

Geospatial Resource Information System for Decentralized Planning & Decision Support in Himachal Pradesh, India

Meher Kaushal (1), Sunil Sharma (2) & Brijesh Saklani (3)

1 Department of Electronics & Communication, SRM Institute for Science & Technology
Chennai, Tamil Nadu, India

2 Haryana Space Application Centre (HARSAC), Hisar, Haryana, India

3 Aryabhata Geo-informatics & Space Application Centre

State Council for Science Technology & Environment, Shimla, Himachal Pradesh, India

Email: meherkaushal15@gmail.com

Key words: Panchyat, spatial, GIS, remote sensing

ABSTRACT: The process and practice of planning are getting decentralized to lower area units to make them area specific and responsive to needs of local people. The XIth five year plan (2007-12) lays emphasis on drawing up of development plans by grass root Institutions, capacity building of these institutions and requirement of sharing developmental information with the beneficiaries. The Gram Panchayat is the foundation of the Panchayat System and it is extremely important to empower Gram Panchayat in terms of resource database creation and use of the same for better future. The present day planning is mainly dependent on the non-spatial and secondary information. Spatial information of the available resources is a pre-requisite for developing grass root level developmental plans, attaining the goals and time bound completion of the developmental-plans. A new wave of technological innovation is allowing us to capture, store, process and display an unprecedented amount of spatial information about natural resources and infrastructure development. Geospatial Resource Information System is designed for the identification and mapping of the local resources spatially and understanding the problems and potentialities of each resource. It provides the basic details in GIS format which serves as a base for planning the development activities of the Departments like Planning, Agriculture, Soil Survey, Soil Conservation, Irrigation, Ground water, Rural Development etc. Geospatial plan helps in upkeep of existing infrastructure, identifying gaps in the existing facilities and planning establishment of an asset based on geospatial analysis of various variables including terrain and topography, action plan generation for rural development works, check duplicity of works, measure and monitor distribution of beneficiaries and regional and sub-regional imbalances.

1. INTRODUCTION

Recent technological advances in domain of spatial technology are making considerable impact in planning related activities. Timely and reliable information in cost effective manner in spatial and temporal domain, which can act as a reliable base line information on natural resources at scale ranging from regional to micro levels, can be generated by Geographic Information System (GIS), which can help for integrated analysis of natural resources inventory, management and planning the strategy for sustainable development and stand as a power effective administrative and management tool for decision making. The GIS provides an added dimension to data analysis which brings us one step closer to visualizing the complex patterns and relationships that characterize real-world planning and policy problems. (Ambasta, 2010; Asadi et al., 2011; Manikkumaran, 1997; Mukherjee, 2011; Scaria and Vijayan 2012; Jain K and Subbaiah, 2007). In the view of above, a project was undertaken to develop Panchayat Resource Information System of Malyanna, Chamyana & Pujarli Panchayat of Mashobra Block of Shimla District of Himachal Pradesh using geo-informatics.

2. MATERIALS & METHODOLOGY

2.1 Study Area

The Three Panchayats selected for the present study named Chamyanna, Malyanna and Pujarli lie in the Mashobra block of Shimla district and are adjoining to the Shimla Urban Area. The Shimla District lies between 30°45" to 31°44"N Latitude and 77°0" to 78°19"E Longitude. It has geographical area of 5131 sq. km (Balokhra, 2005; Jeart, 2005).

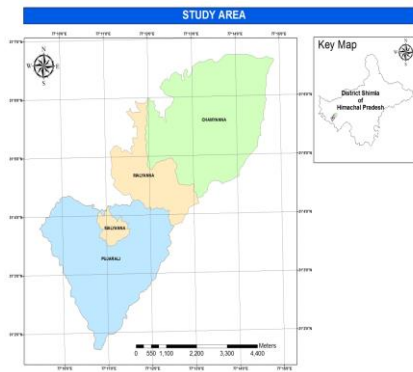


Figure1 Location map of Study Area

2.2 Data Used

The details of various spatial and non-spatial data used in this study area are given below:

2.2.1 Remote Sensing Data

Cartosat - I images are the basic remote sensing data which has been used for mapping the Panchayats.

2.2.2 Ancillary/Collateral Data

Administrative boundary of State, District, Block and Panchayat, Panchayat Asset Registers

2.2.3 Ground Truth Data

The location of various natural and manmade resources was determined with the help of Maps and Global Positioning System.

2.2.4. Mapping & Creation of Geo-database

- Field Survey: The Ground Control Points (GCPs) were taken using GPS Mobile (Samsung Wave 525)
- Geo-Referencing: The satellite data was geo-referenced in Arc GIS
- Layer Creation: The following raster and vector layers were created in Arc GIS
 - Land use/Land Cover
 - Digital Elevation Model,
 - Drainage,
 - Roads
 - Water Tanks
 - Educational Facilities,
 - Medical Facilities
 - Veterinary Institutions
 - Anganwaris
 - Other Socio-economic structures
- Map Creation:-The map outlay was created in Arc GIS

3. RESULTS & DISCUSSION

3.1 Natural Resources

3.1.1 Land use/Land cover & Digital Elevation Model

The Land cover corresponds to the physical condition of the ground surface, for example forest, grassland, etc. while land use reflects human activities such as the use of the land, for example industrial zones, residential zones, agriculture fields etc. Identifying, delineating, and mapping land cover is important for resource management and planning activities. The total sprawl of the study area covering three panchyats is 32.07 sq. km. Approximately 14.37 sq. km, 3.63 sq. km., 12.65 sq. km. and 1.42 sq. km area falls under forest, agriculture and grassland and settlements respectively. The catchment area of the Chamyanna Panchayat, Sargheen, Goasan and

Beolia Villages of Pujarali Panchayat and the Malyanna village of the Malyanna Panchayat are extensively covered by the rich forests. Vegetables are mainly grown on agriculture area (**Figure 2**).

The Digital Elevation Model (DEM) represents the relief structure (elevation) of an area. The use of elevation data improves information extraction especially in hilly states like Himachal Pradesh. The elevation data, integrated with imagery are also used for wetlands and forest management, tourism, route planning, etc. The elevation in the study area ranges between 1238-2601m. (**Figure 3**).

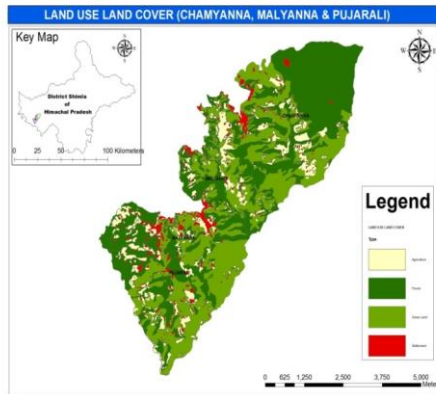


Figure 2 Landuse /Landcover of the study area

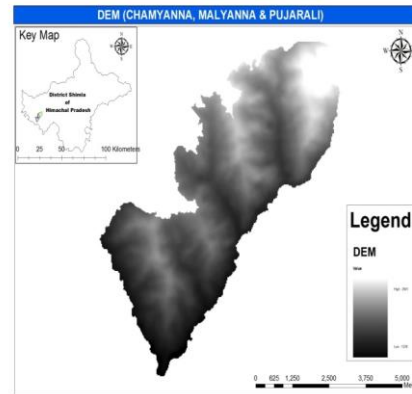


Figure 3 Digital Elevation Model of the study area

3.1.2 Drainage & Hydrology

Drainage is the natural or artificial removal of surface and sub-surface water from an area. Many agricultural soils need drainage to improve production or to manage water supplies. The drainage system is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography as well as gradient of the land. The **Figure 4** shows the drainage system of study area which provides water for drinking, agriculture and other purposes to the people. The drainage map also helps to identify the best location for water tank and other infrastructure to store water. There are three main streams in the study area. All these meet at a point called ‘Dogla Nala’. These carry excess rain water from hills in the rainy season. Physiography of the three panchayats separates these from each other and meets near the Sadhupul and Dogla Nala.

Hydrology is the study of water on the earth surface, whether flowing above ground, frozen as ice or snow, or retained by soil. Hydrology is inherently related to many other application particularly forestry, agriculture and land cover since water is a vital component in each of these disciplines. Most hydrological processes are dynamic not only between years, but also within and between seasons, and therefore require frequent observations. **Figure 5** represents the hydrological system of the study area and includes drainages, water tanks, tubewells, bawadies and hand pumps. Water tanks are mainly constructed under the Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) scheme. Bawadies are mainly used for drinking water.

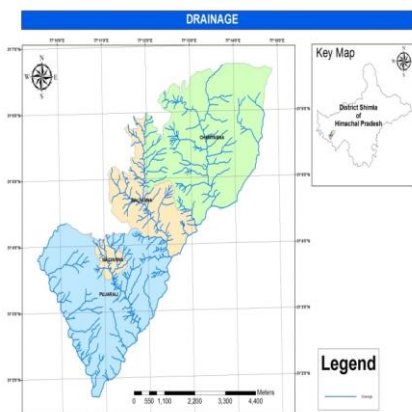


Figure 4 Drainage system in the study area

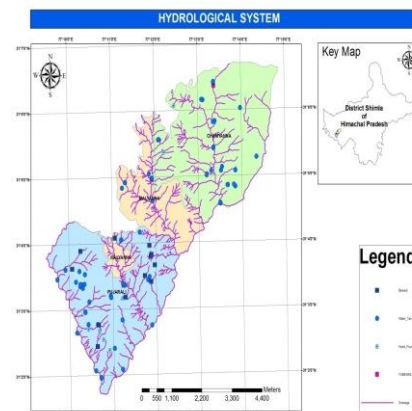


Figure 5 Hydrological system in the study area

3.2 Infrastructure

3.2.1 Medical Institutions & Veterinary Institutions

The health care system and infrastructure in India, at present has been developed as a three-tier structure to provide health care services to the people. The first tier, known as primary tier, has been developed to provide health care services to the vast majority of rural people. The primary tier comprises three types of health care institutions: sub centre, primary health centre, and community health centre. Rural health care institutions are established and maintained by the state governments out of funds provided to them by the central government under the minimum needs programs. The primary health centres are the only medical institution in the study area. They provide the basic medical facilities and other medical aids to the villagers. **Figure 6** depicts the location of health centres in the study area. The Chamyanna panchyat has one Primary Health centres while pujarali panchyat has one primary health centre and one Ayurvedic Health Centres providing the basic medical facilities to the population.

The Veterinary Services and Animal Health facility is being provided to the livestock owners of the State by a network of 3449 Veterinary institutions. Apart from these institutions, 1251 Veterinary Dispensaries have been opened under Mukhyamantri Arogya Pashudhan Yojna providing following services

- Treatment of Ailing animals in the institution as well as at the door step of the farmer.
- Prophylactic vaccination of the animals against contagious disease.
- Dipping and drenching of animals against ectoparasites and endoparasites.

There are four Veterinary Institutions in the study area. Two veterinary dispensaries are located in the Pujarali panchayat at Dhamechi and Sargheen village, whereas one veterinary institute is located at Chamyanna and Malyanna Panchayat each (**Figure 7**).

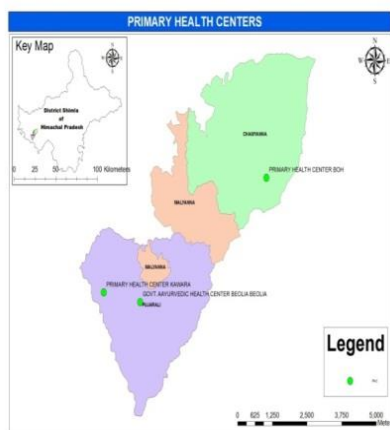


Figure 6 Medical Institutions in study area

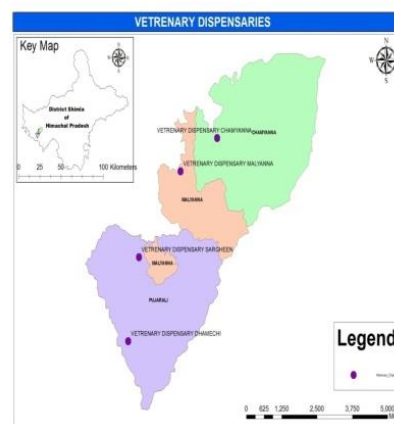


Figure 7 Veterinary Institutions in study area

3.2.3 Educational Institutions

Education is universally recognized as a powerful instrument of social change. Sarva Shiksha Abhiyan (SSA) is a flagship and comprehensive programme initiated by the government of India during the ninth five year plan aiming at universalization of elementary education across the nation. The study revealed that there are five Govt. Primary Schools, one Govt. Middle School and one Govt. Senior Secondary School in the Chamyanna Panchayat and five Govt. Primary Schools and one govt. senior secondary school in the Pujarali Panchayat (**Figure 8**).

Anganwadis were started by the Indian government in 1975 as part of the Integrated Child Development Services program to combat child hunger and malnutrition. A typical Anganwadi centre provides basic health care in Indian villages. These centres provide supplementary nutrition, non-formal pre-school education, nutrition and health education, immunization, health check-up and referral services. The study revealed that there are four anganwari centres in the Chamyanna panchayat and two anganwari centres in the Pujarali panchayat (**Figure 9**).

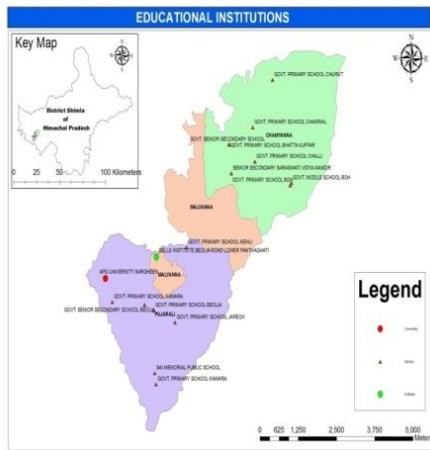


Figure 8 Educational Institutions in study area

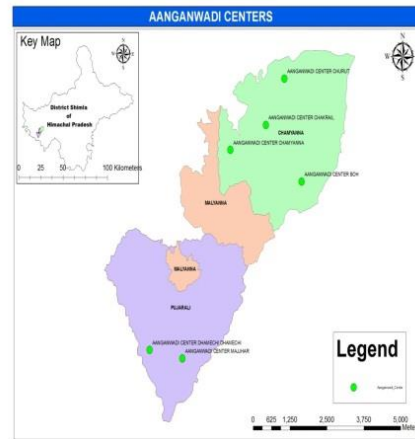


Figure 9 Aanganwari Centres in the Study Area

3.3 Assets Created Under Various Schemes

The spirit of India lives in villages and only by changing the face of rural areas, there will be better future for the State and nation as a whole. The Rural Development Department is engaged in changing the face of rural Himachal through its many fold development schemes, working in a participatory manner with the rural folks. (Report of National Bank for Agriculture and Rural Development (NABARD), HP, 2009; Annual report of Planning department Government of Himachal Pradesh, 2008; Annual Report., 2011; India Infrastructure Report, 2007; Report on Total Sanitation Campaign (TSC) in Himachal Pradesh, 2011).

3.3.1 Pradhan Mantri Gram Sadak Yojna (PMGSY): Rural roads

Rural road connectivity is not only a key component of rural development by promoting access to economic and social services and thereby generating increased agriculture income and productive employment opportunities in India, but is also a key ingredient in ensuring sustainable poverty reduction. Pradhan Mantri Gram Sadak Yojna (PMGSY) is a centrally sponsored scheme with the primary objective of providing connectivity by way of an all-weather road to the eligible and un-connected habitations in the rural area. The PMGSY also permits the up gradation (to the prescribed standards) of the existing roads in those districts where all the eligible habitations of the designated population size have been provided all weather road connectivity. The study shows that all the villages are connected through the pedestrian ways. The pedestrian ways are constructed under the MNREGA Scheme (Figure 10 and Figure 11).

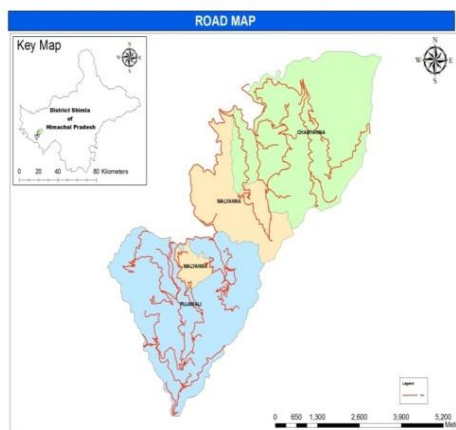


Figure10 Road map of study area

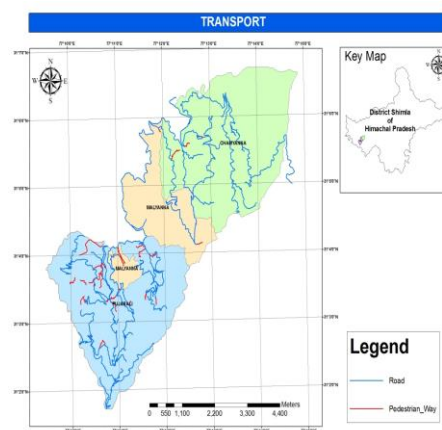


Figure11 Pedestrian Way in the study area

3.3.2 Indira Awas Yojana/ Indira Awas Yojana: Rural Housing

Indira Awas Yojana (IAY) is a Centrally Sponsored Scheme. Under this Scheme, assistance of Rs. 38,500/- per beneficiary is being provided to Rural Below Poverty Line (BPL) families for the construction of new houses upto 31-3-2010. The selection of beneficiaries is being done by Gram Sabha. Atal Awas Yojana (AAY) is a State sponsored scheme aimed at providing housing facility to Rural BPL houseless families. Under this scheme,

assistance of Rs. 38,500/- per beneficiary is being provided to BPL families for the construction of new houses upto 31-3-2010. Now w.e.f. 1-4-2010, the assistance has been enhanced to Rs. 48,500/- per unit. The selection of beneficiaries is being done by Gram Sabha. **Figure 12** shows that four houses are built under Awas yojna in Chamyanna panchyat as compared to one in Pujarali panchyat.

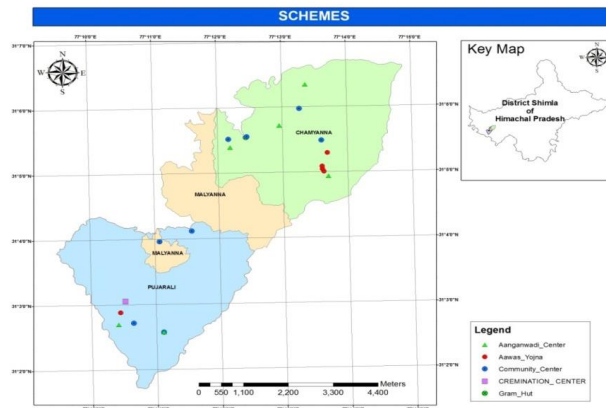


Figure 12 Distribution of Awas Yojna schemes, Aanganwadi Centres, Community Centres etc

3.3.3 Mahatma Gandhi National Rural Employment Guarantee Act-2005 (MNREGA): Employment Generation Schemes

The Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) notified on 7th September, 2005, aims at better livelihood security of households in rural areas of the country by providing at least one hundred days of guaranteed wage employment, in a financial year, to every household whose adult members volunteer to do unskilled manual work permissible under MGNREGA.

The water tanks are mainly those spatial features in the study area which are constructed through different programmes like MGNREGA, Irrigation & Public Health Department (IPH), Panchayat and other funding agencies. Vegetables are mainly grown with the help of these water tanks. The construction of water tanks have benefited the villagers in two ways by providing the employment to the villagers under MGNREGA programme and by growing vegetables with the help of the storing water in these tanks for irrigation of the vegetables.

Figure13 & 14 shows the spatial distribution of water tanks in study area. There are 28 water tanks constructed in Pujarali panchyat as compared to 22 in Chamyanna panchyat. There are 5 water tanks in Malyanna panchyat.

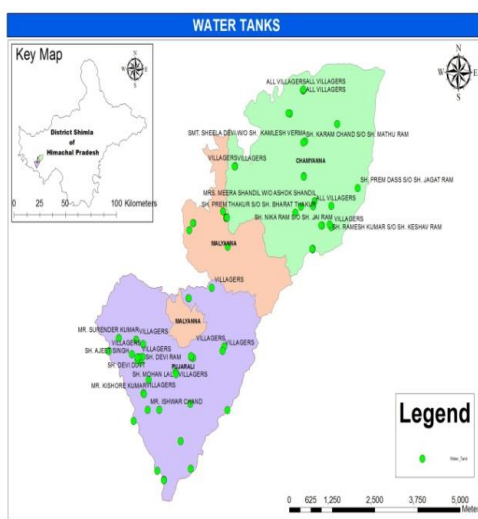


Figure 13 Distribution of water tanks



Figure14 Water Tank (Irrigation) Under MNREGA Scheme

3.3.4 Total Sanitation Campaign (TSC): Rural Sanitation

The main objectives of Total Sanitation Campaign (TSC) is to bring improvement in the general quality of life, accelerate sanitation coverage, generate demand through awareness and health education, cover all schools and anganwadis with sanitation facilities and promote hygiene behaviour among students and teachers, encourage cost effective and appropriate technology development and application, and endeavour to reduce water and sanitation related diseases in the study area.

Figure 15 show the spatial distribution of sanitation facilities under the TSC programs. Six new toilets in Chamyanna panchyat and 4 new toilets have been built in Pujarali panchyat under TSC programme. However, there is only one garbage collection centre for three panchyats housed at chamyanna panchyat.

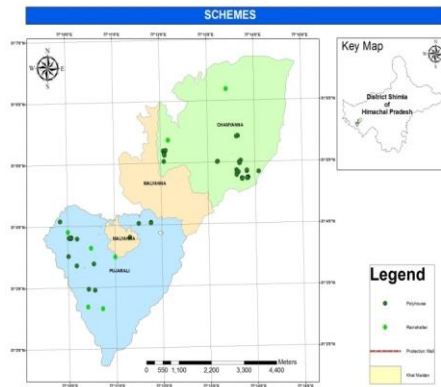


Figure 15 Garbage Collection Centre, Toilets, Land Development, Check Dams, Sanitary Works.

7.5 Development of Common Property Resources (CPR) under various schemes

The other schemes include construction of Rain Shelters, Protection/Retaining Wall, Poly uses, Garbage Collection Centre, Toilets, Land Development, Check Dams, Sanitary Works & Khel Maidan. The study shows that there are 4 community centres in chamyanna panchyat while 3 community centres have been built in Pujarali panchyat and 1 in malyanna panchyat. There are 2 rain shelters in chamyanna panchyat while 5 rain shelters have been erected in Pujarali panchyat. However there is only one Cremation Centre for all the three panchayats. Khel Maidan is being constructed in the Shildi village of Pujarali Panchayat. Protection / Retain wall has been made near IAS colony in Sargheen. Different types of vegetables are being produced in the Poly houses. There are 12 Mahila Mandal Bhawans in the three panchayats mainly used for Common Group meetings and functions in the villages.

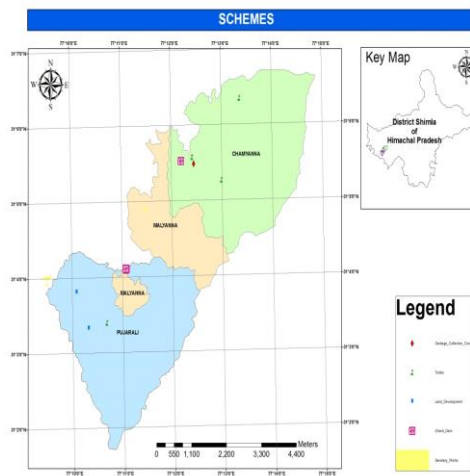


Figure 16 Distribution of Poly houses, Rain shelter, Protection Wall and Khel Maidan

CONCLUSIONS

- The study area covering Chamyanna, Malyanna and Pujarali panchyats presents entirely mountainous and valley shaped topography. The highest proportion of land is contributed to forest only. Although the study area is dominated by agricultural activities but the agriculture yield is low which can be attributed to hilly terrain and small size of land holding and insufficient irrigation facilities.
- The construction of water tanks under various developmental schemes is enabling villagers to cultivate vegetables and enhance their income. The total number of water tank constructed under the above mentioned programmes is 50 with pujarli taking a lead with 28 water tanks (Figure 17) . It is suggested to develop water tanks in both Panchayats to enhance the irrigation facilities. The suitable sites for the same purpose can be suggested with the help of GIS techniques (Jain and Subbaiah , 2007).
- The total population of Chamyanna, Malyanna and Pujarali panchyats is 1821 persons (Male 935, Female 886), 1360 Persons (Male 720, Female 640) and 3450 persons (Male 1750 and Female 1700) respectively.
- The Chamyanna Panchayat (having hilly terrain) has only one primary health centre. Due to the hilly terrain of Chamyanna Panchayat this medical institution fails to meet the requirements of the villagers because they have to travel more distance to avail medical facility. It is suggested to establish more health centre in the area.
- Although both the Panchayats, Chamyanna and Pujarali have sufficient educational institutions but it is again necessary to improve the existing infrastructure to meet the basic requirements of the local masses. Due to the hilly terrain of Chamyanna Panchayat the educational institution do not suffice the requirements of the villagers because students have to travel more distance to take the education. It is suggested to open more educational institutions in the area.
- The various developmental projects running under MNREGA provides employment to the local peoples in all the three panchyats.
- Four houses are constructed under IAY and AAY and in Chamyanna panchayat as compared to one house constructed in Pujarali panchyat.
- Three toilets have been constructed in Chamyanna panchayat as compared to 1 constructed in Pujarali panchyat TSC.
- The Pujarali panchyat has built 5 rainshelters as compared to 2 in Chamyanna panchyat.
- **In context of overall development and implementation of various development schemes, the Pujarali Panchayat takes lead followed by Chamyanna panchyat. However Malyanna panchyat is least developed in terms of socio-economic infrastructure/implementation of rural development schemes.**
- The Panchayat Resource Information System developed for three Panchayats of Shimla district depicts status of land use, water resources, socio-economic facilities created under various government schemes. This information can be used by planners and administrators for
 - Updating Data bank
 - Generating Action Plans
 - Calculating Budget Estimates
 - Planning of micro drinking water schemes
 - Planning of irrigation schemes
 - Development of watershed programmes

- Extension of road network
- Visualizing developed and less developed pockets and thereof establishing of new educational, health and other facilities in less privileged pocket.
- Monitoring of various projects & schemes
- Impact assessment of schemes
- Identification and utilization of ponds for pisci-culture
- Identification of cultural heritage spots/homestay for tourism

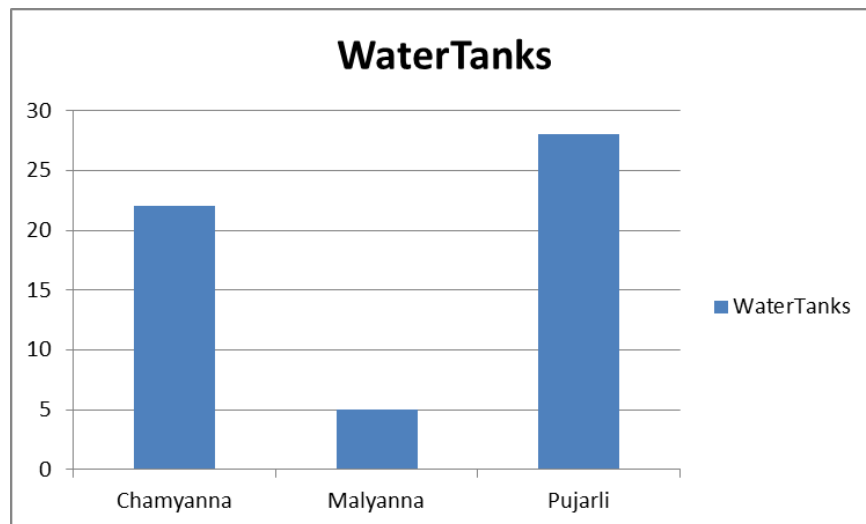


Figure 17: Comparison of establishment of water tanks in the study area

REFERENCES

- Ambasta, P., 2010. MENREGA and Rural Governance reform, growth with inclusion through Panchayats' Paper for International Conference on. Dynamics of *Rural Transformation in Emerging Economies*. Planning Commission, Government of India and Institute for Human *Development*,. India.
- Annual Report., 2011. Natural Resources Data management System. pp. 157-167.
- Annual Report., 2009. National Bank for Agriculture and Rural Development, H P . Evolution of Rural Entrepreneurship Development Programe in Himachal Pradesh.. Evaluation study series, H. P. RO No. 4 pp.43
- Annual Report., 2009. Planning Department Government of Himachal Pradesh. Evolution of Ghandi Kutir Yojana in Himachal Pradesh. pp 42.
- Asadi, S.S., Vasantha Rao, B. V. T., Raju, M. V. and Anji Reddy, M., 2011. Creation of Integrated Rural Development information System using Remote Sensing and GIS – A Model Study on Prakasam District Andhra Pradesh. *International Journal on Computer Science and Engineering* .3(11):3587-3595.
- Balokhra, J.M., 2006. *The Wonderland Himachal Pradesh: An Encyclopedia*, H.G Publication. New Delhi, pp 922-927.
- Jain K and Subbaiah Y. V., 2007. Site Suitability Analysis for Urban Development Using GIS. *Journal of Applied Science*, 7(18): 25-32

Jeart. M., 2006. Geography of Himachal Pradesh, Indus Publication Company in association with Integrated Institute of Himalayan studies, Himachal Pradesh University, Shimla pp 47-53.

Manikkumaran, P. 1997. Agricultural Growth, Rural Poverty and Environmental degradation in Tamil Nadu, Annamalai University, Unpublished M. Phil dissertation,

Mukherjee, S., 2011. Application of ICT in Rural Development opportunity and Challenges. Global media journal, Indian edition, 2: 1-8.

Report of Ministry of Earth Science 2011: Establishment of natural GIS under Indian national GIS organization (INGO), submitted to Planning commission. pp.113.

Report of the Ministry of Water Resources 2011: Major and medium irrigation and command Area Development for the XII five year Plan (2012-2017), pp 216.

Report on Total Sanitation Campaign in Himachal Pradesh, 2011. Department of Rural Development, Himachal Pradesh.

Scaria R., and Vijayan P. K., 2012. Sustainable rural development with the application of Spatial Information Technology and Mahatma Gandhi national rural employment guaranteed scheme. International journal of Geomatics and geosciences. 2(4):1040-1061.