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Analysis of Land Use and Land Cover based on SPOT Image: Temghar lake catchment.

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Abstract:

Land use/ land cover inventories are assuming increasing importance in various resources sectors agricultural planning, settlements, environmental studies and operational planning based on agro climatic zones. Information on land use/ land covers permits to better understanding of the land utilization aspects on cropping patterns, fallow lands, forest grazing lands, wastelands and surface water bodies, which is vital for developmental planning.

Introduction

Land use refers to the human activities on land, which are directly related to the land. It encompasses a vide varieties in both the rural and urban environments such as agriculture, industries, commerce, transportation, constructions and recreation. (Clawson and Stewort 1965 and 1987)

Land cover refers to the vegetation (natural and planted), water, bare rock, sand and similar surface and also manmade construction occur on the earth surface. Another manner according to the Burley (1961) land cover implies the vegetation and artificial constructions covering the land surface. These include natural features such as vegetation, water and cultural features such as agricultural crops, buildings and roads.

The land use planning may be concerned with putting environmental resources to new kind of productive use. The need for land use planning is frequently brought about, however, by changing needs and pressures; involving competing use for the same land. The functions of land cover planning is to guide decisions on the land use in such a way that the resources of the environmental output to the most beneficial use for man, whilst at the same time consuming those resources for the future.(ILRI-international institute for land reclamation and improvement 1997)

Land use/ land cover analysis of the Temghar lake catchment.

Pune city has experienced rapid growth due to its accessibility to Mumbai and remaining cities mainly in western Maharashtra like Nashik, Satara, Kolhapur etc.The conditions are favorable for comprehensive developments like education, information technology, and industrialization. Over the last two decades considerable industrialization has took place around Pune city leading to rapid urbanization of the area. Hence, the growth of population and density of population has been rapidly increased. The growing population has created increasing demands for basic infrastructural amenities like water, electricity and sanitation etc. At the cost of this development, natural resources are at the verge of exploitation, therefore exploited. New ways of management of the natural resources has to be taken up urgently. Temghar lake catchment is one of the best examples to provide water supply to Pune city.

The main purpose to undertake land use and land cover analysis using remote sensing data is to ascertain site suitability for residential zone for rehabilitation of project affected persons as well as to suggest potential land use surfaces for different uses keeping in view the norms of sustainable management and development of natural resources.

Methodology:

Methodology adopted in the present analysis can be summarized in the following steps. SPOT image procured from Google Pro. programme, which is available on the internet. Around 36 pieces of the image having a resolution of 10m each downloaded successfully and rectified accordingly. Thus, the mosaicing of 36 pieces has been achieved in GIS environment maintaining the resolution since the image is true colour in nature; it has become very easy to undertake it for visual interpretation. Digitization of each and every category in the polygons gave area estimation very accurately. In all seven categories could have been identified and area statistics has been generated (fig.5.1)

Table No.5.1

Sr.No.	Village	Area (Ha)
1	Temghar	137.88
2	Vegre	219.44
3	Lavarde	105.20..

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4	**Vedhe**	**42.92**
5	**Govt.Land (MI tank)**	**58.26**
6		**04.50**
Total		**568.20**

Land use /land cover analysis based on SPOT Image (Google Pro) 2006:-

The land use /land cover study of the area has been attempted in order to identify and map the various types of land use/ land cover classes in the study area interpreting of Google pro image 2006.(Table 5.2 and Fig 5.2)

Table No. 5.2
Temghar Lake Catchment
Land use Land Cover (Based on Google Image 2006)

Sr. No.	Land Use / Land Cover Class	Area		
		Km²	Hectares	Percentage
1	Agricultural Land	0.26	25.97	0.69
2	Alluvium Deposits	0.01	1.30	0.03
3	Roads	0.16	15.98	0.42
4	Settlements	0.02	2.20	0.06
5	Water body	4.99	499.00	13.24
6	Barren land	2.38	237.80	6.31
7	Vegetation cover	9.38	937.80	24.88
8	Land with/without scrub	20.50	2050.00	54.38
TOTAL		37.70	3770.00	100.00

Agricultural land: -

It is defined as the land primarily used for farming and for production of food, fiber, and other commercial and horticultural crops. It includes land under crops (irrigated and unirrigated). Fallow, plantations etc.

Crop land:-

It includes those lands with standing crop as on the date of the satellite imagery. The crops may be of either Kharif or Rabi or Kharif Rabi seasons.

Fallow land:

It is described as agricultural land, which is taken up for cultivation but is temporarily allowed to rest, un-cropped for one or more seasons, but not less than one year. **Plantations:**

It is described as an area under agricultural tree crops, planted adopting certain agricultural management techniques. It includes tea, coffee, rubber, coconut, areca nut, citrus, orchards and other horticultural nurseries.

An attempt has been made in the present study to delineate the area under agriculture. It is observed that agriculture is being practiced in patchy form and are mainly paddy fields this seems to be due to hilly terrain and very few plain land in the marginal areas of the water body is available. Thus the agriculture is mainly practiced in kharif season. Fallow land is also present in the form of bunds of agricultural fields. As mention earlier a new trend of development of land for commercial purpose in the form of real estates and farm houses has been emerged in this area and therefore inclination of the people is towards selling of the land and thus practicing of agriculture is almost stopped. Introduced Plantation is being practiced by these owners but proportion is very less. So agricultural lands thus accounts to only 0.69 % of entire catchment.

Built up land.

It is defined as an area of human habitation developed due to non-agricultural use and that which has a cover of buildings, transport, and communication, utilities in association with water, vegetation and vacant lands. In the study area, it is observed that, very scattered settlements are spread over hill slopes on either sides of catchment and therefore their percentage overall land use category is negligible and accounts to only 0.6 % of the total catchment area.

Area under roads measures about 0.42 % of the total catchment area and only runs for Lavasa city from southern marginal area of catchment.

Water body:- It is an area of impounded water, areal in extent and often with a regulated flow of water. It includes man-made reservoirs/lakes/ tanks/canals, besides natural lakes, rivers/ streams and creeks.

River/Stream

It is a natural course of flowing water on the land along definite channels. It includes from a small stream to a big river and its branches. It may be perennial or non-perennial. In the study area major river Mutha flowing from west to east direction Temghar dam on which has been constructed. The upper reach of river mainly characterized by first and second order channels and very less area as been occupied by rivers.

Reservoir/Lakes/Tanks/Canal

It is a natural or man-made enclosed water body with a regulated flow of water. Reservoirs are larger than tanks/lakes and are used for generating electricity, irrigation and for flood control. Tanks are smaller in aerial extent with limited use than the former. Canals are inland waterways used for irrigation and sometimes for navigation.

Temghar lake is a man-made enclosed water body the dam wall of the same has been constructed on river Mutha. It is around three TMC capacity dam and acquires about 13.24 % of the total catchment area.

Vegetation cover:-

Forest:-

It is an area (within the notified forest boundary) bearing an association predominantly of trees and other vegetation types capable of producing timber and other forest produce.

Evergreen/Semi-evergreen forest:-

It is described as a forest, which comprises of thick and dense canopy of tall trees, which pre-dominantly remain green throughout the year. It includes both coniferous and tropical broad-leaved evergreen trees. Semi-evergreen forest is a mixture of both deciduous and evergreen trees but the latter predominate.

Deciduous forest:-

It is described as a forest which predominantly comprises of deciduous species and where the trees shed their leaves once in a year.

It is noticed in the study area to cover about 24.88 % of total catchment area and spreads over almost on all the slope segments. Forest resources in study area are being depleted at an alarming rate due to clearance of forest for commercial purposes. In the study area mainly species of evergreen, semi evergreen and deciduous forest are observed.

Degraded forest or Scrub:-

It is described as a forest where the vegetative (crown) density is less than 20% of the canopy cover. It is the result of both biotic and abiotic influences. Scrub is a stunted tree or bush/ shrub. In the study area forest cover is being transformed to degraded forest or scrub area due to the activities mentioned earlier.

Forest Blank:-

It is described as openings amidst forests without any tree cover. It includes openings of assorted size and shapes as seen on the imagery. In spite of degraded forest, evergreen semi evergreen and deciduous forest, forest blanks are also observed near paddy fields and in reserved forest area.

Forest Plantations:-

It is described as an area of trees of species of forestry importance and raised on notified forest lands. It includes, eucalyptus, casuarinas, bamboo etc. Forest plantations are observed to be introduced plantations in the form of bamboo and jackfruit trees near the settlements and agricultural fields. Basic aim seems to be the protection of agricultural fields as well as settlements.

Waste Land

It is described as degraded land which can be brought under vegetative cover with reasonable effort, and which is currently underutilized and land which is deteriorating due to lack of appropriate water and soil management or on account of natural causes. Wastelands can result from inherent/imposed constraints such as, by location, environment, chemical and physical properties of the soil or financial or management constraints. (NWDB, 1987).

In the study area, three main categories of waste lands are prominently observed and are in the form of gullied/Ravenous land, barren rocky/stony waste / sheet rock area and land with or without scrub.

Gullied/Ravenous land and Land with or without scrub :

The gullies are formed as a result of localized surface runoff affecting the friable unconsolidated material In the formation of perceptible channels resulting in undulating terrain

The word 'ravine' is usually associated not with an isolated gully but a network of deep gullies

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They occupy (relatively) higher topography like uplands or high grounds with or without scrub. These lands are generally prone to degradation or erosion. These exclude hilly and mountainous terrain.

Hill slopes in the study area are mainly characterized by gullied and ravenous topography and shows high proportions of runoff in rainy season. On the other hand land with and without scrub area has also been noticed to its maximum and accounts to 54.38 % of the total study area.

Barren rocky/Stony waste / Sheet rock area

It is defined as the rock exposures of varying lithology often barren and devoid of soil cover and vegetation. They occur amidst hill forests as openings or scattered as isolated exposures or loose fragments of boulders or as sheet rocks on plateau and plains.

Barren rocky surfaces are also observed along very steeper slopes and measured to be 6.31 % of the total study area.

5.3 Altitude wise variation in land use / land cover

Agricultural land: - (Slope range 3 to more than 30%)

Agricultural lands in the form of paddy fields are noticed to in the elevation range of 720 m. to 800 m. Above MSL as well as 920 m. to 940 m and 960 m. to 1000 m. This covers only 0.69% (25.97 ha.) of the total catchment area.

(Table No.5.3a and b)

Alluvium Deposits: - (Below 3%)

This is an occasionally available land surface area and is the sedimentary deposits carried by the streams. Thick soil layers have been deposited in the extreme western end of the Temghar dam and are below the height of 720m above MSL.

Built up land. (Slope range 3 to more than 35%)

Built up land in the form of roads and settlement is present in the study area and only covers 0.18 Km², which is less than 0.5% of the total catchment area. Approach road constructed for Lavasa city passes through the catchment and noticed to be cover elevation range between 740 to 1040 m.above MSL.

Settlements in the study area are noticed to be below 760 m. above MSL. Villages mainly Temghar and Wegre are covering their gaothans and measured to be only 0.06 % of the total catchment area.

Water body: - (Slope range below 1% to 15%)

FRL has been fixed at 710.12 m.above MSL and covers 4.99 Km² area of the total catchment area. This covers around 13.24% of the total catchment area. .

Waste land (Barren land):- (3% to more than 35%)

Barren land covers around 6.31 % of the total catchment area and also spreads throughout the catchment. Surprisingly very high percentage of barren land found to be below 800 m.above MSL.

The variation of barren land in this altitude zone is varying between 8% to more than 12% of the total barren land in the study area.

Land with / without scrubs occupies almost 20.50 Km² area which accounts to more than 50 % of the entire catchment i.e. 54.38%. This is in fact a potential land surface area for optimum utilization provided management practices are done. It also spreads throughout the catchment and almost in all altitude zones. However, maximum percentage of the total land with / without scrubs area has been noticed to be in the altitude zone of 880 to 960 m above MSL and varying between more than 6% to more than 10% of the entire category.

Vegetation cover: - (3% to more than 30%)

Vegetation spread throughout the catchment and covers 9.376 Km² area which accounts to 24.88 % of the total catchment area. Percentage of the total vegetation cover noticed to be high and more than 7.47% to 8.511% stucked in the 880 to 940 m. above MSL.of altitude range. Above 11% of the total the total vegetation cover noticed to in the altitude zone of 700m. to 720m above MSL.

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TABLE NO.5.3 a ALTITUDE WISE DISTRIBUTION OF LAND USE / LAND COVER										
Sr. No.	Height (m)	Built up land (Road)	Built up land (Settlements)	Agricultural land	Wasteland (Barren land)	Wasteland (Land with/ without scrub)	Vegetation Cover	Alluvium deposits	Water body	Area (Km²)
1	<700	0	0	0	0	0	0	0	3.31	**3.31**
2	700-720	0	0.005	0	0.3	0.107	1.078	0.013	1.68	**3.183**
3	720-740	0	0.014	0.067	0.26	0.86	0.33	0	0	**1.531**
4	740-760	0.014	0.003	0.03	0.346	0.865	0.397	0	0	**1.655**
5	760-780	0.01	0	0.05	0.31	0.77	0.411	0	0	**1.551**
6	780-800	0.011	0	0.02	0.195	0.93	0.408	0	0	**1.564**
7	800-820	0.011	0	0	0.18	0.87	0.496	0	0	**1.557**
8	820-840	0.01	0	0	0.15	0.83	0.548	0	0	**1.538**
9	840-860	0.01	0	0	0.047	0.88	0.583	0	0	**1.52**
10	860-880	0.01	0	0	0.05	0.98	0.578	0	0	**1.618**
11	880-900	0.01	0	0	0.042	1.371	0.701	0	0	**2.124**
12	900-920	0.01	0	0	0.061	1.86	0.754	0	0	**2.685**
13	920-940	0.009	0	0.033	0.075	2.112	0.798	0	0	**3.027**
14	940-960	0.005	0	0	0.112	1.93	0.636	0	0	**2.683**
15	960-980	0.01	0	0.03	0.035	1.25	0.385	0	0	**1.71**
16	980-1000	0.02	0	0.03	0.02	1.01	0.238	0	0	**1.318**
17	1000-1020	0.01	0	0	0.02	0.865	0.212	0	0	**1.107**
18	1020-1040	0.01	0	0	0.029	1.24	0.249	0	0	**1.528**
19	1040-1060	0	0	0	0.04	0.66	0.204	0	0	**0.904**
20	1060-1080	0	0	0	0.056	0.49	0.214	0	0	**0.76**
21	1080-1100	0	0	0	0.051	0.29	0.156	0	0	**0.497**
22	>1100	0	0	0	0	0.33	0	0	0	**0.33**
Total Area (Km²)		**0.16**	**0.022**	**0.26**	**2.379**	**20.5**	**9.376**	**0.013**	**4.99**	**37.7**

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TABLE NO.5.3 b ALTITUDE WISE DISTRIBUTION OF LAND USE / LAND COVER										
Sr. No.	Height (m)	Built up land (Road)	Built up land (Settlements)	Agricultural land	Wasteland (Barren land)	Wasteland (Land with/ without scrub)	Vegetation Cover	Alluvium deposits	Water body	Area (%)
1	<700	0	0	0	0	0	0	0	66.33267	**8.779841**
2	700-720	0	22.72727273	0	12.61034	0.5219512	11.4974403	100	33.66733	**8.442971**
3	720-740	0	63.63636364	25.7692308	10.928962	4.195122	3.51962457	0	0	**4.061008**
4	740-760	8.75	13.63636364	11.5384615	14.543926	4.2195122	4.23421502	0	0	**4.38992**
5	760-780	6.25	0	19.2307692	13.030685	3.7560976	4.38353242	0	0	**4.114058**
6	780-800	6.875	0	7.69230769	8.1967213	4.5365854	4.35153584	0	0	**4.148541**
7	800-820	6.875	0	0	7.5662043	4.2439024	5.29010239	0	0	**4.129973**
8	820-840	6.25	0	0	6.3051702	4.0487805	5.84470099	0	0	**4.079576**
9	840-860	6.25	0	0	1.97562	4.2926829	6.21800341	0	0	**4.03183**
10	860-880	6.25	0	0	2.1017234	4.7804878	6.16467577	0	0	**4.291777**
11	880-900	6.25	0	0	1.7654477	6.6878049	7.47653584	0	0	**5.633952**
12	900-920	6.25	0	0	2.5641026	9.0731707	8.04180887	0	0	**7.122016**
13	920-940	5.625	0	12.6923077	3.1525851	10.302439	8.51109215	0	0	**8.029178**
14	940-960	3.125	0	0	4.7078604	9.4146341	6.78327645	0	0	**7.116711**
15	960-980	6.25	0	11.5384615	1.4712064	6.097561	4.10622867	0	0	**4.535809**
16	980-1000	12.5	0	11.5384615	0.8406894	4.9268293	2.53839 59	0	0	**3.496021**
17	1000-1020	6.25	0	0	0.8406894	4.2195122	2.26109215	0	0	**2.93634**
18	1020-1040	6.25	0	0	1.2189996	6.0487805	2.65571672	0	0	**4.05305**
19	1040-1060	0	0	0	1.6813787	3.2195122	2.17576792	0	0	**2.397878**
20	1060-1080	0	0	0	2.3539302	2.3902439	2.28242321	0	0	**2.015915**
21	1080-1100	0	0	0	2.1437579	1.4146341	1.66382253	0	0	**1.318302**
22	>1100	0	0	0	0	1.6097561	0	0	0	**0.875332**
Total Area (%)		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

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Research Paper
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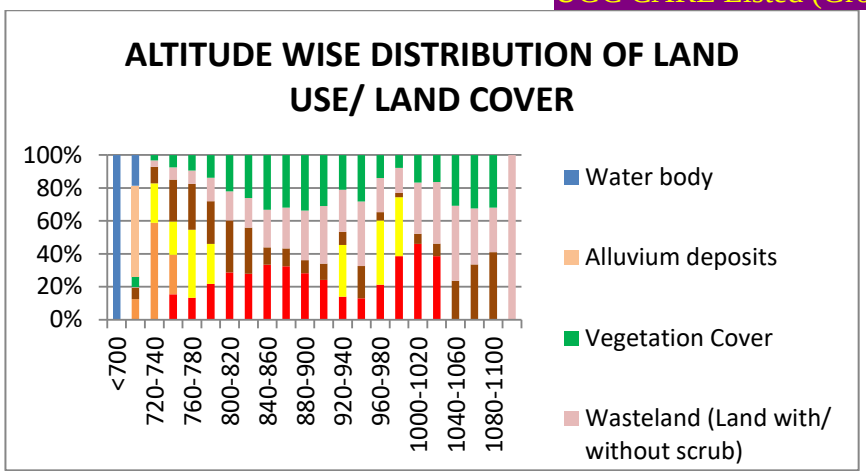

TEMGHAR LAKE CATCHMENT

GOOGLE IMAGE 2006

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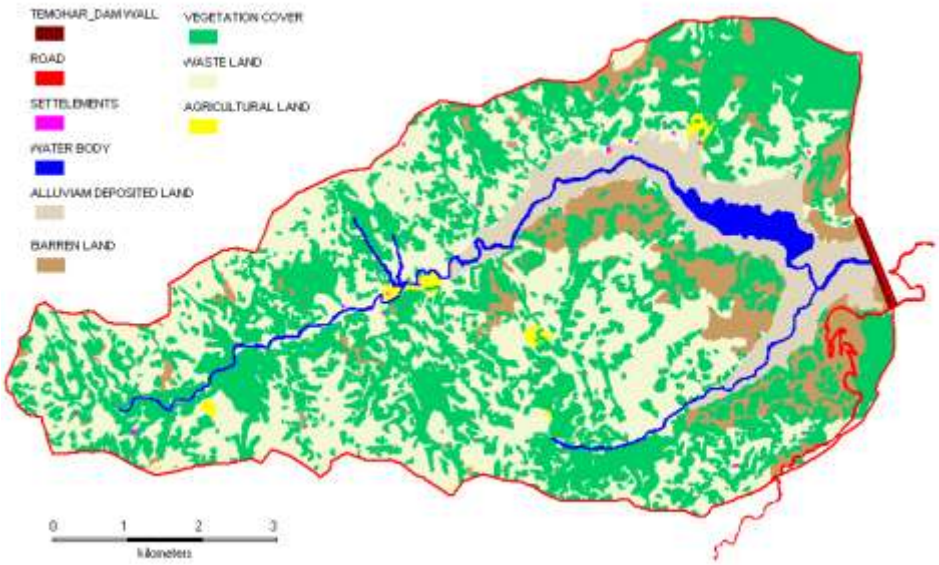
TEMGHAR LAKE CATCHMENT

LAND USE / LAND COVER MAP BASED ON GOOGLE IMAGE 2006



TEMGHAR LAKE CATCHMENT

3D VIEW OF LAND USE / LAND COVER MAP BASED ON GOOGLE IMAGE 2006

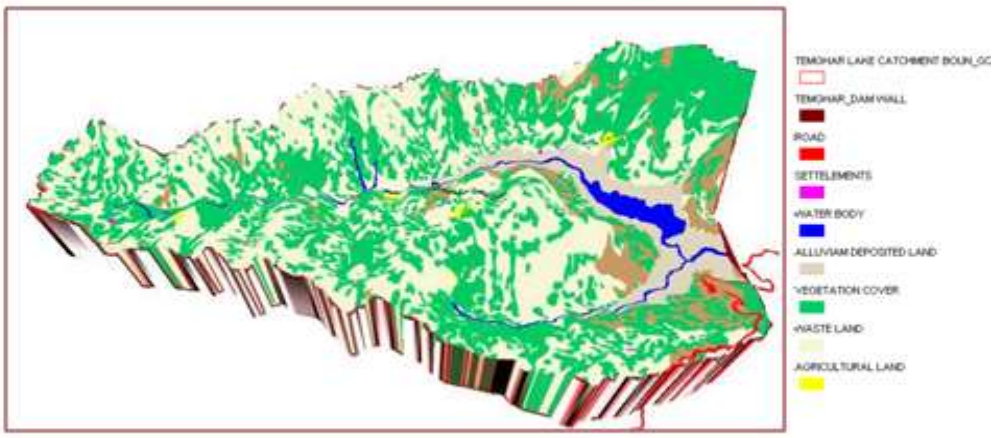


Fig no.5.3

REFERENCES

1. Abhalaxmi Singh (1985): "The problems of Wasteland in India" B.R.Publishers,New Delhi.
2. Abrol E.D. & H.S.Gill. (1986): "Problems and prospects of afforestation of salt affected soils" Dimentions of wasteland development, concept publishing company, New Delhi.
3. Adams.W.M. (1993) "Development's Deat Ear: Downstream users and Water Releases from Bakalori Dam, Nigeria."World Development, vol21 (9):1405-1416.
4. ADB (Asian Development Bank)(1995) Involuntary Resettlement, printed by Asian Development Bank. Available at http://www.abd.org/Document/Policies/Involuantary-Resettlement/involuntary-resettlement.pdf 2004-09-08.
5. ADB (Asian Development Bank)(1998) Handbook on Resettlement-A Guide to Good Practice, printed by Asian Development Bank. Available athttp://www.abd.org/Document/Policies/Involuantary Resettlement/involuntary-resettlement.pdf 2004-09-08.printed by Asian Development Bank. Available at http://www.abd.org/Document/Policies/Involuantary-Resettlement/involuntary-resettlement.pdf 2004-09-08
6. Agnihotri.A (1996) The Orissa resettlement and Rehabilitation of Project Affected Persons Policy, 1994-An analysis of its robustness with Reference to the Improvement Risk Model,in A.B.Ota and Anita Agnihotri (Eds.) Involuntary Desplacement in Dam Project, Prachi Prakashan, New Delhi.
7. Agnihotri.A (1996) The Orissa resettlement and Rehabilitation of Project Affected Persons Policy, 1994: Some Critical Issues, in Mohapatra,A. B.Ota and R.N.Mohanty(Eds.) Development Induced Displacement and Rehabilitation, Prachi Prakashan,Bhubaneswar.
8. Annals of the National Association of Geographers, Balaji K., Raghavswamy.V., Rammohan, Nagaraja R., Gautam N.C. India, Vol. XV, No. 2, (December1995) 121-125.
9. Ashaq Hussain Sheikh,Sarvesh Palria and Akhtar Alam (2011) Integration of GIS and Universal Soil Loss Equation (USLE) for Soil Loss Estimation in a Himalayan watershed. Recent Research in Science andTechnology,
10. Bavisker.A. (1995) In the Belly of the River: Tribal Conflicts over Development in the Narmada Valley.Delhi: Oxford University Press.
11. Beek K.J, De Bie.K and Driessen P.(1997) " Land information and land evaluation for land use planning and sustainable land management.Current Science,Vol.96, No.4,25 february 2009.
12. Bisht S.R. & Kothyari B.P. (2001) 'Land Cover Change Analysis of Garur Ganga Watershed Using GIS /Remote Sensing Technique', Vol. 29, No. 3 (September 2001) 137-142.
13. Brady Niles C. (1995) 'The Nature and Properties of Soils', (Tenth Edition) Prentice Hall of India, New Delhi.
14. Briggs Davis (1977) Edited by Morgan M.A. 'Sources & Methods in Geography Soils',
15. Butterworths London. Brown, L. R. and E. C. Wolf. 1984. Soil Erosion: Quiet Crisis in the World Economy. World-watch Paper 60. Worldwatch Institute, Washington, D.C.
16. Census of India (2011) District Census Handbook, Director, Government printing and stationary, Maharashtra Government, Photozinco press, Pune.
17. Cernea.M.M.(1990).Poverty risks for population displacement in water resources development," Development Discussion Paper 355 (Cambridge,Massachusetts, Harvard Institute for Iternational Development).
18. Cernea.M.M.(1996)"Public Policy responses to Development induced population displacement," Economic and Political Weekly, vol.31,No.24,pp.1515-1523.
19. Cernea.M.M.(1996)" Development, displacement and Rehabilitation-Special Issue," Economic and Political Weekly, vol.31,No.(24),June 15.
20. Chattopadhyay Mahamaja and Shakuntala C. (1987) 'Landuse and Its Relation with Terrain Characteristics: A case Study in Wayanad Plateau, India', Annals of the Association of Geographers India Vol. VII, No. 2, (December 1987) 1-12.
21. Chattopadhyay Srikumar and Salim M.B. (1985) 'Morphological Classification of Land and Assessment of Its Suitability for Various Uses: A Case study on Bovalipuzha – Aralampuzha Drainage Basin', Transactions of Indian Institute of Geographers. Vol. 7, No. 2, (July 1985) 105-112.
22. Colchester.Marcus (2000) Sharing Power: Dams, Indigenous Peoples and Ethnic Minorities. Report Prepared for the World Commission on Dam. Website: http://www.dams.org.
23. Coline Clark. (1970): " The Economics of Irrigation " Pergamon press, New York.
24. Colson.E. (1971) The social consequences of Resettlement: The impact of Kariba Resettlement upon the Gwembe Tonga. Manchester University Press.

25. Daji J.A. revised by Kadam J.R. (1996) 'A Textbook of Soil Science', Media Promoters and Publishers Pvt. Ltd., Bombay.
26. Das T.H., Sarkar Dipak and Singh D.S. (1994) 'Land Evaluation for Different Uses in Sikkim: A Case Study in Perhumid Subtropical Region', Landscape Systems, Vol. 17, No. 2. 96-100.
27. Dent David and Young Anthony (1981) 'Soil Survey and Land Evaluation', George Allen and Unwin (Publishers) Ltd. London.
28. Gerrard A.J. (1981) 'Soils and Landforms – An Integration of Geomorphology and Pedology', George Allen and Unwin (Publishers) Ltd. 40, Musecum Street, London.
29. D.Martin and S.K.Saha.National Bureau of soil survey and Land use planning, Regional planning centre, IARI Campus, New Delhi. Land evaluation by integrating remote sensing and GIS for cropping system analysis in a watershed
30. Dreze,J.M.Samson and S.Singh.(1997) The Dam and the Nation: Displacement and Resettlement in the Narmada Valley. Delhi and New Yark: Oxford University Press.
31. Driessen P.M.and Konijn N.T. (1992) Land use systems analysis.Wageningen: Wageningen Agricultural University , Department of Soil Science and Geology.
32. .Economic and Political Weekly (1996) "Development, Displacement and Rehabilitation-Special Issue," Vol.31 (24) June 15.
33. Fahim.h.m. (1981) Dams, People and Development: The Aswan high dam case, Oxford: Pergamon Press.
34. Fernandes.w.and Thukral (ed.) (1989) "Development, Displacement and Rehabilitation. Indian Social Institute, New Dehli.P.195.
35. Fernandes.w.and Vijay Paranjpye (ed.) "Rehabilitation Policy and Law in India. A Right to Livehood. Indian Social Institute, New Dehli.Econet,Pune P.559.
36. Fox.J. and L.D.Brown (ed.) (1998) The Struggle for Accountability: The World Bank, NGO's,and Grassroots Movement .Cambridge,MA and London:MIT Press.
37. Fisher. W.F.(ed.) (1995) Working Towards Sustainable Development. The Damming of the Narmada River in Western India. Armonk,NY:M.E.Sharpe.
38. Ganopadyay.T. (1983) Katkhadi, Studies on Rehabilitation of Submerging Villages, Centre for Social Studes,Surat.
39. Goldsmith.E andN.Hilyard. (1984). "The Social and Environmental Effects of Large Dams". Vols.1 and 2 Cornwall, UK: Wadebridge Ecological Centre.
40. Government of India. (2004) National Policy on Resettlement and Rehabilitation for project affected families-2003. Gazette of India, Extraordinary Part I, Section I, No-46, 17 February 2004.
41. Government of Maharashtra (2005). Report: Pune District Réhabilitation Centre; Publication.
42. Gaikwad Sunil w. (2003). The significance of Geomorphic Analysis in the evaluation of land resources: A study of Khadakwasala lake catchment, A minor research project.
43. Haberern, J. 1992. A soil health index, J. Soil and Water Conservation. 47:6.
44. Hornick, S. B. 1992. Factors affecting the nutritional quality of crops. Amer. J. Alternative Agric. 7:63-68.
45. Horowitz.M.M.et.al. (1993) Resettlement at Manantali,Mali:Short-term success, Long term Problems. In: Cernea and Guggenheim.
46. ICID (International Commission on Irrigation and Drainage) 2004:Task Force (TF 5)Appropriate Decision Making Procedures for New Dams particularly for irrigation, Drainage and flood management, New Delhi, India.
47. -Dr. Sunil W.Gaikwad (2003) "The significance of geomorphic analysis in the evaluation of land resources, study of Khadakwasala Lake Catchment, Western Maharashtra." The miner research project, UGC,Western Zone Pune.
48. Jadhav Ambadas S. (2001) Landform analysis around Kolhapur based on remote sensing techniques. The Deccan Geographers Vol.39 No 2(July December 2001).
49. J.R.Benites, F.Shaxson, M.Vieira-Land condition change, indicaters for sustainable land resource management. Pp 1-10.
50. K.Anilkumar. (2009) "Dams and displacement: A Review. Centre for economic and social studies.Begumpet, Hydrabad 500016.
51. Land resource evaluation: 23 rd Course Professional Master, IAO 2003.
52. Detailed soil survey report: Government of Maharashtra, Department of agriculture.
53. Larson, W. E., G. R. Foster, R. R. Allmaras, and C. M. Smith. 1990. Research Issues in Soil Erosion/Productivity - Executive Summary. Published by University of Minnesota, St. Paul, Miunesota. 35 p.

54. Lokrajya, (1986) Rehabilitation of the Project Affected Persons. Lokrajya, 42(10):6-8 and 12.
55. Maharashtra Shasan Krishi Vibhag- Mrud Survekshan and Mrud Chachani. Krishi Bhavan, Shivajinagar, Pune-5.
56. Massee, T. W. 1990. Simulated erosion and fertilizer effects on winter wheat cropping inter-mountain dryland area. Soil Sci. Soc. Amer. J. 54: 1720-1725.
57. Majot J. (ed.) (1997) Beyond Big Dams: A New Approach to Energy Sector and Watershed Planning.Berkely: International Rivers Network.
58. Mathur H.M. and Marseden (eds) (1998) Development Projects and Impoverishment Risks: Resettling Project-Affected People in India.New Delhi: Oxford University Press.
59. Mathur H.M. (1999). The Impoverishment Potential of Development Projects: Resettlement Required Risk Analysis.
60. Mitchell Bruce-(1979) Geography and resource analysis. Longman Publishers, New York.
61. Modi R (2004) Sardar Sarovar Oustees: Coping with Displacement, Economic and Political Weekly, March 13, pp.1123-1126.
62. (1995) 'Remote Sensing Analysis of Landuse / Landcover of Proposed Tuticorin Refinery Site: An Input for Environmental Impact Assessment',
63. Moharana P.C. and Vats P.C. (1998) geomorphic evaluation of landform for sustainable landuse planning in Western Rajasthan. Indian Journal of Geomorphology vol. 3, No. 2, (July-December 1998) 221-2321.
64. O.Challa, S.Vedivelu, J.Sehagal (2008). Soils of Maharashtra for optimizing Land use National Bureau of Soil Survey and Land Use Planning. Nagpur. Training Course on soil survey and mapping. February Organized by: National Bureau of Soil Survey and Land Use Planning. Nagpur Soil Annual, Department of Agriculture, Government of Maharashtra.
65. Panda Damodar (2000) 'Land use/Land cover mapping of the Rukshikulya basin – A remote sensing approach', The Deccan Geographer Vol. 38, No. 1 and 2. (January-December 2000) 1-16.
66. Paranjape Suhas, Joy K.J., Machado Terry, Varma Ajaykumar, Swaminathan S. (1998) 'Watershed based development' – A source book, Bharat Gyan Vigyan Samithi, New Delhi.
67. Parasuram S. (1994) Summary of the findings of the status of R and R of Reservoir Displaced People in Maharashtra. Tata Institute of Social sciences, Mumbai. July, 1994, Mimeo. P.17.
68. Patridge W.L. (1990) "Involuntary Resettlement in Development Project,"Journal of Refugee Studies,Vol 2 (3):373-384.
69. Pawar C.T. and Pujari A.A. (2000) 'Soil degradation in sugarcane farming: A micro level analysis', Transactions, Institute of Indian Geographers Vol. 22. No. 1 (January 2000) 25-34.
70. 22. No. 1 (January 2000) 25-34.
71. Pillai Rekha Oleschak (1996) "Sardar Sarovar Injustices. Email: rekha. Oleschak@ using.cli
72. Ram Babu Mallavarapu.(2006)Development Displacement and Rehabilitation: An Action Anthropological Study on Kovvada Reservoir in West Godvari Agency of Andra Pradesh, India.
73. Reddy I.U.B (1993) Rehabilitation.Mittal Publication, New Delhi.P .213.
74. Rossiter D.G.(2003) Biophysical Models in Land Evaluation. EOLSS Publishers Co.Ltd.U.K.
75. Ray Parshuram (2000) Development Induced Displacement in India.SARWATCH Vol.2.