by the IUCN, WWF and the UNEP in 1990 (Fein, 2003) set out eight values for sustainability, including the need to protect natural resources from depletion. Water and forest resource management is a discipline in the management of natural resources with a particular focus on how management affects the quality of life for both present and future generations. Forest conservation is a land management practice that seeks to conserve, protect and restore, habitat areas for wild plants and animals, especially conservation, and prevent their extinction, fragmentation or reduction in range. A successful management of natural resources should engage the community because of the nature of the shared resources the individuals who are affected by the rules can participate in setting or changing them (Ostrom, 2005). The users have the rights to devise their own management institutions and plans under the recognition by the government. These issues are resolved in a quick and low cost manner by the local people according to the seriousness and context of the offence (UNDP, 2005).

Uttarakhand state is well endowed with water and forest resources. More than 12,000 glaciers and eight major river catchments act as the lifeline for the entire hydrological system of Indo-Gangetic plain. Forestry represents the second-largest land use in India after agriculture covering about 697898 sq. kilometers or 21.23 per cent of the total land base (ISFR-2013). The forest cover in Uttarakhand State as per Forest Survey of India (India State Forest Report-2013) is 45.82 per cent of the total geographical area of the State (53483 sq km.). There was 12 per cent increase in forest cover as per India State Forest Report-2013 compared to 2011. This change was mainly due to conservation and afforestation activities in the State. In lesser Himalayan

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regions of Uttarakhand almost all the families rely on medicine, food and fodder obtained from forest plants, loss of the forests could result in a loss of finding more potential livelihood products. Women are the backbone to the farming system of the Uttarakhand hills as they have intrinsic knowledge of different farming activities (Agrawal, 2008). Women are quite knowledgeable both about the environment and about the natural resource base and its uses. They also have information on the varieties of wild fruits and plants that are important supplements in the diets and it is often women who are responsible for providing a significant share of household income and subsistence needs all of which impact biological and natural resources (Mehra, 1993). As the women work ahead in the environment, they are the one who suffer more from the adverse changes/pollution/environment degradation. As a result of deforestation and monoculture practices in agriculture, there has been an extreme loss of ground water, along with flooding, landslides and destruction of biomass, which has further increased the workload on women. These kinds of overburden also keep women more aware, responsible and concerned about the environmental problems. This women centric study was done because the natural resources have considerable impact on women's lives and also have impact on the resources themselves. Thus, the present women centric study would not only address their need for increased income and a reduction in drudgery, but would also give them control over the resource they work with.

METHODOLOGY

Present study was conducted during 2011 and 2012 in micro watershed areas of Nainital district of Uttarakhand for its importance in water and forest management. Out of 38 villages in Dhari and Okhalkanda blocks, 08 villages were selected randomly using simple random sampling without replacement. From these eight villages a sample of 150 women farmers was selected following stratified random sampling method (Best and Kahn, 2010). For collecting information, the semi structured interview schedule was developed. The 'Exploratory Research Design' was used for the study. The interview was conducted personally by the investigator with the women farmers individually at house hold level. The head women members from selected families were interviewed for

the study as respondents. The measures viz importance, benefits, participation in conservation activities on water and soils, availability of water, use, distance covered for water collection, reason of drying traditional water sources, distance covered for water collection, sources developed to meet the shortage of water, waste water treatment, environmental problems related to water, and facilities provided by Government agencies for water and forest conservation were studied. The appropriate statistical tools were used to draw meaningful conclusions.

RESULTS AND DISCUSSION

Forest conservation :

Importance of forest conservation: Almost all the women were aware about the fact that forests were the main source of fuel wood and 97.33 per cent women were aware about the importance of forest in environmental protection (Table 1). This explains why maximum women take part in forest management activities (Table 3). Women were also well aware that the forests are the main source of traditional medicine (Samal et al., 2002) and building material which was reported by more than two third of women (90% and 82.67% respectively). About slightly more than 50 per cent women were well aware that the forests were the source of raw material for trade and wild fruits. Thus such information gives a view that the majority of women in the study area were well aware about the benefits of forest to fulfill their basic needs of livelihood. This compels them to conserve the forest by their involvement in major activities of conserving them.

Table 1. Women’s response about importance of forest conservation

Category	No.	%
Source of fuel wood	150	100
Source of traditional medicines	124	82.67
Source of building materials	135	90
For fruits	088	58.67
Source of raw materials for trade	080	53.33
Environmental protection	146	97.33

Multiple responses were allowed

Benefits of forest protection: Majority of the women in study area (79.33%) protected the forest to maintain complete environmental balance (Table 2). Since the women were well aware of the fact that maintaining

balance in environment also would result in maintaining their agriculture and live stock, women took part in forest management activities (Table 3). About 49 per cent to 50 per cent women protected forest as they got fodder and firewood from the forest. The reason for it can be understood from the fact that out of total livestock feeds, 70 per cent of fodder comes from forest which directly shows dependency on forest for fodder (Anonymous, 2009) and that the fuel-wood and fodder production from cropland was declining (Maikhuir et al., 2003). These were essential needs for their own livelihood and to rear livestock. About 88.67 per cent women were found involved in forest management activities like plantation of grasses and fodder crops (Table 3), thus protection of forest becomes an important activity of the women. Nearly a quarter of women (23 to 27%) participated in forest protection for their self use and for conservation of drinking water. Women linked water availability to the health of the forests and by improving the situation of forests; they would be able to tackle the problem of water scarcity in the region (Bhatt, 2010). In the study area the forests are well maintained by the residents with Oak and other broad leaved trees which are found to be beneficial for water conservation (Rawat et al., 2012).

Table 2. Women’s perception about benefits of participation in forest protection

Reasons	No.	%
Complete environmental balance	119	79.33
Self use	41	27.33
Drinking water conservation	35	23.33
Fodder	74	49.33
Firewood	76	50.67
Medicinal plants	15	10.00
Control of illegal tree cutting	09	06.00
Restricted entry of outsiders	06	4.00
Control of illegal erosion	06	4.00
Availability of wild products	20	13.33
Timber wood	02	1.33
Pine needle (<i>pirool</i>)	06	4.00
Protection from wild animals like wild pigs	02	1.33

The participation in forest conservation as opined by nearly half of the women (53%) was due to forests being good source of availability of raw material for trade and more than two third of the women (82.67%) found forests being good source of traditional medicine (Table 1). About 10 to 13 per cent women participated

in conservation of forest for protecting medicinal plants and wild products which are needed for sale. About 01 to 06 per cent women expressed that forest provided them protection from wild animals and other miscellaneous reasons were for getting pine needle, and control of illegal erosion, to restrict entry of outsiders and to protect from illegal tree cutting (Table 2).

Table 3. Participation of women in forest management activities

Activities	No.	%
Plantation/ afforestation	140	93.33
Digging the trench for the protection of older trees	134	89.33
Shrub cutting	139	92.67
Fire line to protect forests from fire	124	82.67
Fencing	110	73.33
Nursery raising	122	81.33
Construction of water conservation tank	124	82.67
Control of perennial weeds in forest area	127	84.67
Plantation for grass and fodder	133	88.67
Soil conservation work	095	63.33
Employment generation for villagers	052	34.67
Delimitation of forest area	087	58.00
Encourage Horticultural Crops	132	88.00

Participation in forest management activities: It is evident from the data presented in Table 3 that out of fifteen activities related to forest management activities, the women's involvement was mainly in plantation/afforestation and shrub cutting. Participation of women in these activities was by 92 to 93 per cent. *Bhatt (2010)* also observed that 100 per cent of the women cited 'Protection of forest and biodiversity in the local area' as an important activity to mitigate climate change. Protection of older trees was reported by 89.33 per cent women mainly by digging the trenches. More than 80 per cent women (81 to 88%) were involved in activities like fire-line, nursery raising, construction of water conservation tanks, control of perennial weeds, plantation of grass and fodder and encouraging horticultural crops. *Yadav (2008)* opined that hill women always protect the existing trees and transplant new trees from time to time to protect forests. In fencing to protect forest only 71 per cent women cited their involvement. While in soil conservation work and employment generation for villagers, 63.33 and 34.67 per cent women were involved. People of mountain region who participated in formal management activities

were more active towards conservation than other groups (*Sah and Heinen, 2001*). Afforestation, digging trenches, shrub cutting, fire line, fencing etc. activities are to protect forests in the jurisdiction of *Van Panchayats*. It is well known fact that forest are second most important source after water for livelihood in the hilly regions (*Agrawal and Yadav, 1997*) also Van Panchayats are formed with this aim by the government, thereby the residents of the study area remain active in these activities.

Water conservation :

Availability of water: It seems to be interesting that among the availability of water sources in the study area, *naula* was known to maximum number of women (83.33%) followed by *gadhera* which was reported by 66 per cent women (Table 4). *Dhara* as a source of water availability in the study area has been reported by nearly half (50.67%) of the women followed by 38.67 per cent women for tanks and 22.67 per cent for ponds. Least number of women (03%) expressed opinion about availability of hand pumps. This information indicated that most of the women residing in the villages of study area were well acquainted with natural sources of water availability. It is a true fact that traditionally since time immemorial; women in hills were using water from natural sources like *naula, gadhera, dhara* etc. (*Chauhan, 2010; Rawat and Sah, 2009*) and till today these are prevalent in the hills.

Table 4. Women's response to availability of water sources in the hills

Water sources	No.	%
Ponds	34	22.67
Dhara	76	50.67
Naula	125	83.33
Simar	19	12.67
Gadhera	99	66.00
Tank	58	38.67
Pipeline	57	38.00
Handpump	05	3.33
<i>Sources used for drinking purpose</i>		
Gadhera	54	36
Water pipeline	84	56
Pond	02	1.33
Naula	82	54.67
Dhara	32	21.33
Stand post	67	44.67
Hand pump	03	2.00

Drinking water sources: The provision of drinking water is available to fairly large number of villages but their regular functioning is less than satisfactory. Table 4 indicates that 56 per cent women were using drinking water from pipe line followed by 54.67 per cent from *naula* and 44.47 per cent from stand post. *Gadhera* as a source of drinking water was also in use until today by 36 per cent women followed by *dhara* (21.33%). In line with this finding *Chauhan (2010)* reported that for domestic consumption, people preferred to harvest below aquifers (*naulas*) or tap springs (*dharas*). In the study area, very little number of women (02%) reported to use hand pumps as a source of drinking water. In the study area Uttarakhand Decentralized Watershed Development Project (UDWDP) as well as Swajal Yojana of government are in operation, and as an important activity of these projects, the drinking water availability has been improved through water pipeline. Also innovative techniques for recharging of *naula* have been done in most of the villages of study area. Where no natural water springs were existing, the project personnel's have made tanks close to springs and thus the water, which was going waste in the past, get stored in these tanks. From these storage tanks, stand posts have been installed at various places in the villages. Due to these innovative works most of the women are using drinking water from these renovated sources. *Negi and Joshi (2002)* said that the Uttarakhand Himalaya harbor a wealth of springs and shallow wells used for drinking water and other household purposes. Also it was observed that water from the *Naula* was primarily used for drinking purpose (*Anonymous, 2012*). Villagers also drew water from a *Gadhera*, when the water supply from the *Naula* proved insufficient.

Use of water: In the study area 100 per cent women use the available water for household purposes followed by 98 per cent for livestock and minimum number of women (16.67%) use available water for agricultural purpose (Table 5). Based on the observation and discussion researcher found that water is scarcely available in hills, that is why agriculture is mostly dependent on the rain and water available in surface (*simar*) and also no efficient irrigation techniques have been used to use the available water in the study area, thus women were rarely using this water for agricultural purposes. The life in hills is dependent on livestock, water and forest resources. Therefore, most of the women

were rearing livestock and were using water mostly for this after household purposes.

Table 5. Women's involvement on use of water and distance covered to collect water

Category	No.	%
<i>Use of water</i>		
House hold chores	150	100.0
Agriculture	025	16.67
Livestock	147	98.00
<i>Distance covered for water collection</i>		
Available at home	092	61.33
Less than 50 meter	023	15.33
50 to 100 meter	018	12.00
Above 100 meter	017	11.33

Distance covered for water collection: Majority of women (61.33%) expressed that the water is available at home (Table 5). Only 15.33 per cent women reported they covered less than 50 meters of distance for collection of water. Almost equal numbers of women (11 to 12%) were covering above 50 meters distance (100 or more than 100 meter) for collecting water. Since the government agencies has established water pipeline (Table 4), the majority of women are getting water at their home. Only few women, that too of extreme lower and higher elevation in the villages were walking more than 100 meter to collect the water. In some places the stand post or pipelines were shared by four to six households this might be the reason that few women were collecting water from distance close to the vicinity of their homes. It has been observed that natural source of water in the mountain usually lie at considerable distance from habitations (*Chauhan, 2010*).

Drying of natural resources and its impact: In almost all the hill areas, the natural sources of water have mostly dried up. The women on the basis of focus group discussion identified the reasons for drying up of natural springs. Data presented in Table 6 indicates nearly 60 per cent of the women identifies landslide as one of the prominent reason for drying up of natural springs. Landslide might have covered the springs and thus became unavailable to the residents. About 46 per cent women attributed reduced rainfall as the cause of drying of springs followed by 34 per cent women cited hot weather as one of the cause. Natural water resources in hills such as springs, *naula* and *dhara* have degraded and many of these resources have already dried up

(Bisht, 2010). The main cause behind the diminishing natural resources is change in climate particularly rainfall pattern, snowfall pattern and increasing temperatures. The extremities of weather condition viz. excessive rainfall, low rainfall, and high temperature (hot weather) pose serious impact on the natural springs. Since the water in natural springs is recharged through rains, and if rains are reduced, the recharging of these natural springs gets adversely affected (Bhatt, 2010). Also least rains coupled with high temperatures leads to fast evaporation and most of the vegetation and soils become dry and the water below soil gets reduced and a point comes when the natural springs get dried. Least number of women (07.33%) reported reduction in forest trees as a reason for drying of natural springs. Since the trees are the main components of the vegetation in hilly areas and the village. It was observed as *Van Panchayat* was taking care of forest trees in the study areas, thus the reduction in trees has not been reported as one of the reason of drying of natural springs. Discharge from natural water sources has declined in recent decades some springs have even dried up making water a crucial development issue in the region (Negi and Joshi, 2002).

Table 6. Women's awareness about reasons of drying of natural springs and its impact on village life

Category	No.	%
Reasons of drying of natural springs		
Land slide	89	59.33
Reduced forest trees	11	7.33
Reduced rainfall	70	46.67
Hot weather	51	34.00
<i>Impact on village life</i>		
Loss of soil moisture	02	1.33
No effect	08	5.33
Shortage of water	128	85.33
Time loss in collecting water	31	20.67
Unavailability for agricultural	25	16.67
Affect on household chores	21	14.00
Reduced trees and plants	37	24.67

Impact on village life : The data in Table 6 enumerates the reasons how drying of natural springs affected village life. On the basis of open ended question about effect of drying up of natural resources on village life the majority of the women expressed shortage of water as one of the major affect. Majority of women (85.33%) out lined shortage of water as the major impact. About 25 per cent women pointed out adverse effect on

household chores which was closely followed by 20.67 per cent women view on loss of time in collecting water by people residing at extreme lower or higher elevation. Only 16.67 per cent women were of the view that drying of natural springs posed adverse impact on availability of water for agricultural use and a very less number of women (01 to 05%) cited the impact as 'loss of soil moisture' or 'no impact'. In line with the results of the present study, Bhatt (2010) also observed that 'Increased Water Scarcity' was cited by majority of women as an impact of climate change followed by 'Problem of fodder and grasses'. Such impacts compel the hill women to conserve the water by active participation in the water conservation activities like construction of water conservation tanks (Table 9).

Other sources of water: With respect to development of other sources for fulfilling the water shortage, majority of women (70.67%) cited construction of 'tanks' followed by stand post and *naula* recharge by 56 to 57 per cent women (Table 7). Construction of trenches, check dams and afforestation (densification) respectively by 55.33 per cent, 41.33 per cent and 38 per cent women were reported as other means of overcoming the shortage of water. As much as 10 to 12 per cent women cited hand pumps and ponds. Least per centage of women (4-5%) told about *gool* construction. Check dams are small barriers built in the direction of water flow for the purpose of irrigation as well as for water conservation (Iyer, 2011). The trenches and check dams reduced soil erosion as well as conserve/store water for further use.

Table 7. Women's awareness to sources developed to meet water shortage.

Category	No.	%
Checkdam	62	41.33
<i>Gool</i>	06	04.00
Tank	106	70.67
<i>Naula</i> recharge	84	56.00
Ponds	19	12.67
Trench	83	55.33
Afforestation/densification	57	38.00
<i>Kachha</i> pond	32	21.33
Stand post	86	57.33
Handpump	15	10.00

Thus, construction of check dams in the study area has improved water level. Tanks/stand posts provided easy availability of water at doorstep, which led to most of the residents to mention these sources.

Measures for waste water treatment: Considering the shortage of water in the hills as very serious problem due to drying of natural resources and its impact on village life (Table 8), about 38 per cent women opined to treat waste water (Filtration, Contour trench and Chemical treatment) for reuse. More than half of the women (53.33%) in the study area reported no need for water treatment. This indicates that most of the women have access to the pure available water. Since majority of residents were using water pipeline as a source of water (Table 4) it is obvious that the water needed no treatment. Construction of ponds (*khaal*) and filtration was cited by 20 to 21 per cent women.

Table 8. Women’s awareness to measures for waste water treatment

Category	No.	%
Filtration	32	21.33
Construction of ponds	30	20.00
No need for water treatment	80	53.33
Contour trench	16	10.67
Chemical treatment	10	06.67

The natural ways of waste water treatment such as construction of ponds (*khaal*) and contour trenches and filtration of water might have been reported for reutilization of used water from washing, cleaning of livestock etc. This practice led to efficient utilization of water as it can be reused for cleaning of livestock and irrigation in kitchen garden. Considering shortage of water in hills, *Sharma (2002)* suggested for proper rainwater harvesting and treatment of poor quality water.

Table 9. Women’s participation in water management activities

Activities	No.	%
Quality analysis of Drinking water	61	40.67
Irrigation	81	54.00
Animal husbandry	144	96.00
Agro-forestry	17	11.33
Cultivation of crops	80	53.33
Furrow irrigation	08	05.33
Drip irrigation	08	05.33
Application of surface mulch	81	54.00
Construction of water conservation tank	139	92.67
Installation of Shallow Dug Hand pumps	32	21.33

Participation in water management activities: It is clear from data presented in Table 9 that the participation in water management activities by majority of women

(92 to 100%) was construction of water conservation tanks and animal husbandry. *Sah and Heinen (2001)* opined that most women in mountains expressed willingness to participate in water conservation like lake water. *Bhatt (2010)* also observed people’s participation in conserving water in hills and suggested that the women linked water availability can improve the health of forest and women will be able to tackle the problem of water shortage in the region.

In the activities like irrigation, application of mulch, cultivation of crops and quality analysis of drinking water, the participation of women was respectively 54, 54, 53.33 and 40.67 per cent. These activities are prime needs of the women in the study area; therefore, serious thought was given. Only 05 to 21 per cent women were found participating in furrow irrigation (*gool*), drip irrigation and installation of shallow dug hand pumps. None of the women favored the activities like fisheries and sprinkler irrigation system because these activities are not introduced as well as not preferred by the women in the region.

Environmental problems: Women were asked to give responses on three point continuum depending on the degree of seriousness by which the problem needs to be addressed. Categories were ‘Very serious problem’, ‘Serious problem’ and ‘Not a problem’ for which scores were assigned as 3, 2 and 1 respectively.

Table 10. Women’s opinion regarding environmental problems

Environmental Problems	WMS	Rank	Problem Level
Water shortage	2.74	I	Very serious
Water pollution	2.41	II	Serious
Environmental protection	2.02	IV	Serious
Air pollution	1.71	VII	Not any
Quality of neighborhood environment	1.85	V	Serious
Recycling of wastes	1.73	VI	Serious
Wastewater treatment	2.37	III	Serious

WMS-Weighted Mean Square

Women opined about environmental problems related to water use and considered water shortage was the very serious problem in the study area as depicted by highest WMS of 2.74 and ranked as I (Table 10). Water pollution (II, WMS 2.41), waste water treatment (III, WMS 2.37), environmental protection (IV, WMS 2.02), quality of neighborhood environment (V, WMS 1.85) and recycling of waste (VI, WMS 1.73) were

considered as serious problems by the women whereas air pollution was considered as not a problem to be addressed seriously (VII, WMS 1.71) in the study area. In Uttarakhand Himalaya, the drying of natural springs has posed a serious problem of water shortage (Negi and Joshi, 2002). Considering shortage of water in hills, Sharma (2002) suggested for proper rainwater harvesting, improvement in groundwater and treatment of poor quality water.

Facilities provided by Government agencies for water and forest conservation: Majority of women (96%) received facilities for 'Training and skill development', which was mainly due to the UDWDP operating in the study area since 2005 (Table 11). About 93.33 per cent women opined 'Reduction in water collection time' followed by 'Reduction in fuel/fodder collection time' (84.67%). It is evident from the Table 4 that government projects have made water available at doorstep through water pipeline, stand post, tanks etc. also growing fodder trees, grasses in farm sector and use of fuel wood from farm and regulated community forest through formation of *Van panchayat* has facilitated the women for availability of these usable leading to reduction in time of collection.

Table 11. Facilities provided to women for water and forest management by GRAMYA.

Facilities	No.	%
Training and skill development	144	96.00
Agricultural activities	091	60.67
Loan related	074	49.33
Livestock related	083	55.33
Extra income producing facilities	085	56.67
Participation in SHG	119	79.33
Employment	037	24.67
Reduction in fuel/fodder collection time	127	84.67
Reduction in water collection time	140	93.33

Multiple responses were allowed

More than two third of the women (79.33%) told about 'Participation in SHG' followed by 'Agriculture activities' (60.67%). Nearly half of the women (49 to 56%) mentioned that GRAMYA provided 'Extra income producing facilities', 'Livestock related' and 'Loan related' facilities within the village itself. Most of these facilities were available to the women due to the village developmental activities, particularly socio-economic, executed by the watershed project in the study area (UDWDP report-2011).

Correlation Studies: The correlation studies (Table 12) indicated significant negative relationship between age and forest management activities; however this was positive for water management activities. Considering the fact that water is mostly available at doorstep and all age groups can participate in water management activities and with increasing age, the working efficiency, that too away from the village, decreases which might have led to significant negative relation between age and forest management activities. The family size was negatively correlated with water management activities and significant positive correlation existed with forest management activities. Similar was the relationship between education and management activities. There existed significant negative association between annual income and water management activities. However, annual income was related with forest management activities in significant positive manner. Since water availability is mostly at doorstep (Table 6), the higher education percentage of women (Table 1) followed by more benefits from forest (Table 3) and dependency on forest for livelihood, women might have selected forest management activities as more important and mostly participated in this activities resulting in significant positive correlation of family size education and annual income with forest management activities.

Table 12. Correlation between selected socio-personal and economic variables and management activities for water and forest

Variables	Management activities	
	Water	Forest
Age	0.052	-0.276*
Family Size	-0.047	0.372*
Educational Status	-0.168	0.300*
Annual Income	-0.247*	0.282*

Table value at 5% = 0.273 (at n-2 d f)

CONCLUSION

Almost all the women were aware about the fact that forests were the main source of fuel wood and 97.33 % women were aware about the importance of forest in environmental protection. Majority of the women in study area (79.33 %) protected the forest to maintain complete environmental balance. Out of fifteen activities related to forest management activities, the women's involvement was mainly in plantation/afforestation and shrub cutting. Participation of women

in these activities was by 92 to 93 %. Water is mostly used for household and rearing livestock. Nearly 60 % of the women identifies landslide as one of the prominent reason for drying up of natural springs. About 46 % women attributed reduced rainfall as the cause of drying of springs followed by 34 % women cited hot weather as one of the cause creating adverse impact on village life owing to shortage of water. Waste water treatment was considered by about 38 % women in acute water shortage areas whereas majority of women expressed no need of waste water treatment as they were getting water from pipe line. Majority of women (92 to 100 %) participated in construction of water conservation tanks and animal husbandry activities. Water shortage was

the very serious problem in the study area as depicted by highest WMS of 2.74 and ranked as I whereas air pollution was considered as not a problem to be addressed seriously (VII, WMS 1.71). Majority of women (96 %) received facilities for 'Training and skill development', on water and forest conservation. The study points out that for proper conservation of water and forest, Government and local institutions should consider seriously for the overall development of entire villages in the hills. The correlation study indicated that increasing age leads to less participation in forest management activities while more family members, education and annual income leads to more participation in forest management activities.

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