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Sustainable rural development with the application of Spatial Information Technology and Mahatma Gandhi national rural employment guaranteed scheme

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ABSTRACT

Information technology has emerged as an inevitable phenomenon influencing every walk of life in all sections of in the present society. With the ease of availability of enormous computing power and convenient access to large volume and variety of data and information, the structure functions of all human organizations will undergo profound transformation in this century. Nations are engaged in exploiting this phenomenon for many of their environmental and socio-economic requirements. Timely and reliable information on 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 as decision making. The present study integrates the advantages of Geomatics technology and the man power of MNREGS for the rural development activities.

Keywords: Spatial information technology, GIS, Geomatics, GIS packages.

1. Introduction

Spatial information technology has developed at a remarkable pace over the past two decades and will play a key role in development of nations in the 21st century; thereupon many countries have already prepared their strategic development plans for application of Geomatic technology with gigantic financing endeavors. Recent technologies' advances made considerable positive impacts on rural development planning. This domain of planning is of prime importance for agriculture country like India with varied geographic patterns, cultural activities etc. Planning is a widely accepted way to handle complex problems of resources allocation and decision making. It involves the use of collective intelligence and foresight to chart direction, order harmony and make progress a public activity relating to human environment and general welfare. In order to provide more effective and meaningful direction for better planning and development necessary support of the advanced spatial information technologies has become essential. Hence the need for suitable information system is increasingly being felt in all planning and development activities, whether these are for urban or rural areas. The significance of rural development and its study in the context is well reflected in the words of Mahatma Gandhi who once remarked that India lives in villages. Rural development is multi- dimensional and much borders that poverty alleviation through social programmes and transfer. It emphases on changing environments to enable poor people to earn more, invest in themselves and their communities and contribute toward maintains of key infrastructure; a successful strategy will make people less poor, rather, more comfortable in their poverty. Even with six decades of economic planning after independence, the bulk of the country's population continues to live in rural areas and majorities are still continuing as poor. Hence an integrated sustainable rural development planning is required for improving livelihood status of rural poor in India.

2. Objectives

The broad objective of the study was to develop an interactive software package for sustainable rural development through proper utilization of advanced spatial information technology and man power of MNREGS.

Fine objectives were as followed:

1. To find out the environmental and social challenges in Chalavara Panchayat.
2. To suggest solutions to overcome the problems with Geomatics technology.
3. To develop software package for sustainable rural development.

3. Study area

The study area, Chalavara lies in south western parts of Palakkad District, Kerala. This Panchayath belongs to Ottapalam Block. (map.1). Its Arial extension is around 30 square kms. Physiographically, the study area comprises of small elevation on the one hand and depression on the other, forming irregular and diverse nature of topography. The climate of the area is tropical monsoon climate with annual rainfall less than 2800 mm and annual average temperature between 30 degrees Celsius to 35 degrees Celsius. Study area has population of about 14000 (map.2), and majorities depend on agriculture for their livelihoods.

Figure 1: Location map

4. Materials and methods

1. Arc GIS 9.1 developed by ESRI was the geographical information system used in this study. It offers a completely new frame work for working with these tools that combine together in a visual modeling environment and apply scientific principles related to the study. IRS-P6, LISS-III with 23.5 meters resolution is used for analyzing the land use scenario of the study area. . GIS is applied to the geographical data for identification of environmental and social challenges and also used to develop strategies for solving the existing problems.
2. To assess a well balanced optimum daily diet requirement of a person in India, **Aykroyd "well balanced diet" chart** is used. Nutritional value of food crops has been measured here in terms of calories and protein produce from grains, fruits, vegetables, etc .per oz. of weight. The caloric (c) and protein (p) value has been calculated with the help of table developed by the nutritive values of Indian foods, I.C.M.R. NO: 42, 1963. For calculation of food requirement ***Singh's consumption unit*** is used for the calculation of food availability ***Chakrovarthy's*** *co-efficient of production unit* is applied. This calculation is applied in all food crops of this rural areas to get the co efficient of food crop production.
3. For preparing annual work plan for MNREGS workers, from each wards, 20 respondents were selected, those who have completed 100 days of wage employment. Secondary data was collected from Grama Panchayat and official website of MNRGS. An informal discussion was held with officials and workers to understand the problems and difficulties in projet implementations.
4. Advantages of GPS ware used in field investigation to identify the social and environmental problems of the study area.
5. Software called SPSRD was developed. This application was developed using C#(sharp.Net and ASP.Net provided by visual studio package (2008)

5. Results and discussion

5.1. GIS as a Tool for Sustainable Rural Development

Geographic information technology has developed at a remarkable pace over the past two decades and plays a key role in the development of nations in the 21st century. A geographic information system (GIS) is a computer based information system that has the capability of handling all kinds of spatial data for decision making. It enables the input, management, manipulation, analysis, modeling, output and dissemination of spatially referenced land-relative data. In Panchayath raj or decentralized administration, empowering various tiers of governance with decision making power need complex data and information on various aspects. Analyze these data parameters and talking decisions based on this database often is not easy. IT tools like GIS integrate both spatial and attribute parameters and reflect the free representation of field situation .Analysis of these data base help to identify and solve the problems of an area. The present study in Chalavara Panchayath emphasize the power of GIS Technology which will help the authorities to better understand and evaluate spatial data for identifying and solving the problems by creating graphic displays using information stand in the data base.

Following are the environmental and social challenges identified in Chalavara Gram Panchayath

1. Food insecurity
2. Water scarcity
3. Soil erosion

4. Domestics waste and Poor rural connectivity
5. Lack of scientist support in the execution of MNREGS works.

5.2. Land use model for sustainable food security

Food is one of the most basic needs for human survival. Access to it is a basic human right. Moreover, the pursuit of the Millennium Development Goal to cut hunger requires a sound understanding of the related food security issues. The concept of food security is very complex, multidimensional and complicated and is debated since last three decades. It has been visualized at international, regional, household and even at individual levels. According to FAO (1984) the basic concept of food security implied that "all people at all times have both physical and economic access to the "basic food they need. Kerala is the lowest land man ratio among the States in India and is known as a 'food deficit' state in India because of the wide gap in the consumption and production of food grains.

Table 1: Chalavara Panchayath - Food Security Status

Fooder crops	Required in kg	Required calories	Available in kg	Available Calories	Shortage
Rice	2451971	86431977	3127712	110251848	+675740
Pulses	50696	1787034	75387	2657391	+24690
Fruits	502240	17703960	255525	9007256	-246715
Vegetables	171696	6052284	125688	4430502	-46008
Oilseeds	332880	11734020	182875	6446343	-150005
Milk	1372400	48377100	292000	10293000	-1080400

Table 2: Food self sufficiency – model

FOODER CROPS	AREA IN (HE)
RICE	437
PULSES	27
FRUITS	167
VEGETABLES	104
OILSEEDS	665
LIVESTOCK'S NUMBERS	3760

Kerala's position with regard to the availability of food is below the national average, leading to the characterization of the state as a 'food deficit' one. In other words, Kerala is perhaps the most vulnerable to any short-term or long-term food grain deficit at the national level *(food security in a regional perspective a view from 'food deficit' Kerala., k. p. kannan-2000).* Hence, this analysis was chosen with these circumstances in mind and for the micro level study. The present study made strategies to achieve sustainable food security status through the sustainable land resource management. Present case study discovered that existing food crops and cropping pattern are not sufficient for achieving food self sufficiency and to satisfy the dietary needs of present population (map-3). This investigation also find out and suggests the sustainable land

use model for achieving food security with the available net sown area of this Panchayat (Table.1 & 2). It is hoped that the study would provide key inputs to strengthen the efforts of the civil organizations at local levels. It would also provide critical inputs to policy makers to frame appropriate policies to achieve food security status.

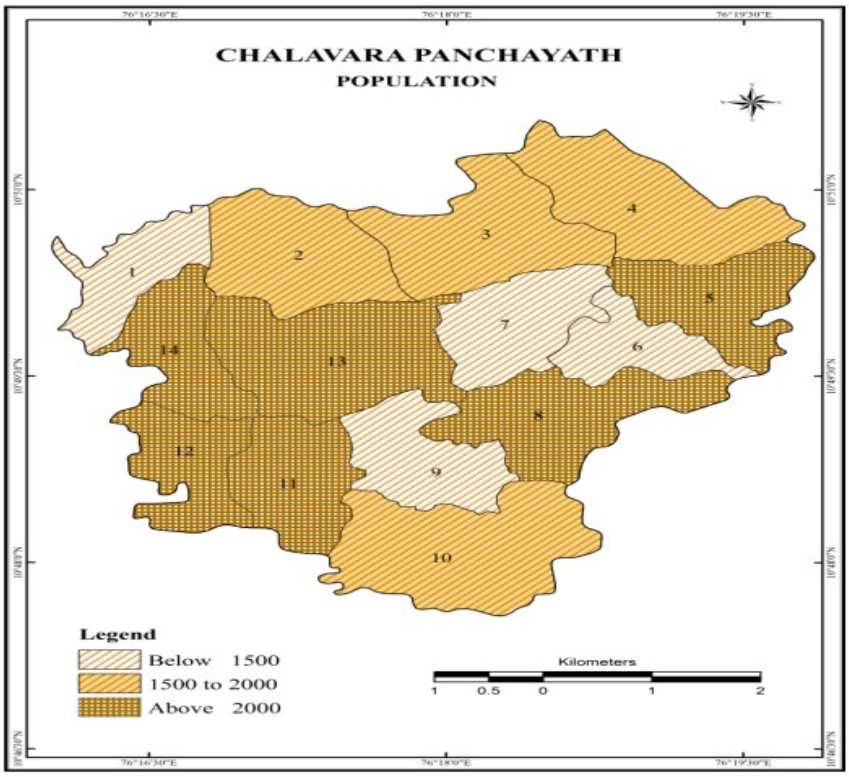

Figure 2: Food Security Status

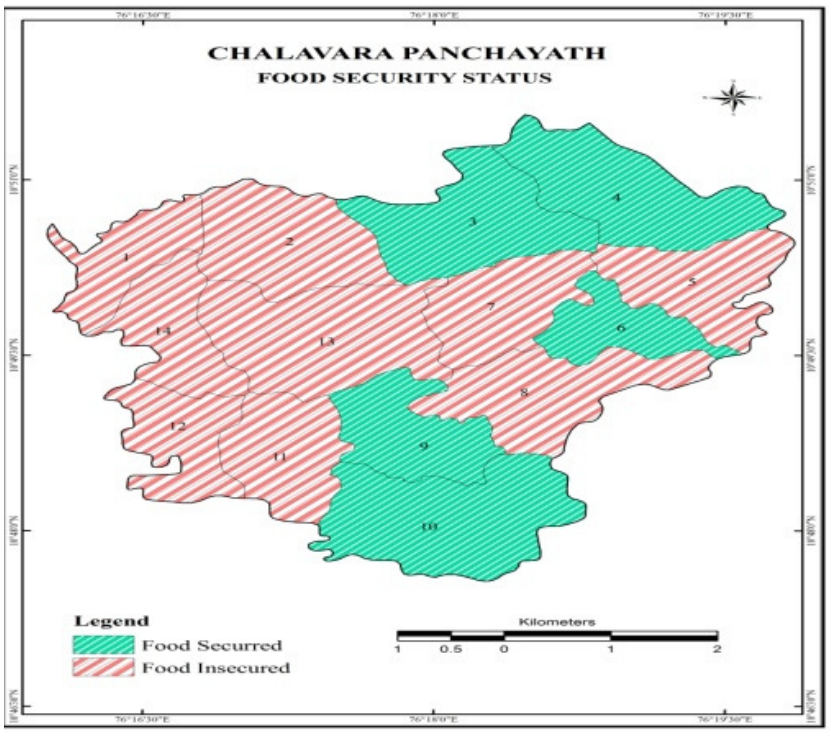

Figure 3: Population in study area

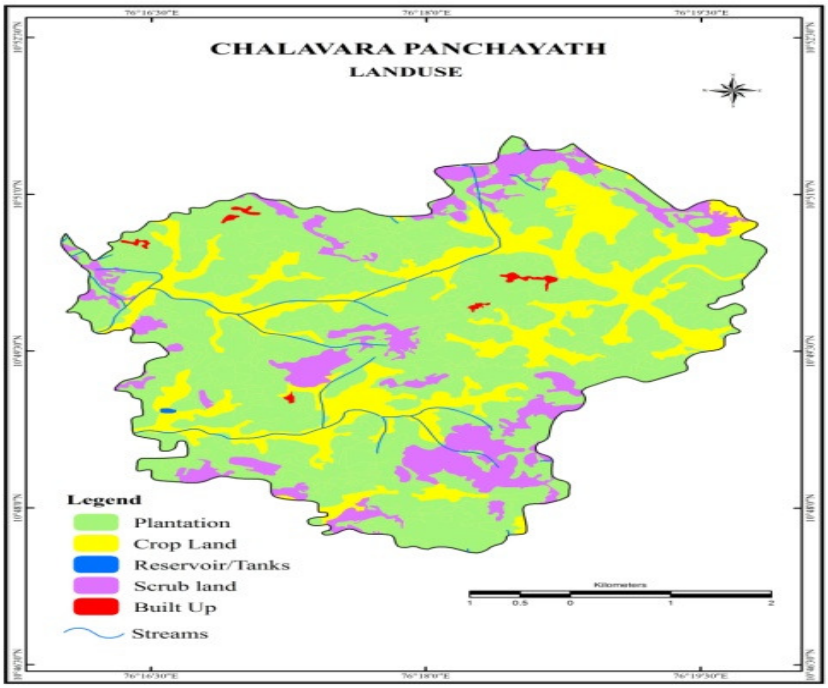

Figure 4: Land use pattern

5.3. Ground water augmentation plan

Land and water are the two important and crucial natural resources supporting all forms life on the earth. Availability of water varies with space and time.

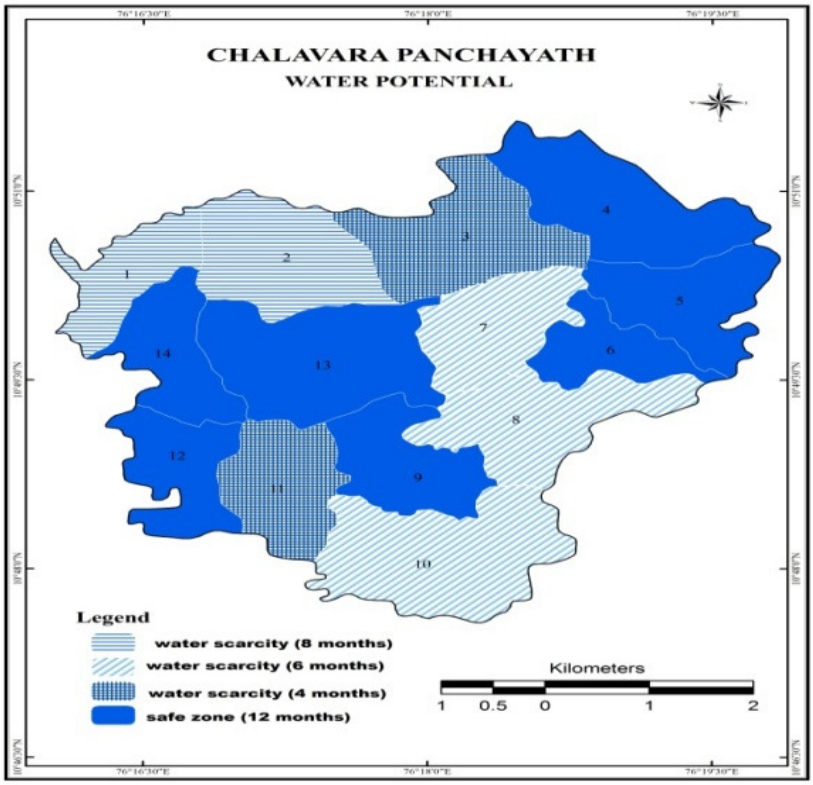

Figure 5: Water potential

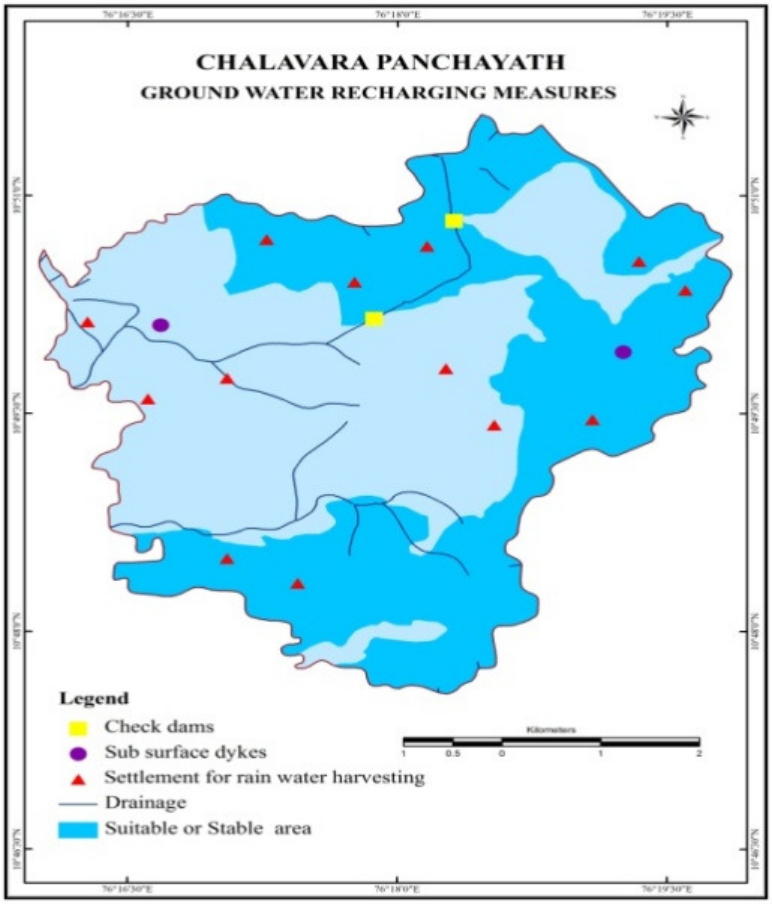

Figure 6: Groundwater recharging measures

As the demand on water is steadily on the increase, it is rapidly becoming more and more scarce resource. Chalavara Grama Panchayat in Palakkad district enjoys a humid tropical climate. But being densely populated, it is facing problems like drying up of wells and ground water pollution due to increased water demand and consequent over exploitation of ground water for domestic as well as agriculture purpose. Despite the increase of high annual rainfall (2900mm) and large number of rivers, it experiences drought of different order during summer (map - 4). In this regard, the technology of remote sensing and GIS act as an effective tool for identification of exiting water bodies and selection of suitable areas for ground water recharge measures and renovation programmens. The integration of spatial and non spatial data for Chalavara Panchayat under GIS platform, hold up the decision making process to develop ground water augmentation plan for solving water scarcity. Following map shows the suitable sites and structures for ground water recharge (Map-5).

5.4. Terrain analysis

The conventional method will take more time to complete the work and it will be laborious for the person who involved the work. GIS provide powerful engines for landscape visualization, analysis and studies of land scope evolution. 3 D mapping has the best visual impact by which the authorities can easily plan strategies for integrated development. This stimulates relief in reality, thus allowing the viewer to quickly recognize and understand difference in elevation. 3D map of Chalvara Panchayat is prepared to support authorities to understand the terrains (Map – 6 and Map-7).

Figure 7: Contour

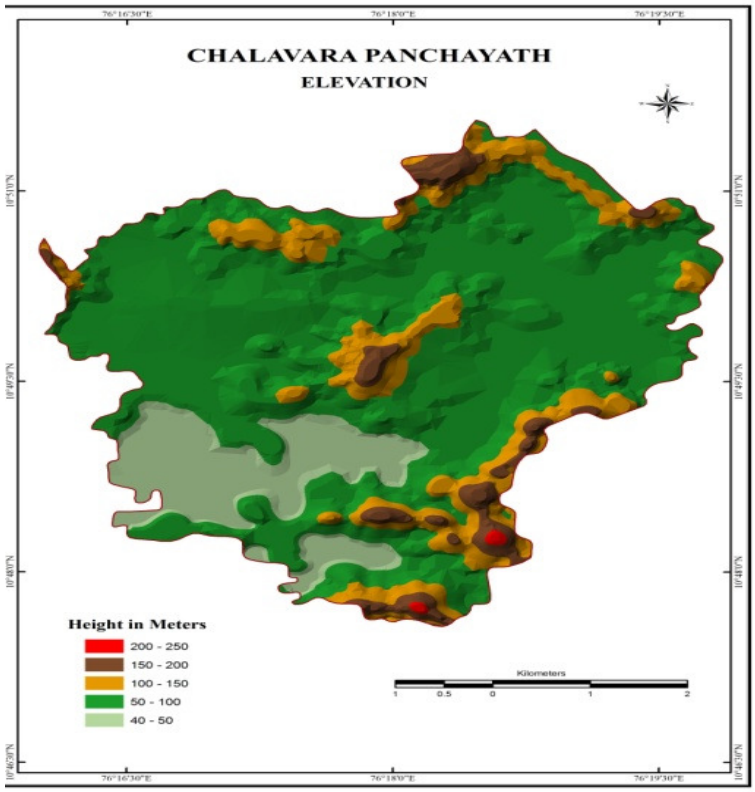

Figure 8: Elevation

5.5 Sustainable agriculture development

GIS has the power to develop a platform for sustainable agriculture practice and leads to food self sufficient area. Maps of Land use, 3D map, water potential and scarcity, soil erosion, Land suitability etc., were prepared with GIS environment, which helps farmers to practice environmentally permissible, economically viable, socially acceptable agriculture (figure1 and 2). One of the keys to food security is sustainable agriculture**.** Sustainable agriculture can be considered as food production that integrates the goals of environmental health, economic profitability, and social and economic equity. Food production is one of the most important elements in the food security and it is commonly believed that agricultural production directly affects food security. However, there is more to it than a mere direct link. Rising agricultural productivity increases rural incomes and lowers food prices, making food more accessible to the poor *(World Development Report, 2008).* Hence GIS has a pivot role to develop strategies for sustainable agriculture practice.

5.6. Soil conservation measures

Soil is important natural resources which support or sustain life on the earth surface. Fertile soil is an essential requirement for good agriculture practice. Removal of fertile soil is one of the major problems experienced by the farmers of this Panchayat. Geographic information system helps the decision makes to identify or delimit the places of soil erosion and it also support to take initiatives for controlling soil erosion (map.9).

5.7 Domestic waste management

Disposal of domestic waste in public places is a common and serious problem in settlement areas. This will become the hot spots of different microbes and also leads to onset of different diseases and hence proper management of house hold waste is essential for a healthy society. Suitable site for domestic waste collection and treatment plant is identified in chalavara Panchayat With the support of GIS.

5.8 MNREGS in Chalavara Panchayat

The National Rural employment Guarantee Act (NREGA) is a historic legislation passed by the government of India in September 2005. It was enacted in order to address the crucial issues of unemployment and poverty in rural india. The NREGA guarantees a 100 days of unskilled employment to each house hold in every financial year at an equal wage rate for both male and female workers. Additionally, it guarantees the “right to work” as a legal right of every able-bodied adult in rural India. A well designed employment guarantee programme under favourable circumstances can promote job creation, gender equality and pro- poor development. The MNREGA has great potential for increasing the volume of employment among the rural unemployed and underemployed. It provides many oppurtunities for creating rural public assets, which has been largely neglected. It helps to enchance the purchasing power of rural households, thereby contributing to poverty aviation. M.S Swaminathan (2009, The Hindu daily news paper, June I) described MNREGA as the world’s largest ecological security programme, which can successfully strengthen the ecological foundation for sustainable agriculture.

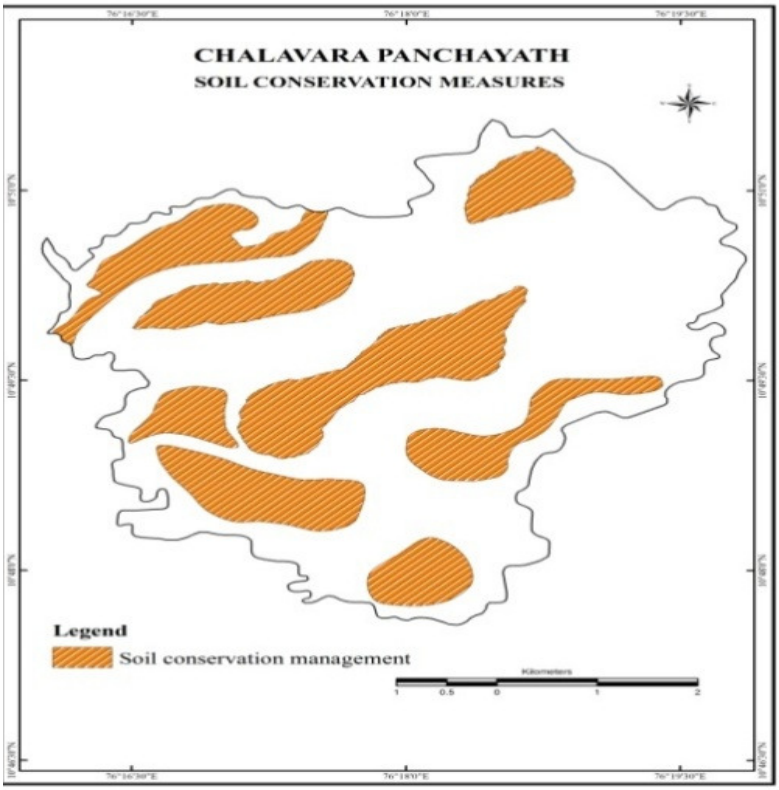

Figure 9: Soil conservation measure

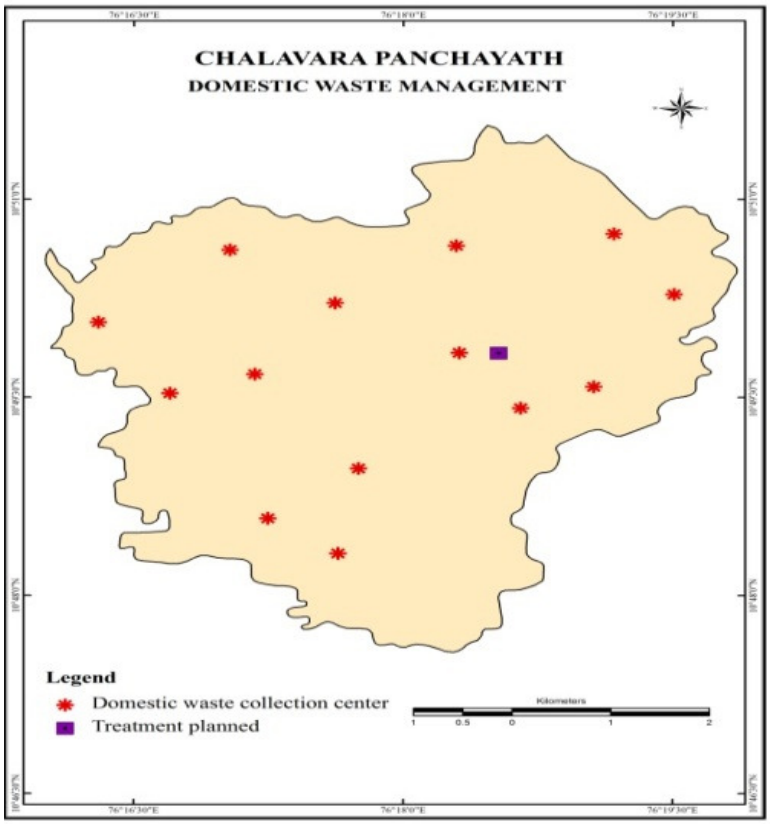

Figure 10: Domestic waste management

Year 2006 - 2007 onwards MNREGS workers sincerely encaged in the developmental activities of Chalavara panchayath. Nearly 2000 labours of this Panchayath register in MNREG scheme and engaged different development activities of this panchayath. More than 80% of workers are females; majority belongs to below poverty line (table and map). Water conservation, flood control and protection, renovation of traditional water bodies, micro irrigation, rural connectivity, land development, etc., are the thrust areas of work of this panchayath. More than 50% of the fund is utilized for water conservation activities because of the prevalence of water scarcity. Discussion with MNREGS workers and officials highlighted different problems such as lack of scientific and expert supports in identification and execution of the works, absence of scientific and realistic labour budgeting, less use of machinery, less considers of interest of workers, less quality of works carried out etc, while implementing the various development works in Panchayath. To overcome the above mentioned problems of MNREGS, it requires a technical and theoretical support. So this study utilizes the advantages of GIS and remote sensing in identification and execution of the various developmental activities and grouped the labours based on their skills and interests (table). For improving the efficiency of MNREGS workers, an annual work plan is developed with the support of Remote Sensing and GIS environment (Figure – 5). GIS made the data handling and analysis much easier with meaningful research outcomes. This developed plan gives clear cut idea about the various projects, location, area, nature of works, required man power and time. Hence this plan will improvise the efficiency of MNREGS workers in Chalavara Panchayat .

5.9 Software package for Sustainable rural development (SPSRD)

The need for a spatial information system becomes a fundamental component for better planning and administration.

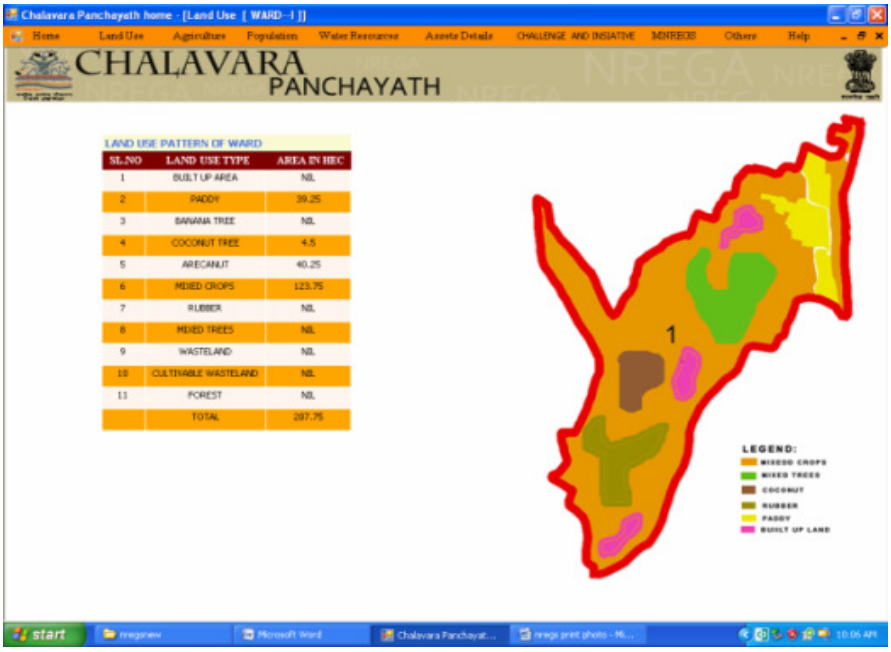

Figure 11: Image showing screen shot of the software

Software called SPSRD (Software Package for Sustainable Rural Development) is aimed to improve the efficiency and role on MNREGS in the rural development activities. This application is developed by C#.Net and ASP.Net. It can also import or link directly to data

stored in other applications and databases (Microsoft .Net, Wikipedia, 2012). This software gives detailed description of geography, demography, Hydrology, Assets, land use, MNREGS details and their work plan of Chalavara panchayat (Figure-5 and Figure - 6). SPSRD also mentioned the various environmental challenges of Chalavara Grama Panchayat such as water scarcity, soil erosion, waste management etc (Figure – 7 and 8). More over it gives detailed report about the Annual work plan for NREGS workers i.e. it provides the detailed work report of each months and each wards, types of works, their location, required manpower and time (Figures 9 and 10). Thus this software becomes an ideal tool for the sustainable rural development activities.

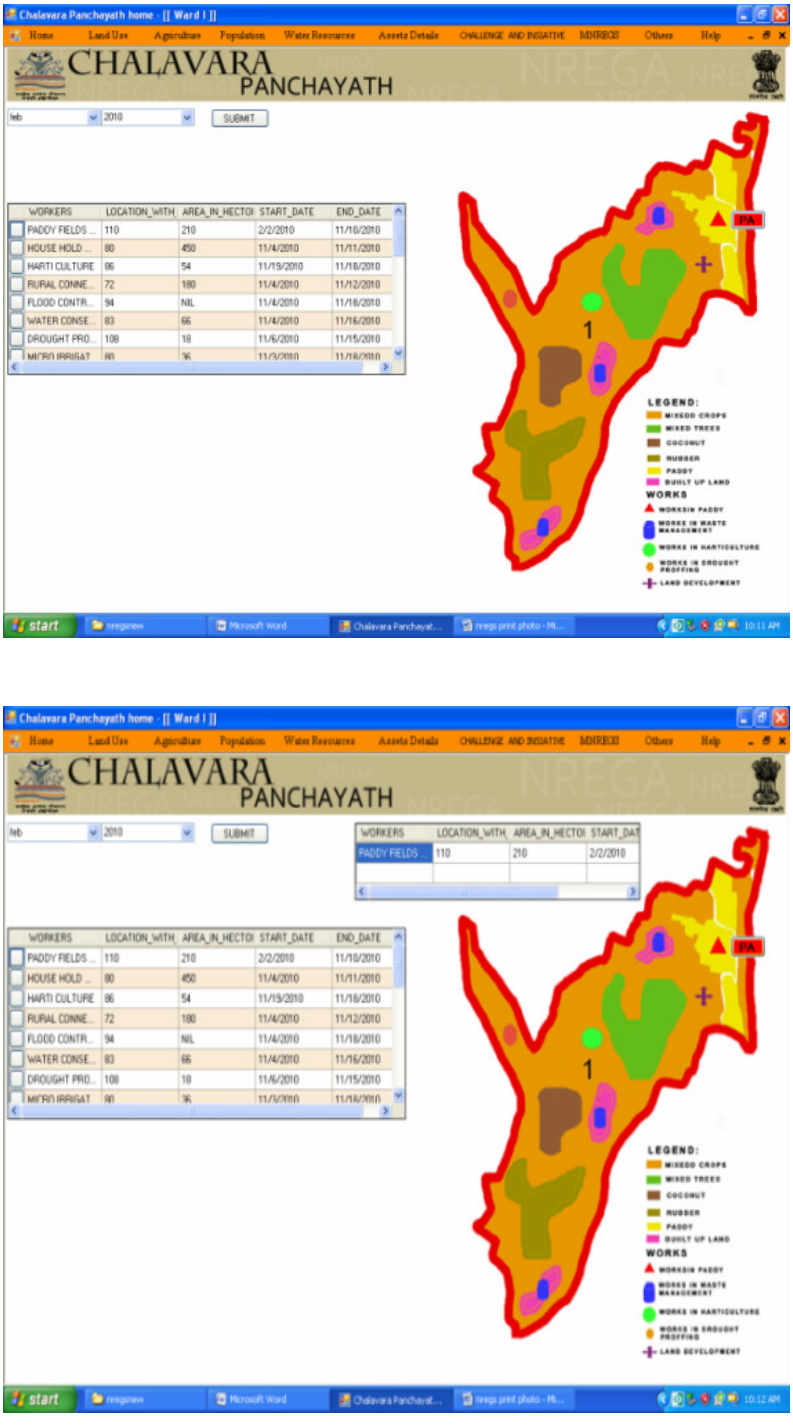

Figure 12: Image showing the legend and data input

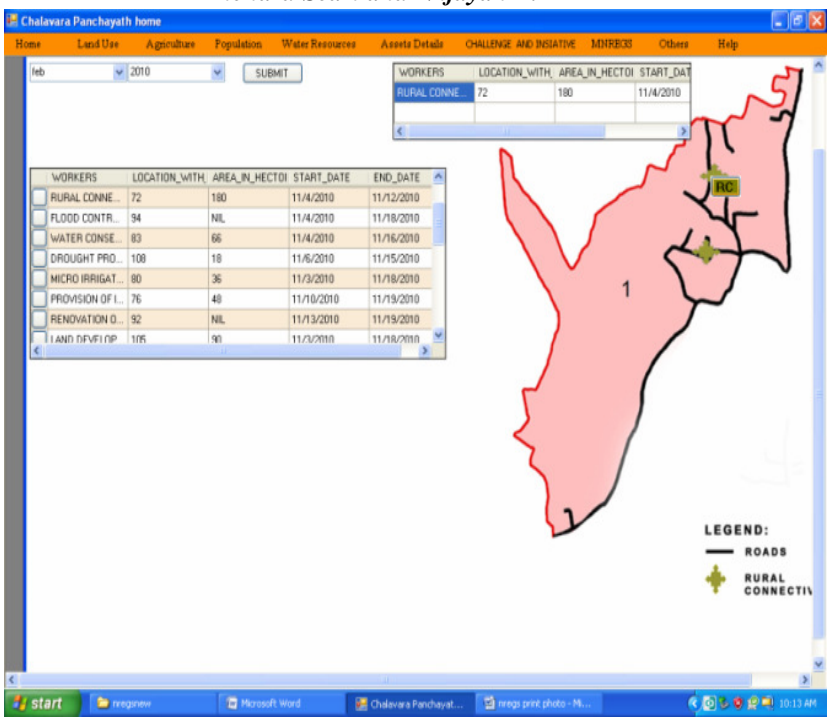

Figure 13: Image showing output from the software

5.10 Conclusion

The introduction of computers, micro – electronic equipment and telecommunication services have paved the way for an avalanche of information, not only for scientific research, but also for information transfer to a broader public and for planning of policy purpose. With varied complexities of data availability and analysis and with multitudinal dimensions of projects handling and the pressure for generation of multi-use reports and formats, it's imperative to use simple and user friendly IT Tools like GIS for Gram Panchayat Planning, at all levels of administration and governance. With the empowerment process peculating to all levels and involving people as stakeholders and decision makers, the support system, like the present IT Tool, would help them to gear up and speed up, the decentralization process and bring in visible development in all fields by information storing, processing, analyzing, presentating and by taking appropriate decisions. Thus Software SPSRD (Soft Ware Package for Sustainable Rural Development) is aimed to integrate the scope and advantages of spatial information technology and MNREGS for the sustainable growth. Definitely IT tool Such as SRSRD for Gram Panchayat Planning would open new avenues and opportunities in rural development.

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