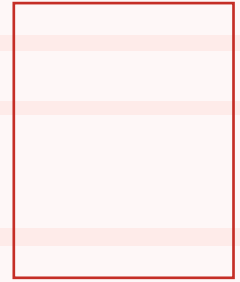


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Title : *Impact of Rural Hill Road on Agro-Hydrology and Livelihood Transformation of Chakkhu Khola Sub-Watershed, Bhaktapur, Nepal*

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Background

Despite being an important contributor to both GDP and export earnings, agricultural growth in Nepal has remained sluggish since the 1980s. The main reason is the lack of connectivity with the market for the rural farmer, this dents delivery and supply. With the extension of hill road development, rural people get access to modern technology, and this creates potential for agricultural transformation, leading to agricultural intensification, diversification and commercialization. Agricultural intensification can bring about livelihood transformation for the rural population.

Besides contributing to the rural economy through its linkages with agricultural intensification, opening of roads in the rural areas is also likely to impact local hydrology and environment in terms of the changes in the land use, agricultural practices and cropping system and the alterations brought to the landscape. A significant change expected to result from rural road development is changes in the water demand due to agricultural intensification and livelihood changes.

The changes brought to the local hydrology and upstream water demand are likely to influence the livelihood of downstream people due to reduction in the dependable water flow and increased incidences of flood and other forms of water hazards on the downstream.

Objective of the Study

The main objective is to evaluate the impact of rural road development on agro-hydrology and livelihood transformation in Sipadol sub-watershed in Bhaktapur district.

Study Area

Chakkhu Khola Sub-Watershed, where this study was undertaken, lies in Sipadol VDC in Bhaktapur District. The landscape of the study area is north facing with the road under the study traversing almost centrally through the study area from south to north. This landscape of the VDC consists of plane to relatively plane area to the north and ridge to the south with the general drainage pattern in south to north direction. Chakkhu Khola that flows almost centrally through the VDC is the major drainage stream in the study area.

Methodology

The PRA tools like time trend analysis, Focus Group Discussion, Field Observation and Key Informant Survey and semi-structured questionnaire household survey were used. Secondary information and data were collected from different sources such as VDC, DDC, District level offices of Road, Irrigation and water supply to supplement the primary data obtained. Map analysis was used to track the changes resulting from the development of the road connectivity. These changes were analysed with respect to the agro-hydrology and water supply situation.

1. Results and Discussion

A significant change in land use and land cover was revealed during the period 1997-2006. There is a clear shift in the increase in the area under intensive crop cultivation from tail to head reaches from 1997 onwards and the most important reason for this shift is the development of roads. Similar pattern was also noted in the increase in the area under settlement. The demographic changes in the study area have been as a result of the changes in the population due to migration at different periods of time while the livelihood changes have been due to increased opportunities with the increased access to the market. Migration of people into the study area was triggered with the development of the road and increased accessibility of the area resulting thereto. Increase in population has been the highest the lower reach due to proximity to the highway and access to transportation and market and other services. There has been distinct pattern of settlement of people belonging to different caste/ethnic groups in different parts of the study area.

The pattern of change in the occupation reveals that the engagement of the people in farming has decreased substantially. This shift in the occupation can be largely accrued to the development of roadways. As a result, the number of households dependent solely on food purchased from market has increased. The situation of food sufficiency of households improved.

There is increase in the number of households with access to piped water supply in the study area between 1992 and 2009. With the increase in the access to piped water supply, the use of dug wells, rivers and springs for domestic water supply was noted to have reduced in the study area. There has been significant change in the sanitation behavior related to increased income opportunities of the people and increased access to information and communication in the study area.

The two crop changes observed are increasing shift from cereal based cropping to vegetable cultivation during winter and spring seasons and shift from maize and millet farming to rice based cropping.

The flow of water in this stream has been decreasing over time. Disposal of grey water from the households into this stream and increasing extraction of sand and boulders from the stream in the past has rendered this stream polluted. The available water supply in this stream is unreliable for downstream irrigation use.

The situation of flow characteristics of the streams revealed that the flow in the streams throughout the sub-watershed has been declining over time, both in the volume and the duration of flow, and that this decline of flow is more apparent after 1997.

Different sources domestic water such as dug wells, stone spouts, springs and rivers, community water taps and private piped water connection have been exploited for domestic use in all the study areas. But overtime with the development of study rural road significant changes in the source of water being tapped for domestic purposes has been changing.

The change from cereal based traditional cultivation to commercial vegetables cultivation pattern is more pronounced in the upstream areas with better availability of water for irrigation. This has led to enormous increase in water demand in agriculture. To overcome the water scarcity for agriculture in the downstream, a new community irrigation scheme, called Palabu kulo has been recently developed at the tail reach.

6. Summary and Conclusion

Expansion of settlements which was concentrated at the lower end 1997 was found with the development of the road with significant impact on the land use and land cover changes in the study area.

The flow in the three streams in the study has declined because of water extraction on the upstream to support the irrigation needs in the area under intensive vegetable cultivation in the upstream. The frequency and events of flooding, landslide and mass wasting and soil erosion were found to have increased in the recent years.

Agricultural intensification not only contributed in improving the livelihood of the people but also triggered water scarcity on the downstream due to increased domestic and agricultural water uses in the upstream. Increasing trend of direct pumping of water from the streams and rivulets was noted on the downstream of the study area to support the irrigation needs in the crops.

Major change has been increase in the number of households served with piped water. With increased trend of improvement in the livelihood and living standard, domestic water consumption of people has changed.