GENERATION OF ACTION PLANS AT IMPLEMENTATION LEVEL USING IRS-P6,LISS-4 MX DATA AT 1:12,5000 SCALE – A CASE STUDY OF NALCHHA MICRO-WATERSHED(5D2A8), DHAR DISTRICT (M.P.)

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ABSTRACT:

An attempt has been made to demonstrate the potentiality of IRS-P6 data for generating action plans at implementation level with a specific case study of Nalchha micro-watershed (5D2A8). First of all, various thematic maps (land use/ land cover, groundwater prospect, soil resource and land capability) are prepared at 1:12,500 scale through visual analysis and interpretation technique by using multi-date IRS-P6, LISS-4 (MX) data. Slope map is prepared at 1:50,000 scale by using SOI ancillary information. Spatial database is created for these themes in GIS environment by using ARC/INFO software, and later on these maps are integrated and unionized in GIS environment to generate action plans for development of land and water resources and for arresting soil erosion and thus conserving productive land.

1. INTRODUCTION

Rapidly growing population puts heavy demand on natural resources and the production system. Thus, increasing emphasis is being laid on scientific management of natural resources to ensure their optimal utilization, keeping in view conservation, environmental and socio-economic needs (Anon, 2003). It calls for judicious use of natural resources and puts emphasis on the need for conservation at micro level. It needs understanding of the mutual interdependence of various resources (both land and water), characterization and identification of the constraints and understanding of ecological problems at the micro level. It is aimed to generate locale specific action plans by integrating natural resources information generated from satellite data in conjunction with socio-economic data to meet the needs of the local people for sustainable development of the region (Dhinwa,et.al,1995). An attempt has been made to demonstrate the potentiality of IRS-P6 data for generating action plans at implementation level with a specific case study of Nalchha watershed. , First of all, various thematic maps (land use/ land cover, groundwater prospect, soil resource and land capability maps) are prepared at 1:12,500 scale through visual analysis and interpretation technique by using multi-date IRS-P6,LISS-4 (MX) data. Slope map is prepared at 1:50,000 scale by using SOI ancillary information. Spatial database is created for these themes in GIS environment by using ARC/INFO software, and later on these maps are integrated and unionized in GIS environment to generate action plans for development of land and water resources and for arresting soil erosion and thus conserving productive land.

2. STUDY AREA

The Nalchha Micro-watershed,(5D2A8) lies in the Dhar district of Madhya Pradesh state (Anon, 1990) . This micro-watershed is drained by a seasonal stream which originates from Vindhyan Super Group Ranges near Mandu Fort, then it flows towards south in the agricultural area and finally feeds into Kunda Talab near Kasumla village. Geographically, it is bounded by latitude 22° 16′ – 22°: 19′ N and longitude 75°: 26′ – 75°: 29′ E. The total area of the micro-watershed is 15 sq. km. The Climate of the area is semi arid to sub-tropical (Velayutham, 1999). The Nachha micro-watershed is undulating in nature. Physiographically, two third of the area is under agriculture, one third is under forest and the remaining area is occupied with land with scrub.

)3. DATA USED

The Indian Remote Sensing P6 satellite (IRS-P6)(also known as IRS-resourcesat-1 satellite) launched in November 2003 has a unique capability of acquiring simultaneously multi-spectral (MS) data at three different spatial resolutions from three independent optical sensors (LISS-4, LISS-3 and AWIFS). Of these, LISS-4 can be operated in two modes:(i) multi-spectral (MX) mode covering a swath of 23 km and (ii) monochromatic (MO) mode covering a 73 km swath, both at a spatial resolution of 5m. Thematic Maps are prepared by using high resolution dat(Fig.5 & 6)

Satellite ID	Sensor ID	Date of Acquisition
RESOURCESAT-1 RESOURCESAT-1 IRS-1D	L-IV PAN + LISS- 3	Jan 06,2004 Apr. 11,2004 Apr.25,2004
46N/7,(1:50,000) Scale	-	-
1.Population	-	-

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2.Climate 3.Geology 4.Soils		

Table 1. Satellite data and ancillary data used

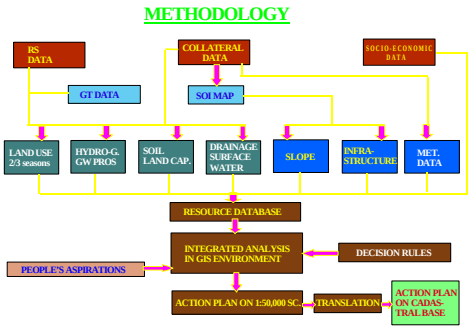

Fig.1 Methodology

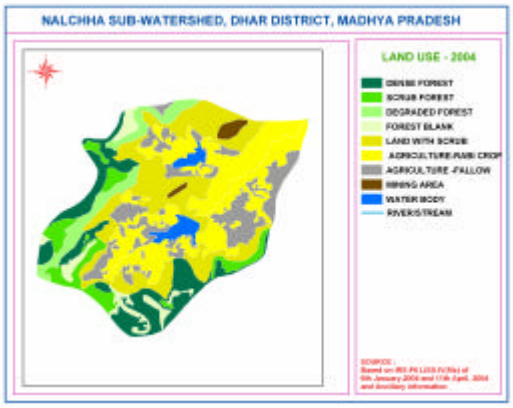

Fig.2: Land Use / Land Cover Map

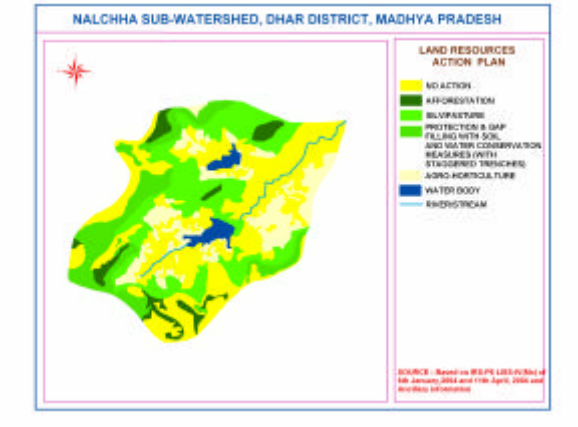

Fig.3: Land Resources Action Plan(LRAP)

4. RESULTS & DISCUSSION

Various thematic maps, land use / land cover, hydro-geomorphology, soil resource and land capability are prepared at 1:12,500 scale using multidate L-IV (MS) data of IRS-P6 satellite and slope map is prepared by using ancillary information(Fig.1). Spatial database is created for these themes in GIS environment using ARC/INFO software. Later on, these coverages are integrated and unionized and a CLDU map is generated (Fig.2). Based on the decision rule, action plan maps are generated for land and water resources development (Table 2).. Various measures are suggested for optimal use of agricultural land, for protection of Protected and Reserved forest and natural regeneration of forest resources, best possible use of waste land for producing fuel and fodder, arresting of soil erosion, conserving water resources and thus conserving natural resources in a meaningful manner.

Sr. No.	Land Use/Land Cover	Percent Slope	Ground Water Prospect	Land Capability	Measures suggested
1	Agriculture Land-Double Crop	0-1 (Nearly level)	Very good	2	No action
2	Agriculture Land-Double Crop	1-3 (Very gently sloping)	Very good	2	Raising of two crops with e.g contour cultivation, Farm bunding, Farm ponds measures at farm level
3	Agriculture Land- current fallow in Kharif Season	1-3 (Very gently sloping)	Good	3	Growing of Rabi crop with soil water conservation measures, e.g contour cultivation, Farm bunding,
4	Agriculture Land-Permanent Fallow	1-3 (Very gently sloping)	Moderate	4	Agro-horticulture
5	Stony waste-Mining	3-5 (Gently Sloping)	Poor	6	Silvipasture and afforestation
6	Open Forest	10-15 (Strongly sloping)	Poor	6	Protection and gap filling with proper S/W conservation. measures(Stagerred trenches)

Table 1: Decision Rule for generation of Land Resources action plan

Sr.No.	Measures	Area in sq.km	Percent
1	No Action	02	13
2	Raising of two crops with e.g contour cultivation, Farm bunding, Farm ponds measures at farm level	03	20
3	Growing of Rabi crop with soil water conservation measures, e.g contour cultivation, Farm bunding,	03	20
4	Agro-horticulture	02	13
5	Silvipasture and afforestation	03	20
6	Protection and gap filling with proper soil and water conservation. measures(Stagerred trenches)	02	14
	Total	15	100

Table 2: Showing area under various measures

4.1 Land resources Development Plan (LRAP)

The action plans suggested for land resources development, are as follows and given in (Fig.3):

4.1.1 Agricultural Land:

a) No action has been suggested for agriculture land which is double cropped, where soil is deep and belongs to category 02 of land capability, ground water prospect is very good and rather it is a plain region and slope is 0-1 (nearly level).
b) For double crop area where slope varies from 1-3(very gently sloping), raising of two crops with e.g Contour cultivation, Farm bunding and Farm ponds measures at farm level are recommended.
c) For agricultural land which is lying fallow in Kharif season, Lay farming ,Alley cropping and growing of rabi crop with soil water conservation measures, e.g Contour cultivation, Farm bunding is suggested
d) In agriculture land which is permanently fallow,Agro-horticulture is recommended where slope is less than 3 per cent, ground water prospect is moderate and soil is moderately deep and land capability belongs to category number 4.

4.1.2 Wasteland

Silvipasture and afforestation is suggested for stony waste land use/ land cover type,where slope is 3-5 per cent (Gently Sloping) and ground water prospect in poor and soil depth is in very shallow in and capability is of category 6.

4.1.3 Forest Land

For open forest land, Protection and gap filling with suitable species of trees along with adequate soil and water conservation measures(Stagerred trenches) is suggested where slope is 10-15 (strongly sloping) and ground water prospect is poor and soil is shallow and falls in category 7 of land capability.

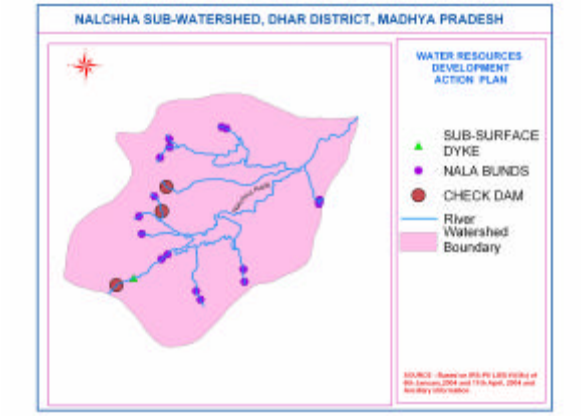

Fig. 4: Water Resources Development Plan(WRDP)

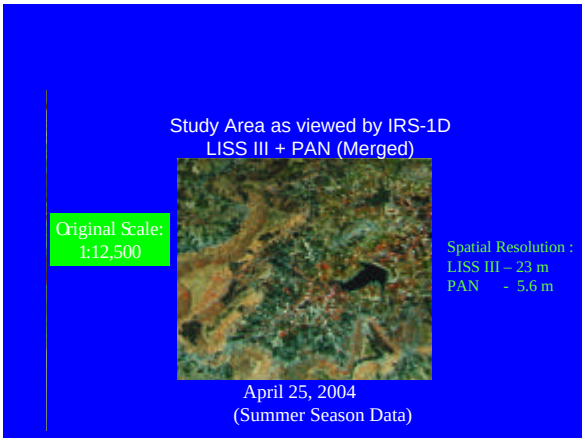

Fig. 5: Merged Image (IRS 1D LISS-III+PAN)

4.2 Water resources Development Plan(WRDP)

The following actions have been suggested in the study area for the development of water resources as specified in Fig.4.

4.2.1 Nala Bund

•Nala bunds have been suggested in the upstream part of the river in order to check siltation of down stream reservoirs.

4.2.2 Check dams

Check dams have been suggested at specific locations where there is need to recharge the ground water regimen especially in upstream part.

4.2.3 Sub-surface dykes

Sub-surface dykes have been suggested along porous stream segments in down stream.

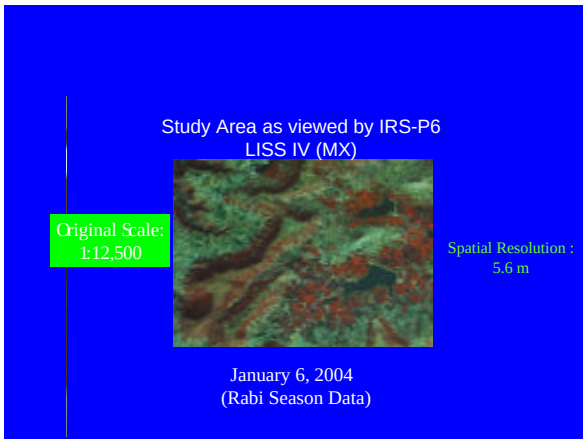

Fig. 6: IRS P6 LISS-IV (MX) Image

5. CONCLUSION

The study has demonstrated that high resolution satellite data of IRS-P6 and GIS are very important for preparation of an inventory of natural resources, creation of spatial database and for generation of action plans for land and water resources development and for arresting soil erosion and thus conserving productive land. .This study reveals that with the use of high resolution data , L-IV(MS),5.6 m , it is possible to prepare action plan maps directly at implementation level scale, i.e.1:12,500 which is more accurate and provides better scientific and technical information content at farm level and thus measures suggested are more accurate and better workable to implement with. Within agricultural lands, current and permanent fallow lands are distinguishable with more clarity at farm level and thus better delineable .Each crop in every farm

plot can be easily identified. In Forest land, Open Forest, scrub forest, and forest blanks are better delineable.

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