

Climate Smart Agriculture Initiative through Integrated Watershed Management: A Case from Village Haripur-Narsinghdanda of Champawat District in Uttarakhand

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According to the Special Report (SR15) of the Intergovernmental Panel on Climate Change (IPCC), the impact of 1.5⁰ C⁴ increase in global temperature will disproportionately affect vulnerable households through food insecurity, increased food prices, income losses, less livelihood opportunities, adverse health impacts, and population displacement.

It is evident that the communities whose livelihoods are closely related to natural resources are facing more uncertainty due to the changing climate. During the last decade, Uttarakhand has experienced frequent occurrence of extreme events such as flash floods and cloud bursts resulting in devastating effects on the communities. Furthermore, the changing climate has resulted in changing cropping patterns in the region. Cultivation of traditional crops such as local millets, buckwheat, soybean and barley are in the decline in the region. The output from agriculture is much less considering the soil and environmental conditions. On the marketing front of farm produce too, the efforts need to be stepped up. Markets are dominated by a few private players and the regulated markets are not so active. Almost the entire horticultural produce of the area is either consumed locally or is collected by some contractors.

The present case study provides a view of farmers' innovative efforts in the Haripur-Narsinghdanda Gram Panchayat of Champawat district in the state of Uttarakhand, and represents the Climate Smart Agriculture approach adopted by the village community through participatory watershed management activities. It represents a successful case towards strengthening resilience and adaptive capacity to climate related hazards and natural disasters. For better representation of the case, an effort has been made to bring out the initiatives taken by the local community to enhance their livelihood through sustainable agriculture development integrating with climate change adaptation. The efforts of farmers have not only addressed the impacts of climate change to large extent but has also strengthened the food security and livelihood opportunities in the village.

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⁴ Special Report (SR15) of the Intergovernmental Panel on Climate Change (IPCC) October 2018

1. Geographic and Demographic Profile

A part of the Western Himalayan Region, Haripur-Narsinghdanda is a small Gram Panchayat (GP) located at an altitude of 1750 mts in the Dhamisaun micro-watershed of Champawat District in Uttarakhand. Climate here is temperate to subtropical; the average temperature remains 5°-30°C. During monsoon season, the area receives 75% of rain, with an annual rainfall of 1200 mm. The area of GP Haripur-Narsinghdanda is 175.075 Ha which is spread over 11 hamlets having a population of 833 (Male: 442, Female: 391)⁵. The economy is highly dependent on climate sensitive sectors like agriculture, horticulture and livestock, with other economic activities being limited. Rain-fed agriculture is practiced in nearly 60.83 percent (i.e. 106.492 Ha)⁶ of the total agricultural area of the GP, predominantly by marginal farmers, who are directly impacted by the changing climatic conditions. The Himalayan region has been identified as being not only highly vulnerable to the impacts of climate change, but also having a low capacity to adapt to the constraints. The instability of climate has further accelerated the process of marginalization of the village communities.

2. Rationale for the Initiative

Hill and mountain habitats have five overarching specificities. They are: (i) inaccessibility; a product of altitude and terrain coupled with inadequate access infrastructure that hinder mobility, imposes isolation and “closeness”; (ii) fragility; a product of altitude, steep slopes, and other associated biophysical conditions that prevents higher intensity of land use, and limits both the physical and economic scope of input use; (iii) marginality, that results in limited and low payoff options and high cost of upgrading resources; (iv) diversity resulting from a high degree of spatial, temporal, physical and biological variability over short distances that at one level makes it difficult to achieve economies of scale but at the same time offers potential for higher productivity and specialization; and (v) niche which implies potential for products and services having a comparative advantage over the plains. It is evident that the communities whose livelihoods are closely linked to natural resources are facing greater uncertainty than ever before. Rain fed agriculture being primary occupation of the communities, exposes them to greater risks and makes them more vulnerable to climate change effects.

3. Socio-Economic Conditions and Needs of the Impact Group

The economy of the hilly regions of Uttarakhand is predominantly rural and highly dependent on climate sensitive sectors like agri-horticulture and livestock; other economic activities are limited. Agriculture is mostly practiced on sloping lands and in small patches of terraced lands and relies entirely on seasonal rainfall. To feed their livestock, farmers rely heavily on natural fodder resources including forest areas, thus adding to the continuous degradation of natural resources for fulfilling the various needs of village population.

⁵ Census 2011

⁶ Participatory Rural Appraisal Exercise conducted under Component 2 - Project Society Watershed Management Directorate (PSWMD) of Integrated Livelihood Support Project

Farmers from the village have migrated to urban areas or to the plains, which is a result of fragmentation of landholding and environmental degradation leading to water and fodder scarcity, impacting viability of agriculture and livestock related livelihood options that remain the mainstay of the hill economy. This already stressed situation has been further aggravated in recent times by the effects of climate change. Increasing variation in precipitation (both rainfall and snow), and temperature has altered the soil moisture availability, plant phenology and viable altitudinal range, and pest susceptibility. The families of farmers cultivate crops in limited area for just fulfilling their household needs, resulting in increase in area under fallow land in the region. Due to subsistence livelihood prevailing in the region, migration and remittance economy operates in the region. Therefore, there is a need to develop and improve agricultural standards of the region, to enhance the livelihoods of the village community.

4. Prevailing Issues

Champawat District is highly vulnerable to climate mediated risks. Due to anthropogenic increase in greenhouse gas emissions, the atmospheric temperature of the area is rising, resulting in recent natural extreme weather events like upward movement of snowline, depleting natural resources, erratic rainfall, irregular winter rains, advancing cropping seasons, fluctuations in the flowering behavior of plants, shifting of apple cultivation zones, and other crops, reduction in snow in winter & depletion off perennial streams. The problems experienced due to specific reasons are mentioned as under-:

4.1 Rising Temperature

The region has experienced an increase in maximum temperature up to 1 degree centigrade. The impact of rising temperature has led to shifting of apple orchards towards higher altitudes. Increased vulnerability of agri-horti sectors and absence of any other livelihood options has resulted in migration of productive labor. Some of the other patterns observed due to rise in temperature are: change in cropping patterns, greater losses in winter crops as compared to rainy season crops, increase in pests and diseases, infestation in crops, decline in the production of wheat and potato and consequent adverse impact on food security, reduction in traditional crop diversity (For example, finger millets, barnyard millet etc.), degradation of soil and declining soil moisture due to increased heat stress and early snow melting, and decline in availability of fodder and its adverse impact on animal husbandry among others

4.2 Changed Precipitation Conditions

There has been a decrease in water availability in the streams and rivers in summer due to decreased snow fall. Increased run-off, less infiltration and loss of surface soil on steeper mountain slopes accelerate the rates of siltation and flash floods. Increased run-off coupled with removal of forest cover, have already started showing signs of depleted hill aquifer regime. Overall trend shows decrease in water availability in the area. Streams and natural springs that used to act as the lifeline of the mountain communities by providing much needed water for drinking and agriculture during dry spells, are drying up.

4.3 Extreme Weather Events

Intense rainfall coupled with deforestation, sloping terrain and loose soil have led to soil erosion and loss of fertile soil, thereby making agriculture impossible. The process of land degradation and loosening of soil has further catalyzed:

Sudden events leading to total loss of crops and property

There has been increased instances of landslides compared to the past. Sudden weather events like hail storm in 2009 have heavily impacted crops and increase in losses. Cloud burst in June 2013, resulted in major natural devastation.

Land and soil degradation due to intense rains

The increasing pressure on forests have increased the man-animal conflicts, resulting in decline of biodiversity. There area is witnessing proliferation of invasive species (Lantana), increased requirement for feed supplements for livestock fodder scarcity and resultant drudgery for women.

5. Project Approach and Activities Undertaken

Participatory Watershed Development is a component of the Integrated Livelihood Support Project (ILSP) funded by International Fund for Agriculture Development (IFAD) and being implemented by Watershed Management Directorate, Dehradun in Haripur-Narsinghdanda Gram Panchayat. This is being done by the local Gram Panchayat institution, Village Water and Watershed Management Committee (VWWMC) headed by the Gram Pradhan in the form of Participatory Watershed Management, Food Security & Scaling Up, Access to Market and Monitoring & Evaluation and Knowledge Management.

The main objective of the project which was launched in the year 2012 was to reduce poverty through developing livelihood of the village community in the Micro Watershed (MWS) area. Under the project, the community decides, plans and implements all the activities to be carried out in the Gram Panchayat area. At the Gram Panchayat level, Gram Panchayat Watershed Development Plan (GPWDP) is prepared which enlists the different activities decided by the community and the budget allocated for each activity. Along with watershed activities, climate smart agriculture has been given importance to provide livelihood options at producer group level in conjunction with climate resilience.

The steps taken to implement the project are mentioned as under:

5.1 Problem Identification

After the inception of project, a series of Participatory Rural Appraisal (PRA) exercise was carried out in the Gram Panchayat to provide an open platform to the participating community in identifying the problems/issues and possibilities in Natural Resource management (NRM), agriculture, horticulture, and other village based interventions with the help of community. Participatory Rural Appraisal (PRA) exercise was carried out for

validating the information gathered through secondary sources. These include Historical Transect/ Time Line, Resource Mapping, Social Mapping, Seasonal Diagram+ Daily Activity Schedule, Venn diagram/ Chappati diagram, Livelihood Analysis, Focus Group Discussions, Tree Matrix, Wealth Ranking and Transect Walk to identify the existing resources, issues of the Gram Panchayat. The information derived from this activity helped in preparation of Gram Panchayat Watershed Development Plans (GPWDP). During the PRA exercise it was found that while the agricultural land was depleting and the farmers grew only staples for self-consumption, majority of the farmers did not reach food self-sufficiency. Further, farmers also claimed that the perennial water sources were depleting and water for irrigation was not available, leaving agriculture completely rain-fed.

5.2 Preparation of GPWDP Plans

GPWDP was prepared with the help of village community highlighting the activities to be performed under the project. A budget of INR 54 Lakhs was allocated for the area to implement watershed activities as mentioned below:

- i. Natural Resource Management: Under this sub activity Assisted Natural Regeneration of Oak (ANR Oak) was carried out in 10 ha. and plantation of trees in another 10 ha. area in the Gram Panchayat.

In the inter Gram Panchayat space, in a total of 205.87 Cu M area, crate wire check-dams were built and 312.73 Cu M area of dry stone checkdams were constructed. In an area of 314.32 Cu M, retaining wall were constructed as part of soil and moisture conservation activities. In addition, for the catchment area, treatment recharge pits, dug out ponds and contour trenches were made.

- ii. Water harvesting and Minor Irrigation: A total of 2 irrigation tanks and 29 rooftop rain water harvesting tanks were constructed.
- iii. Agri-Horticulture: Orchard development was done in 0.87 ha along with 3 ha of homestead plantation. In addition to these, 6 poly houses were also constructed.
- iv. Livestock: Napier crop border plantation was done in 6.5 ha and stall feeding is being promoted in the area.
- v. Rural Access: Last mile connectivity was established through construction of small bridge and 0.52 kms rural road.
- vi. Access to market: In-order to support market linkage activities for agri-horticultural produce a self-reliant Cooperative Society was registered in the year 2017 under the name of 'Bishjula Ajeevika Swayatt Sehkarita, Khalkadiya,' which has been equipped with all the necessary equipments and a large collection centre for processing, grading, sorting and packaging. To provide efficient backward linkage, this collection centre was linked with three small collection centres located at village level (Haripur-Narisnghdanda, Ladabora & Badpass). Farmers from the different producer groups of the area are board members of the cooperative society holding responsibility for the management as well as business activities carried out by the cooperative society.

vii. Agronomic measures to adapt to climate change: Furthermore, on the basis of adverse climatic events for agriculture cultivation like early season drought, mid-season drought, terminal drought (early withdrawal of monsoon), continuous high rainfall in a short span leading to water logging, outbreak of pests and diseases due to unseasonal rains, extreme events like heat wave, cold wave, frost etc., contingency measures are being taken which include change in crop, cropping system including crop diversification and agronomic measures as per adverse climatic conditions. Some of the agronomic measures which are taken as per the climatic conditions in the region are:

- **Early Season Drought:** In case the delay is by 2-4 weeks the cropping pattern was changed from Potato-Wheat-Potato to delayed sowing of kidney beans/ french beans. In case of delay of 6 weeks, kidney beans is replaced by vegetable pea and if the delay is 8 weeks then sowing of radish, vegetable rai, and organic practices to control late blight of potato is followed.
- **Mid-Season Drought:** In case of long dry spell of consecutive 2 weeks rainless (>2.5 mm) period at vegetative stage, gap filling in kidney beans and inter culture operations are carried out. At the flowering stage, organic management of cut worm is practiced.
- **Terminal drought:** In case of early withdrawal of monsoons, harvesting at physiological maturity stage of kidney beans is carried out. For the Rabi season, mostly early maturing crop varieties like *Toria* etc. are preferred.

The above activities form a package for resilience against climate change

6. Impact of the Initiative

As part of the project, intermediate Impact Assessment was carried out in February 2018 by an external agency. The Impact Assessment Report highlighted the following positive impacts of the initiative:

6.1 Micro Watershed (MWS) Profile

Soil fertility is reported to have improved. The factors resulting this change are the use of organic composting, repairing terrace farming, mulching, use of organic fertilizers, and adoption of other soil and moisture conservation practices such as minor irrigation

6.2 Revenue Village Level Profile

- Majority of the farmers in the study area grow two crops per year after project interventions
- Marginal farmers, having an agricultural area of less than 0.5 ha, account for 75 percent of the total farming HHs. Small farmers comprise 23.7 percent of the total farming households
- Among the modes of irrigation, there is a rise in the area irrigated using percolation dams, and irrigation tanks

- Producer Groups as a source of credit has received positive response in the project area
- The reported agricultural income indicates considerable improvement in income from fruit cultivation
- The average number of milking cows and buffaloes per household has increased over time
- The most popular livestock services utilized by majority of the households has been artificial insemination and livestock vaccination for both baseline and Impact Assessment survey

6.3 Household Assets

- About 95 percent of the sample households in this survey have access to a toilet within the house or shared/community toilet; while the corresponding figure for baseline survey was about 84 percent
- Average distance travelled to access drinking water has marginally reduced for all the three seasons as compared to the data collected during baseline survey
- Ownership of household assets has improved from the Baseline survey till Impact Assessment survey

6.4 Access to Financial Services

- Almost all the households in the study area have bank accounts
- During baseline survey, only one-fourth of the households in the project area were reported to be involved in regular savings whereas, during Impact Assessment survey, 68 percent of the sample households in the project area are practicing regular savings
- The trend of availing a credit from local moneylenders has waned in the project area, still a considerable percentage of households tend to depend on local moneylenders for emergency loans

6.5 Producer Groups (PGs)

- During the survey, it was noted that all the sample households are part of producer groups; of these, 26.4 percent hold leadership positions
- The percentage of households that attended training pertaining to micro-finance and linkages with external funding sources has increased
- 10 percent of the sample households who are part of producer groups are part of livelihood collectives formed under the project ILSP. Of these, 90 percent have reported using services provided under livelihood collectives. Largely, these services range from providing farmers with agricultural input supplies, awareness generation, and preliminary processing of agricultural produce

6.6 Migration

- The proportion of migration has increased from 22 percent (baseline survey) to about 32 percent. Prevalent cases of migration are temporary and seasonal in nature
- 40 percent of the sample households cite reasons such as better opportunities in terms of education, health, and employment , for migration

6.7 Gender and Empowerment

- Comparing the average number of hours spent by men and women in the study area, the women spend a considerable portion of time in agriculture related activities
- Most of the decisions on key matters in the household are largely taken by the family. Womens' participation has marginally improved in the decision-making process of the family

6.8 Vulnerability

- Majority of the sample households have faced extreme events such as the prevalence of droughts, hailstorms, torrential downpour and pest infestation etc.
- The analysis shows that droughts and torrential rains occur more frequently than other types of extreme events, and their severity and negative impact on households are also more. Floods and flash floods are not as severe as droughts and torrential rains, though they impact about one-fourth to one-third of the population. Forest fires occur every year as mentioned by 63 percent of respondents. Pest infestation impact 75 percent of the households every year.

7. Scale and Sustainability of Programme

For the sustainability of the project interventions, three pronged efforts were made:

- 1) Economic sustainability of important project activities for vegetable cultivation under poly house structures and fruit tree plantations;
- 2) Ecological sustainability, to ensure focus on regeneration of natural resources such as ground water, degraded pastoral lands; and
- 3) Institutional sustainability, to build capacities of producer groups, vulnerable producer groups, a livelihood collective, Self Reliant Cooperative Society was registered in the year 2017 under the name of Bishjula Ajeevika Swayatt Sehkarita, Khalkadiya.

All the activities under the project are based on community participation and engagement, which has ensured the involvement of all the participants in the process from planning, implementation through to evaluation. Early stage involvement of the participants in the project has helped in formulation of strategy and execution of activities of Gram Panchayat. In the process of formulation and execution, the participation of women, youth and

landless poor families was ensured in order to have inclusive implementation and benefit sharing at different stages.

As a part of the project intervention, formation and strengthening of user groups, producer groups, vulnerable producer groups were proposed. The livelihood collective has been strengthened to handle the marketing of agri produce including vegetables (tomatoes, capsicum) and other products. A team of resource persons in the village have been identified and trained for various technologies proposed under the project. The local resource person is representing community interests and is the interface between the community and local technical experts as well as the Government. linkages. The project has also helped in improving the capacity of the local community in order to develop and support future adaptation actions.

Physical and community assets built under the project are managed by the Community Users Group and a guideline for using the community assets have been developed and signed by the users. Technical support has been provided by experts from the project. The ownership and maintenance of the structures rests on Gram Panchayat and Water User Groups. The village committee decides upon the operational issues related to activity. There is a mandatory agreement between the user group and Panchayat for the management and maintenance of the assets to be created. This is particularly so for watershed maintenance funds.

Income diversification through adoption of technology based activities is expected to be sustainable because of well-established marketing linkages that will provide better returns from the produce. This initiative is supported under the project, through intensive planning in harvest season, set up of collection centers and direct linkages with the markets. All these are executed by the livelihood collectives established in region for different produce proposed under the project. The livelihood collective has been provided with three staff who are selected from amongst the educated youth of the village itself.

Livestock is a secondary source of income for the community. This source of livelihood is important for income diversification and minimising the risk of vulnerable communities. The local communities are supported by providing animal health care services in the villages under the project. Besides, cultivation of fodder trees in Gram Panchayat has increased the green fodder stock in the village, which is beneficial to enhance the digestion process of livestock and decrease GHG emission level caused by livestock. For making this activity sustainable, these farmers are being linked with network of collection centre of Anchal Dairy in the nearby villages. This linkage has provided long term assurance of returns from their milk produce along with other privileges such as patronage bonus, loan facility and input support facility from the Dairy.

Knowledge generation from field evidence and dissemination of these field based best practices to larger audience for policy inputs and replication through various Government as well as Non-Governmental Organizations is carried out under the project.

8. Scope for Further Replication

Public representatives, community leaders and officials from the Government are being involved in visits to field sites to sensitize them on the field level issues and to influence policy, planning and resource allocation decisions. The best practices and case studies on climate smart interventions are being disseminated through local and national media to create required acceptability by mainstream funding agencies. This is facilitating further replication of proven and successful interventions for the benefit of hill communities in rest of the Northern Western Himalayas.

9. Conclusion

The successful implementation of these activities in the Haripur-Narsinghdanda Gram Panchayat is a step towards strengthening resilience and adaptive capacity to climate related hazards and natural disasters. Project inputs, as a whole has brought farm diversification, reduction in vulnerability, and promoted environmentally sound and sustainable livelihood. The interventions have addressed the issues of drudgery of women by improved access to water, making available fodder and alternative sources of water. The village communities are now able to irrigate their land even during unfavorable climatic conditions. Due to this, it is hoped that in the coming future, the migration of youth from the village in search of employment will decrease because of greater access to employment opportunities within the village.

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