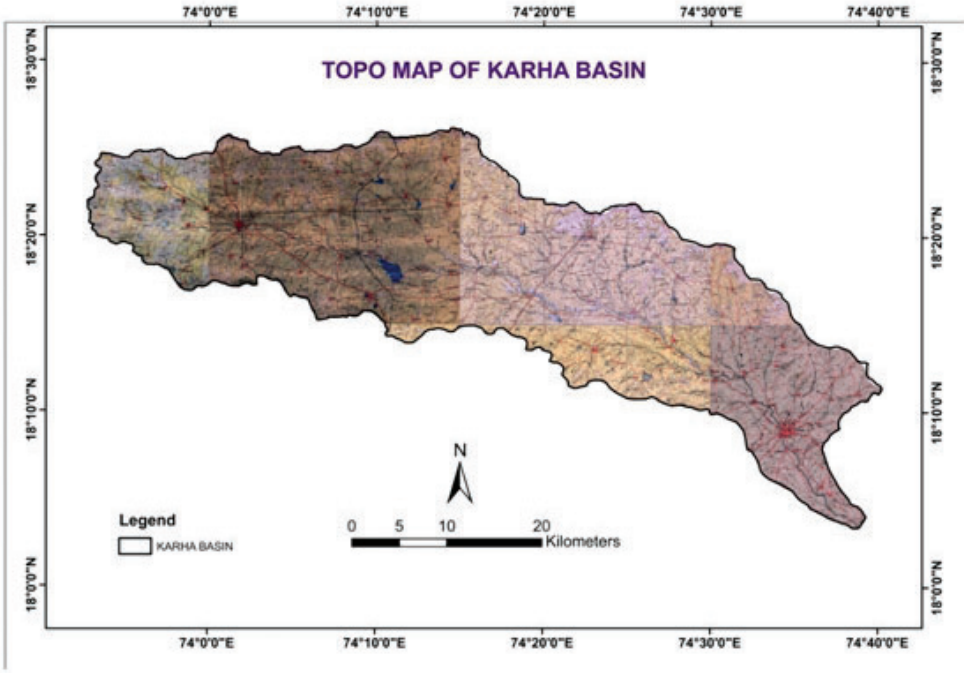
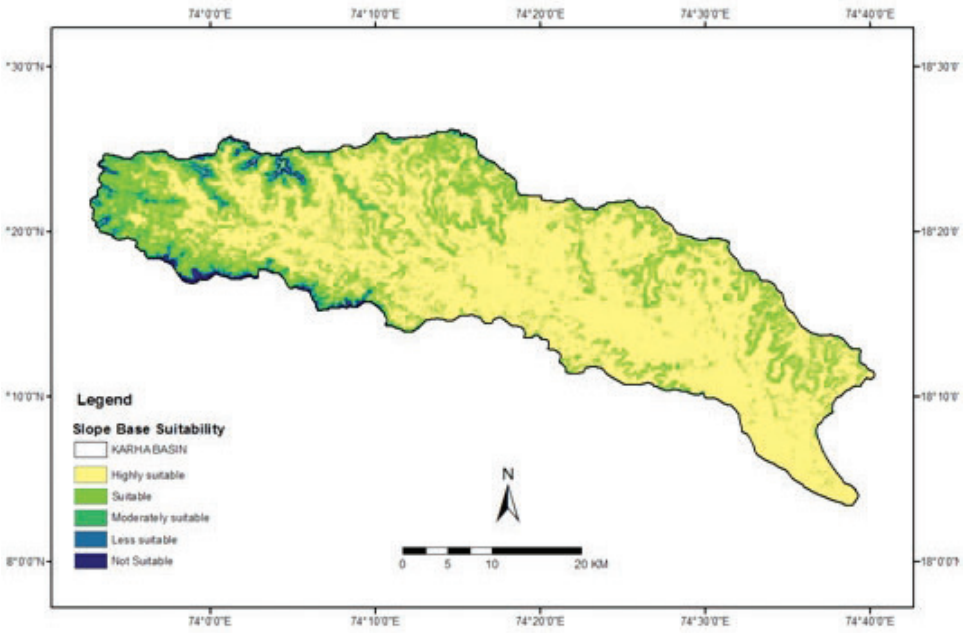
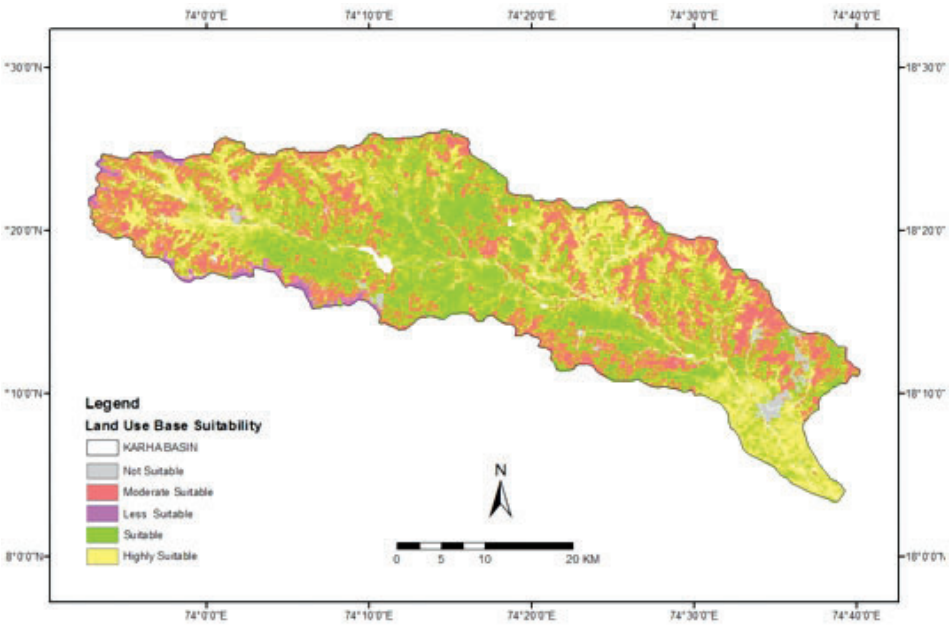


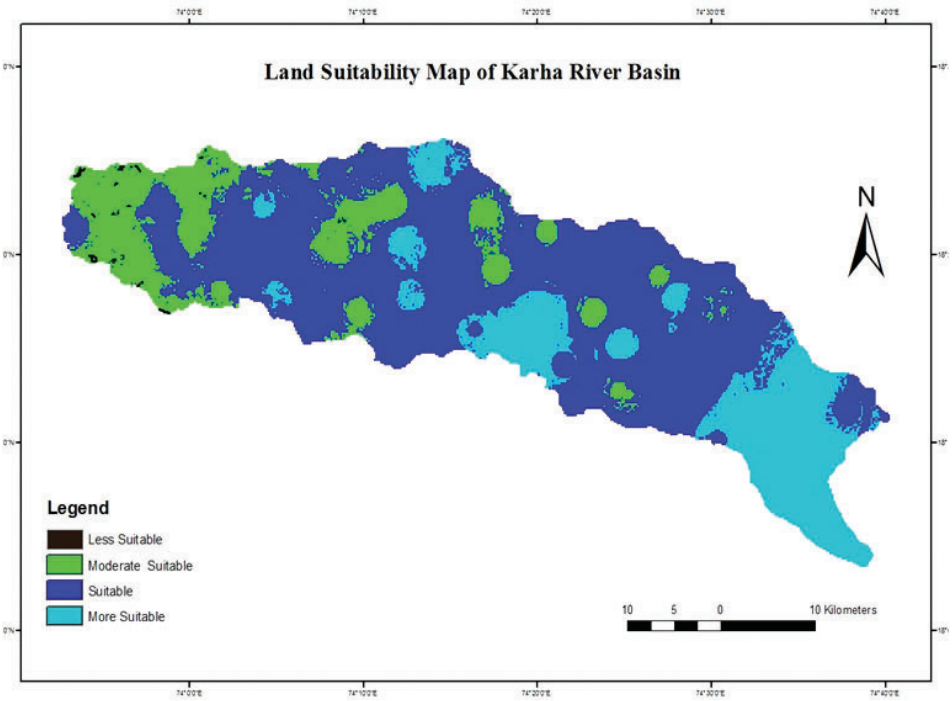
Map No. : 1 (see page 274 for the text)



Map No.2 Slope Base Suitability Of Karha Basin (see page 276 for the text)



Map No. 3 Land Use Base Suitability of Karha Basin (see page 277 for the text)



Map No. 4: Agro Land Suitability of Karha River Basin (see page 277 for the text)

Trans.Inst.Indian Geographers
ISSN 0970-9851

'Agro base Land Suitability Analysis of Karha River Basin'

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Abstract

Geographic Information System (GIS) has recognized itself as a very powerful tool in agricultural research. This study proposes an empirical methodology for analyzing and mapping of land suitability using the GIS techniques.Land cover is an important input parameter for a number of agricultural, hydrological, and ecological models which constitute necessary tools for development, planning and management of natural resources in the territory.Land-use suitability mapping and analysis is one of the most useful applications of GIS for spatial planning and management (Collins et al., 2001; Malczewski, 2004). Land-use suitability analysis is a multi-criteria evaluation,which aims at identifying the most appropriate spatial pattern for future land uses.This research work provides information at local level which could be utilized by farmers.Tremendous pressure on land resource due to population explosion, especially on soil and water resources resulting in sluggishness of agricultural productivity.

Knowledge of extent of land suitability is essential for land use planning to avoid any adverse consequences in future. Such planning also requires the knowledge of land diversion over a period of the time to judge the priority of the area.The purpose of the criterion weighting is to express the importance of each criterion relative to other criteria.In the present research, attempt has been take for studying land suitability of Karha Drainage Basin. Karha is a tributary of Nira River. Karha river having catchments area around 1350 sq.km. The purpose of this study focus agro base land suitability for agricultural growth and rural development.

Key Word: *Land Suitability, Karha Drainage Basin, GIS, Analytic Hierarchy Process, MCDM -Multi-criteria decision making.*

Introduction

Land resources are the base for various developmental activities on the earth. Owing to ever increasing pressure of population on land for meeting the growing demand for food, fuel, and fiber, a sizeable area of previous barren, fallow and marginal lands and forest in the country have been brought under cultivation (Rao,1999)

Land suitability is ability of given type of land to support a defined use. The process of land suitability classification is the evaluation and grouping of specific areas of the land in terms of their suitability for a defined use.Land Suitability analysis is an interdisciplinary approach by including the information from different domains like Soil science, crop science, meteorology,

social science economics and management. Being interdisciplinary, Land Suitability analysis is deals with information, which is measured in different scales like ordinal, nominal and ratio scale etc.

Land Suitability analysis is needed for various purposes in the context of present days agricultural. 'Suitability is measure of how well the qualities of the land unit match the requirement of a particular from of land use' (FAO)Pressure on land resources has increased duringrecent years despite goals to improve their management. Globalization and urbanization are aggravating competing demands on land. Land suitability analysis using GIS and remote sensing would resolve these issues while providing better land-use options to the farmers. Productivity of land can be determined byenvironmental components such as climate, local topography (roughness, steepness, and exposure), soil type and existing vegetation. Improper land use results in land degradation and decline in agricultural productivity.

Land cover is a fundamental parameters that describing the earth's surface. These parameters play an important role to describe the physical feature of environments. If the area is small then suitable land cover may be based on ground observed and survey but if the area is large than it is difficult to access the information. Hence modern technology like remote sensing and GIS - use for land suitability Analysis.Land suitability assessment for agriculture is very important for agriculture development and future planning. Land suitability analysis is an assessment of an area to determine how proper or appropriate it is for a particular use of the land in a particular location. Agricultural land suitability classification based on ethnic knowledge is important to land use planning. The systematic assessment of land and water potential aims to identify and put into practice future alternative land uses that will best meet the needs of the people while at the same time conservation resources for the future.

One of the most important factors affecting the land suitability classification for cultivation is soil properties.

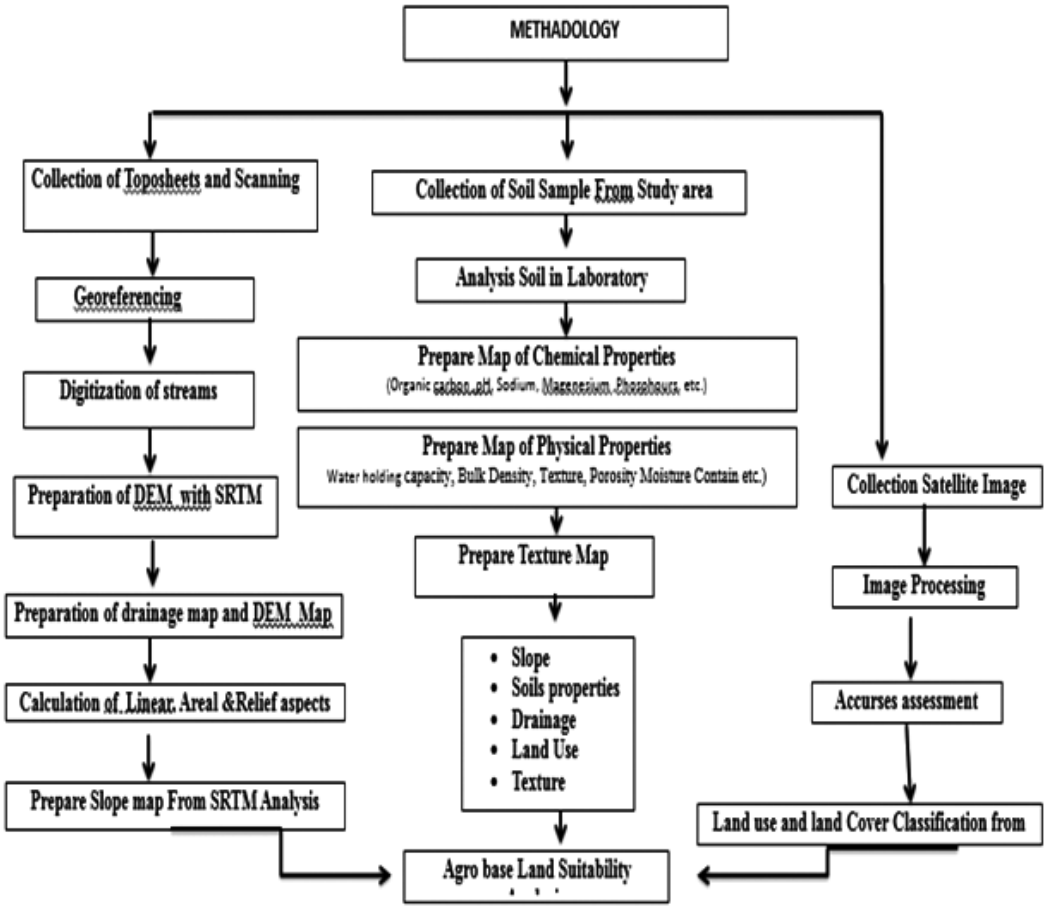
Study area: (See map 1 on page 271)

Karha watershed is selected for the present study. Karha drainage basin is located in the southern part of Sahyadri mountain range in Pune District. The Karha river is one of the major tributary of Nira river. Karha river flows from Askarwadi and confluence of Karha with Nira River at near Songaon in Baramati Tehsil.. Malharsagar dam is built upstream on this river. The Karha River extends from 18° 15' 45" N to 18° 22' 48" N latitude, 73° 52'40" E to 74° 2'00" E longitude. Catchments area is 1350 sq km.

Objectives:

The main objective of the present paper is to analyze the Land Suitability of Karha Drainage basin for the agriculture productivity

Flowchart of methodology



Database Methodology:-

The methodology adopted toland suitability analysis of Karha river basin. Based on the Analytic Hierarchy Process use for Land suitability analysis of Karha river basin. Slope, drainage, physical and chemical properties, landuse and cover use for suitability this analysis Criteria weights assignment by the weight to each criterion. The purpose of weighting in land suitability analysis for agricultural crops is to express the importance or preference of each factor relative to other factor effects on crop yield and growth rate. The weights can be defined through the Analytic Hierarchy Process (AHP) module in Arc Map.

The AHP was introduced by SAATY (1977) and is a very popular means to calculate the needed weighting factors by help of a preference matrix where all identified relevant criteria are compared against each other with reproducible preference factors. The Analytical Hierarchy Process is a well-known multi-

criteria technique that has been incorporated into GIS-based suitability procedures. For the classification of land suitability within Karha river basin area we utilized the AHP's ability to incorporate different types of input data, and the pairwise comparison method for comparing two parameters, simultaneously. The application of the AHP process involves several steps in order to rank Criteria or factors to the set of suitable criteria

The more important criterion had the greater weight in the overall evaluation.

Karha river basin area is classified on 4 classes on the basis on their suitability sites there are follows:

1) More Suitable 2) Suitable

3) Moderately Suitable 4) Less Suitable

Table 1. Suitability Class

Order	**Class**	**Description**
Suitable (S)	S1(Highly suitable)	Land having no, or insignificant limitations to the given type of use.
	S2 (Moderately suitable)	Land having minor limitations to the given type of use
	S3 (Marginally suitable)	Land having moderate limitations to the given type of use
Not Suitable (N)	N1 (Currently not suitable)	Land having severe limitations that preclude the given type of use, but can be improved by specific management
Not Suitable (N)	N2 (Permanently not suitable)	Land that have so severe limitations that are very difficult to be overcome.

(Source – FAO)

Table 2. Slope Base Suitability Class
(See page 271 for map 2)

Sr. No	**Slope Degree**	**Suitable Class**	**Area in Percentage**
1	0.00-3.05	Highly Suitable	69.66%
2	3.05-8.84	Suitable	24.43%
3	8.84-19.82	Moderate	3.61%
4	19.82-35.38	Less Suitable	1.70%
5	35.38-77.79	Not suitable	0.57%

The slope of any surface may be defined by measure of topography. The slope map of the study area show that the catchment area of Karha basin is having maximum range of slope includes in 0 to 3.5 degree in slope and in study area 69 % of the area is under more suitable class which is classified as more suitable for agricultural. Slope, an important element of landform, plays an important role wherever mechanization is concerned. Minimum area of Karha drainage basin's shows higher degree of slope which includes in 35-77 degree range and it covers 0.57 % area. which area is unsuitable area of agricultural.

Table 3. Land Use Base Suitability Class
(See page 272 for map 3)

Sr. No	Class	Suitable Class	Area in Percentage
1	Agricultural	Highly Suitable	28.15%
2	Fallow Land	Suitable	38.31%
3	Open Land	Moderate	17.23%
4	Forest Land	Less Suitable	12.08
5	Settlement	Not suitable	7.23%

Land cover and Land use information are essential many different kind of spatial planning, form urban planning at a local level up to regional development. They play vital role in agricultural policy making. Besides land cover data are used as basic information for sustainable management of natural resources; they are increasingly needed for the assessment of impact of economical development on the environment, hence they are fundamental for guiding decision making at various geographical levels. In Karha basin 38 .31 % area under the suitable class for land use. This area cover in agricultural zone of basin. 28.15 % area cover in thehighly suitable, 17.23 % area under the moderate suitable class. Less suitable class under the 12.08 % of basin. 7.23 % area cover the not suitable for land use base suitability. This class having very less percentage in basin.

Table No. 4: Agro Base Land Suitability Classes (see page 272 for map 4)

Sr. No	Class	Percentage	Characteristic	Area
1	Less suitable	6.55 %	Sandy loam, Gravelly Sandy, Gravelly sandy loam soil found. Steep and convex slopeobserved this class.	Area under this class mostly source region. It is up stream part of Karha basin
2	Moderately suitable	14.26 %	Gravelly Sandy, Gravelly sandy loam gentle slope and steep slope observed this class	In this class covered some part of Up steam the basin such as chambhali, Garade, Hivre villages observed
3	Suitable	49.39%	Suitable Class cover Gravelly clay, Gravelly clay loam found,	In this class middle part of basin area cover, like morgoan, Supa, Sasvd, Jejuri.
4	More Suitable	29.78 %	More Suitable class cover the mostly Clay, Gravelly Clay, type soil found also Gentle slope present.	In this class cover the area mostly near confluence of river such as the Baramati, Loni Bhapkar it is observed that down steam part Baramati Tehsil area under most suitable

(Source : Compiled by researcher)

Result and Discussion:

Land suitability analysis is carried out for Karha river basin.All variables, namely topography (slope and aspect of the land), physical (texture, water holding capacity and depth) and chemical (pH, nitrogen, potassium, phosphorus) soil properties, climate (temperature and rainfall) and land use, which are all used in the land suitability. Arc GIS platform is used to prepare these Weighted Overlay analyses for land suitability for agricultural. Weightage Overlays several rasters using a common measurement scale and weights each according to its importance so here assign more weightage on the agricultural area because cultivation is done on the suitable area. Settlement, water body forest area give the lesser weightage. Settlement is given the less weightage because in that part of land we cannot expand the agricultural land.

Soil texture of Karha basin is varied from sandy, loamy and clayey. In Karha basin 42 % area is under the clay texture of soil, Clay loam under area is covers 21.52% and Gravelly sandy loam soil covers 25.61% area. While, Gravelly sandy clay loam soil cover 3.77% area, Gravelly sandy clay soil cover 2.66 % area ,Sandy loam soil cover less area that is 0.38%, Gravelly clay soil also cover less than 0.057 % area. Slope classes of soil of Karha basin are distributed as; steeply sloping (>30%), Mod. steeply sloping (15–30%), and moderately sloping (8–15%) which are coveringthe western part of the of the basin which is the hilly areas of Karha basin. Gently sloping (3–8%), very gently sloping (0–3%), nearly level are covering the eastern parts ofthe Karha basin, this class cover the 69 % of the area of basin.

Land suitability for agricultural49.39% area cover in suitable class.In this class middle part of basin area cover, like such as the morgoan, Supa,Sasvd, Jejuri villages.Dominate Crops are this area Sugarcane, Onion, Wheat, Jawari, Cotton, Vegetables,29.78 % of the total area cover in Highly Suitable group Karha basin .Under this class area mostly near confluence part of basin.Most suitable for agriculture, favorable area for intensive agriculture if irrigation facilities areavailable 14.26 % area cover under Moderate Suitable class.6.55 % area cover less suitable class for agriculture in Karha river basin. This less suitable class mostly source region part of basin.Less suitable land for agriculture with careful farm management, necessary protections from drainage and intensive erosion these area mostly observed higher elevation, coarse loamy to gravel loamy soil, lowdrainage availability.

References

Atesmachew Bizuwerk Don Peden, et.al (2005) : *GIS Application for Analysis of Land Suitability and Determination of Grazing Pressure in Upland of The Awash River Basin,* Ethiopia International Livestock Research Institute (ILRI)

Flavio Lupia (2012): *Crop/Land Suitability Analysis By Arc GIS Tools publication website : https://www.researchgate.net*

Jankowski, P. (1995): *Integrating Geographical Information Systems and Multiple Criteria Decision-Making Methods*. International Journal of Geographical Information Science 9: 251-273.

L. Kazemi Rad and M. Haghyghy (2014): Integrated Analytical Hierarchy Process (AHP) andGIS for Land Use Suitability

Analysis, World Applied Sciences Journal 32 (4): 587-594, 2014 ISSN 1818-4952/ publication/26851798

Lidija Tadić (2012):*Criteria for Evaluation of Agricultural Land Suitability for Irrigation in Osijek County Croatia, Problems, Perspectives and Challenges of Agricultural Water Management, Manish Kumar (Ed.)*, ISBN: 978-953-51-0117-8.

M. Mokarram a, F. Aminzadeh (2010) : *GIS-Based Multi criteria Land Suitability Evaluation Using OrderedWeight Averaging With Fuzzy Quantifier: A Case Study In Shavur Plain, Iran* The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Vol. 38, Part II

Malay Kumar Pramanik (2016) : *Site Suitability Analysis For Agricultural Land Use of DarjeelingDistrict Using AHP and GIS Techniques* Springer International Publishing Switzerland

Malczewski, J. (1996) : *A GIS-Based Approach To Multiple Criteria Group Decision-Making. International Journal of Geographical Information Science,* 10: 955-971 Manag., 28, 611-621.

Mohamed A.E. Abdel Rahman (2016): *Assessment of land suitability and capability by integrating remote sensing and GIS for agriculture in Chamarajanagar district, Karnataka, India* The Egyptian Journal of Remote Sensing and Space Sciences (2016) 19, 125–141

Prkash T.N. (2003): *Land Suitability Analysis For Agricultural Crops: A Fuzzy Multi Criteria Decision Making Approach,* The Egyptian Journal of Remote Sensing and Space Sciences

Saaty, T.L. (1977) :*A Scaling Method For Priorities In Hierarchical Structures.* Journal of Mathematical Psychology, 15, pp. 231-281.

Sudabe Jafari1 and Narges Zaredar (2010):*Land Suitability Analysis using Multi Attribute Decision Making Approach,* International Journal of Environmental Science and Development, Vol.1, No.5, December 2010 ISSN: 2010-0264.

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