Crop Planning For Food and Nutrition Security Using GIS and Mobile GPS Technology– A Case Study of Ghoti Village in Ahmednagar, Maharashtra.

Vinit Raskar [1], Manoj Pawar[2]

[1] Sr.Officer-GIS, Watershed Organisation Trust (WOTR)

[2] GIS Consultant, Watershed Organisation Trust (WOTR)

WOTR, "The Forum", 2nd Floor, Padmavati Corner, Pune-Satara road, Pune-411009

Abstract:

Food security has a number of dimensions which have to be addressed at different scales. There are number of ways by which food and nutrition security can be measured based on set of indicators and measuring this is a major challenge due to lack of qualitative, relevant and timely data. These indicators could vary at national, regional or local scale depending on climatic conditions of the area. Climate change may affect all components of food and nutrition security at different scales. Increase in temperature will have impact on crop production, Livestock, Fisheries and associated sectors. Around 60% of Indian agriculture is rainfed, it is highly vulnerable to impact of climate change and around 80% Indian farmers are marginal, they are having less capacity to cope up with these impacts. In this context, crop planning at local level could be one of the effective tools through sustainable food and nutrition point of view. Technologies like GIS and mobile GPS can be used as an effective tool for crop planning along with dissemination of information to farmers which has direct relevance to food nutritional values .Spatial approach is Important in order to bring transparency and accuracy which adds value to results. An attempt was made by Watershed Organisation Trust (WOTR) in Ganeshwadi hamlet of Ghoti village of Ahmednagar district in Maharashtra. One of the objectives of this study was to balance agricultural production for the market and nutritional food consumption. This was tried to achieve by promoting production of cereals, pulses, vegetables to improve nutritional needs. GIS and Mobile GPS based crop mapping helped a lot at planning, dissemination, monitoring and impact assessment level to achieve objective of the study. Participatory approach was adopted for planning purpose. ArcGIS was used to carry out spatial analysis at plot level for monitoring of crops sown suggested by WOTR and assessing the impact of the social mobilization. ArcPad was used for onsite crop mapping by visiting each plot to build farmerwise crop-profile.

About the Author:

MR. Vinit Raskar

is working as Senior Officer-GIS, leading GIS team at Watershed Organisation Trust, Pune.He is having knowledge of application of GIS technology for Planning, Monitoring and Evaluation of Watershed Development Project. He was part of project called Multi Disciplinary and Multi Locational Watershed Research Study and Policy Dialogue with formed group of ForWaRD (Forum for Watershed Research and Policy Dialogue) and Live diverse-Identification of biodiversity hotspots. He has supported to various components of Climate Change Adaptation (CCA) project in many ways. Currently his team is involved in Adaptation at scale in Semi-Arid Regions work and ALCES (A Landscape Cumulative Effects Simulator) modeling at regional scale.

E mail ID: vinit.raskar@wotr.org.in

Contact No:- +91-20-24226211

Introduction

In India the impact of climate change will be serious in coming decades as it has diverse agro-ecological and agro-climatic zones. Due to climate change, frequency of extreme events have increased which consequently impact crops and food production. These impacts are in terms of shortage of food, quality of food, fluctuating market dynamics and health of the farmers. The farmers which are rainfed and with less land holding are the first and easy target of the of climate change as they have less adaptive capacity. Ghoti village of Ahmednagar district, agro-climatically falls in transition zone and agriculture is rainfed. This region has experienced erratic climatic events like rainfall, coldwave and dryspells frequently which damaged crops. In present study an attempt of crop planning is made at the household level using GIS technology to balance between the agricultural production for market and household food consumption.

Objective

Plotwsie crop suggestions to promote dietary diversification to achieve a balanced intake of all micronutrients to fulfill nutritional need of the family.

Components involved are:-

i. Plot mapping using high-resolution satellite images and plot wise crop mapping using Mobile GPS
ii. Plot wise crop recommendation and Social mobilisation
iii. Monitoring and Impact assessment of social mobilisation

Methodology

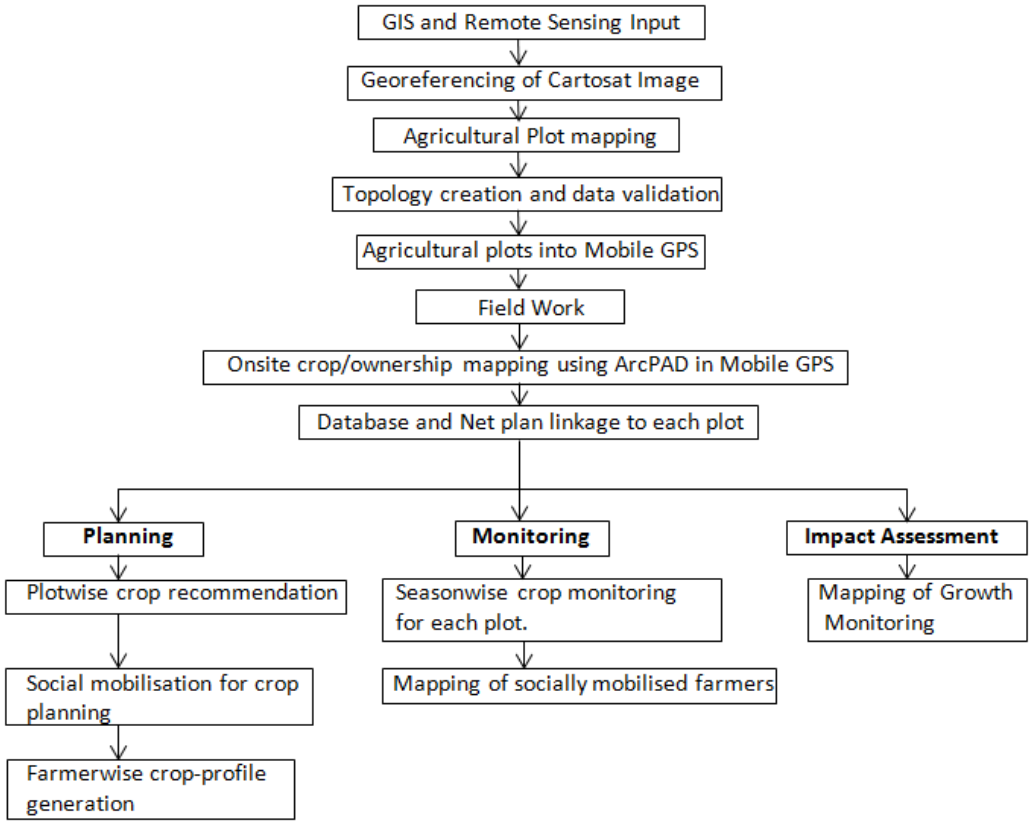


Fig: 1 – Flow Chart Showing methodology used for Crop Planning using GIS and Mobile GPS technology

Data and Software Used

Toposheet from Survey of India (SOI) and Satellite Image from National Remote Sensing Centre (NRSC) of the study area was collected. As the geographical scale was plot, high resolution Cartosat image (2.5m) was taken for agricultural plots mapping.

Georeferenced Cartosat image (2.5m resolution) was used to map agricultural plots and was performed using Esri ArcGIS 10.2 version software. These plots were identified using Mobile GPS based ArcPad software during on-site crop mapping in the field.

Database Generation

Step I: - Boundary of selected hamlet was demarcated on cartosat image and then agriculture plots were mapped in ArcGIS. Here, major farm bund was taken as plot. For each plot, unique ID was assigned which helped in linking data. After mapping, topology was generated to remove minor errors emerged during digitisation.
Step II: - Shapefile of plots was then transferred on Mobile GPS and on the filed ArcPad was used to locate plot. With the help of resource person, information related to cropping pattern and ownership was collected for each plot. This information was then linked to each plot (Shapefile) using ID as a primary key. Along with this, Net plan survey conducted by WOTR was also linked to each plot. This linkage was necessary to get land characteristics like slope, soil type, soil texture, soil erosion etc. for crop suggestion.

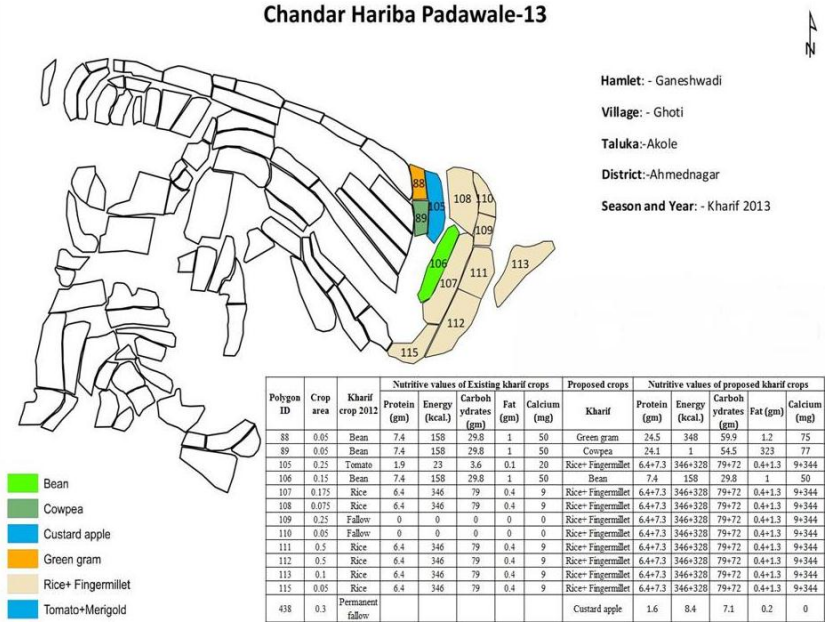
Fig: 1 – Plotwise information collected using ArcPad for crop planning

Planning

Planning includes crops suggestion. It was necessary to identify food intake patterns of the farmers, precisely identifying food deficiencies in intake habits and season wise resource availability.
Step III: - Crop suggestion was done in two steps. In the first step, crops taken in the earlier season in all plots were identified. Looking at the soil profile (from Net Plan), first level of crop recommendation was prepared. In the second step, socio-economic and health aspects were considered as they are equally important. Farmers were promoted to take

commercial crops to fulfill need of cash and local varieties which have balance and nutritive values. Based on set of criteria, final plot level crops were suggested.

Step IV: - Household maps were prepared with the information like crops taken in earlier seasons with nutritional values (in Kharif, Rabi, summer), crop suggested by WOTR in all coming seasons with nutritional values. These maps were used as an IEC material for social mobilisation. These maps helped a lot in convincing the farmers the need of taking crops suggested by WOTR. These activities were done prior a month of sowing crops in each season.



Polygon ID	Crop area	Kharif crop 2012	Nutritive values of Existing kharif crops					Proposed crops	Nutritive values of proposed kharif crops				
			Protein (gm)	Energy (kcal.)	Carboh ydrates (gm)	Fat (gm)	Calcium (mg)	Kharif	Protein (gm)	Energy (kcal.)	Carboh ydrates (gm)	Fat (gm)	Calcium (mg)
88	0.05	Bean	7.4	158	29.8	1	50	Green gram	24.5	348	59.9	1.2	75
89	0.05	Bean	7.4	158	29.8	1	50	Cowpea	24.1	1	54.5	323	77
105	0.25	Tomato	1.9	23	3.6	0.1	20	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
106	0.15	Bean	7.4	158	29.8	1	50	Bean	7.4	158	29.8	1	50
107	0.175	Rice	6.4	346	79	0.4	9	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
108	0.075	Rice	6.4	346	79	0.4	9	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
109	0.25	Fallow	0	0	0	0	0	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
110	0.05	Fallow	0	0	0	0	0	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
111	0.5	Rice	6.4	346	79	0.4	9	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
112	0.5	Rice	6.4	346	79	0.4	9	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
113	0.1	Rice	6.4	346	79	0.4	9	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
115	0.05	Rice	6.4	346	79	0.4	9	Rice+ Fingermillet	6.4+7.3	346+328	79+72	0.4+1.3	9+344
438	0.3	Permanent fallow						Custard apple	1.6	8.4	7.1	0.2	0

Fig 3: Household wise map showing crop suggestion along with nutritional values

Monitoring

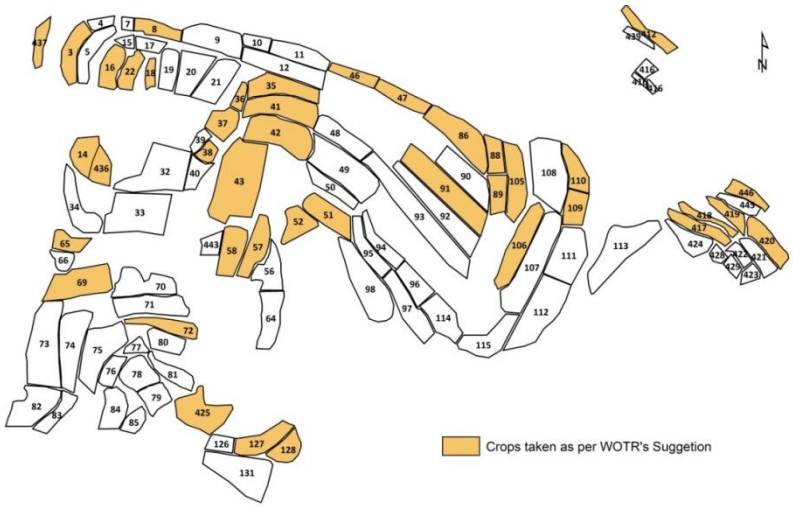


Fig 4:- Map showing plots cultivated as per WOTR's suggestion

It was decided to do plotwise monitoring to check whether farmers have sown crops as per the guidelines or not. For all seasons (Kharif, Rabi and summer), monitoring was conducted using mobile based GPS survey.

Impact Assessment

For impact assessment, social and cropping indicators were selected. Some of the indicators were overlapped in monitoring and impact assessment activity. Following indicators were decided to use for impact assessment.

1. Changes in cropping pattern including nutritive values and quantity produced
2. Area under cultivation
3. Changes in food intake and habits
4. Changes in selected nutritional and growth indicators

Indicators like changes in cropping pattern and area under cultivation were assessed at the time of monitoring using mobile GPS but other indicators involve human behavior and hence are time consuming. To achieve this, frequent social mobilisation is required through HH surveys and FGDs.

Conclusion

It was observed that Rice is the traditional crop of the study area followed by vegetables. In 2012 Kharif season, around 83% crop area of the project village was occupied by Rice followed by Groundnut, Indian Beans and Tomato. Looking at topography, soil type, food sources, food habits and nutritional needs along with rice, “Fingermilete” was proposed on 31% of total plots. On 34% plots Soybean, Vegetables and beans were proposed. On remaining 35% plots, varieties of crops were suggested.

During monitoring it was observed that 42% of the plots were sown as per the WOTR’s suggestion. Out of all suggested crops, Fingermillete was most accepted crop by farmers. On 23% plots, farmers partially followed crop suggestion by taking suggested crops as an intercrop but the crop area was very less as compare to WOTR’s suggestion. On 35% plots, farmers did not follow crop suggestion; they sowed as per their choice.

From this study we may conclude that GIS and Remote Sensing technology can be effectively used for planning, monitoring and assessment of the need of crop planning for food and nutrition security at household level.

References

1. Anna Ranuzzi, S. Richa, Impact of Climate Change on Agriculture and Food Security, ICRIER Policy Series, No. 16, May 2012
2. S.Mahendra Dev, Alakh N.Sharma, Food Security in India: Performance, Challenges and Policies, Oxfam India working paper series, September 2010, OIWPS-VII.
3. Santhakumari Kalavathi, Vishnu Potti Krishnakumar, Regi Jacob Thomas, George V. Thomas, Maria Luz George, Improving food and nutritional security of small and marginal coconut growers through diversification of crops and enterprises. Journal of Agriculture and Rural Development in the Tropics and Subtropics, Vol. 111 No. 2 (2010) 101-109
4. Vinit Raskar, IGDSS- Applied Technology at the Grassroots Using Satellite imagery and Mobile GPS at village level for on-site plot level Crop-Mapping. International Journal of Scientific and Research Publication, Volume 3, Issue 5, May 2013.