

Site Suitability Analysis for Fish Farming Using Heuristic Approach Method - A Case Study in Silangtoli Village of Bageshwar District(Uttarakhand)

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Abstract— The present study was to identify the potential area for the commencement of sustainable fish farming in the mid/high Himalayan region of Uttarakhand with the help of remote sensing and geographical information systems (GIS). Current land use pattern of the study area (Silangtoli village of Bageshwar district, Uttarakhand, India) was extracted from the LISS-III (2012)/ Google Earth imagery and with the help of global positioning system (GPS) data. The GIS has an increasingly important role in management and utilization of natural resources, particularly in fisheries resource assessment and management. Fish farming has become one of the fastest growing food industries in the world. For fish farming development in the study area, the important parameter of land use/ land cover, water availability and infrastructure facilities were accessed by using heuristic approach is adopted which is also known as knowledge based approach. Various buffers layers were prepared on the base of wasteland for categorizing suitable fish sites based on transportation and river. The site suitability map for fish farming development was prepared for Silangtoli village of Bageshwar district, Uttarakhand. The area suitable for fish farming development was computed in the village on the bases of buffers on road and river. The most suitable site is found for fish farming in under 60 meters buffer of each parameter because it consist same distance from road and river.

Keywords: Analytical hierarchy process, fish farming site selection, rural development and heuristic approach.

I. INTRODUCTION

Fish farming is one of the fastest growing food production systems in the world. The fisheries sector occupies an important place in the socio-economic development of the country. It has been recognized as a powerful income and employment generator and is a source of cheap and nutritious food besides being a foreign exchange earner. Most importantly, it is the source of livelihood for a large section of economically backward population of the country (Ayyappan and Krishnan, 2004). To meet the minimum protein requirement of the ever-increasing population of the country, the fish production needs to be enhanced. The inland aquaculture sector has a great scope to meet the demand of

the nation. The success of aquaculture is dependent on the site that has suitable qualities of soil, water and infrastructure facilities. Application of geo-informatics may provide various ways of handling, analysis and interpretation of data, as well as decision making process for aquaculture development.

The Kumaon region of Uttarakhand State is blessed with an abundance of aquatic resources. In addition to the lake resources, the low and mid Himalayan Kumaon region has small ponds and has great potential for exploring more water areas for aquaculture development (Jalal, 1988; Vass, 2002). The GIS may help in making authentic decision, which are purely based on ground realities and can be used for scientific in-hand information for exploring the suitability towards aquaculture development. The site suitability is the preliminary study for sustainable development of land area available for aquaculture development. Bahuguna *et al.* (1995) proposed the site suitable for brackish water aquaculture in Andaman and Nicobar group of Islands by using IRS LISS II data of land use map on 1:50,000 scale. Kumar *et al.* (2002) selected the aquaculture site through geo-informatics in Sagar Island, Hugli Estuary, Sundarbans. Karthik *et al.* (2005) applied the GIS and remote sensing technology for identification of potential sites for brackish water aquaculture.

II. OBJECTIVES

The present study was carried out with the following objectives:

- To provide the villagers sustainable source of income using their own resources by the help of Remote Sensing and GIS technique
- Selection of Suitable site for construction of pond for fish farming in the study area.

III. STUDY AREA

The study area is “Silangtoli Village” in the Bageshwar district of Uttarakhand, lies between 79°33’407” E and 29°53’031” N to 79°33’58.174” and 29°54’11.407”. It covering an very small area of 0.15 sq. km. There are about 25-30 families in Silangtoli and the total population of this village is around 115 peoples. The almost population of the

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village comes under Scheduled Castes. The village has basic infrastructure facilities i.e. School, Hospital and Road within a suitable distance. The main occupation of villagers is farming and animal husbandry. They sow crops i.e. wheat, paddy, soybean, mustard, oats, Green pea, lentils and some vegetables etc. The major fruit plants we can see here are mango, pomegranate, walnut etc. The sources of irrigation are springs, gad, gadheras and rivers in the hilly terrain. Silangtoli village is situated at altitude of 1300 to 1400 meter above from sea level. During the month of summer the temperature range between 22^o C and 17^o C and the winter month are colder with the maximum and minimum temperature touching 8^o C and 1^o C respectively. The location map of the study area is shown in figure- 1.

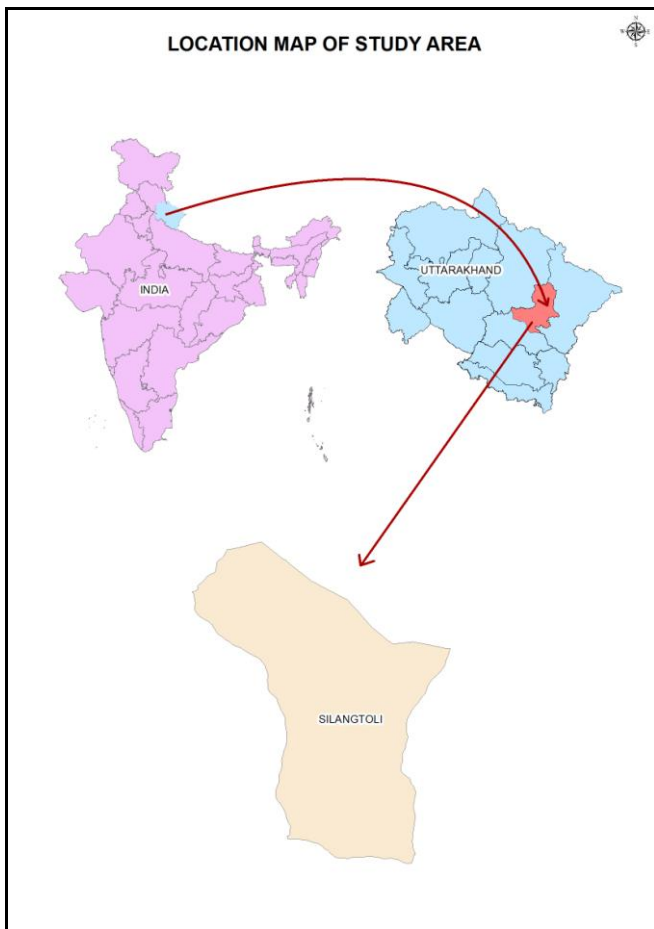


Figure-1

IV. MATERIALS & METHODOLOGY

Satellite Data:

Mainly Indian Remote Sensing Satellite-P6 – LISS-III satellite data was used for the present study. The satellite data for years (2012) was downloaded from Bhuvan used to prepare LULC layers and Google earth image has been used for ancillary information. The specification of remote sensing satellite data is given in the table-1.

Table-1 Specification of satellite data

Sr. No.	Satellite	Sensor	Spatial Resolution	Date of acquisition
1.	IRS-P6	LISS-III	23.5 meters	September 2012

Scale:

The present study of site suitability analysis for fish farming was prepared on 1:50,000 scale to monitor suitable sites for fish farming of the village.

Ground Truth:

All suitable sites for fish farming are checked by field verification. The heuristic approach was adopted to find the suitable sites in the village. The methodology for above study is shown as in figure- 2 and the LULC classification and classes ranking is shown in table-2.

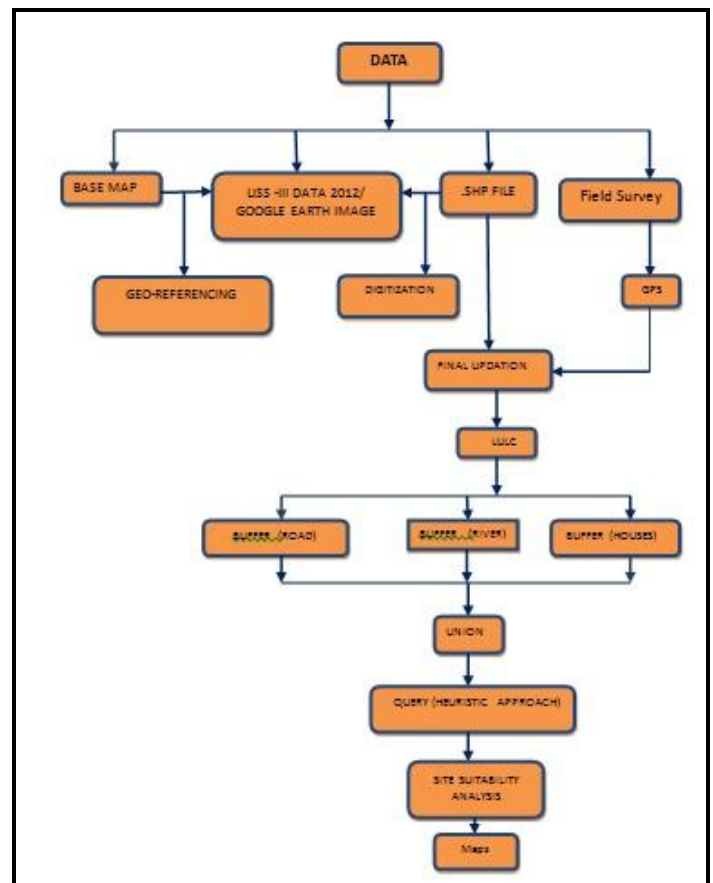


Figure-2

Sr.No	Classes	Ranks
1	Agriculture	6
2	Scrub Land Dense	4
3	Wasteland	1
4	Bridge	8
5	Road	3
6	River	2
7	Settlement	5

V. RESULT AND DISCUSSION

The Silangtoli Village of Bageshwar district is covering a very small area of 0.15 sq. km. only. Based on the interpretation of satellite data, the land use/ land cover categories identified in this village were agricultural land, scrub land dense, wasteland, river and village settlements. The interpreted satellite maps for the years 2012 is shown as figure-3. The heuristic approach was adopted to find the suitable sites for fish farming in the village. This approach is also known as knowledge based approach because in this approach analyst rank all those factor which are taken for site suitability. In the present study the main aim was the use of wasteland of the village and provided theme economic for the villagers. Different buffers were created on river and road for site suitability which is described as below.

River Buffer:

Rivers/streams are natural course of water flowing on the land surface along a definite channel/slope regularly or intermittently towards a sea in most cases or a lake or an inland basin in desert areas or a marsh or another river. Depending upon the nature of availability of water, rivers are sub-divided into perennial or seasonal. River is the main source of water for fish farming pond in the village, so the 30 meter, 60 meters and 90 meters buffers were created to find out the site suitability.

30 Meters Buffer: This buffer ranked as 3rd position because of it covers mostly scrub land dense and agricultural land of the village. This buffer also has maximum distance from the road network.

60 Meters Buffer: This buffer ranked as 1st position for fish farming because this buffer layers covers mostly wasteland and it's have same distance (30metrs) from road network and river. This site is most suitable for fish farming because water and transportation is easily available here.

90 Meters Buffer: This buffer layer ranked as 2nd position and it is moderate suitable. However, it has long distance from the water source but it covers mostly wasteland and transportation facilities are easily available from this site. The river buffer site suitability map of the village is shown as figure- 4.

Road Buffer:

Roads are mainly seen in association of settlement nodes, amidst and around built-up developed areas etc. Roads are categorized as Pucca and Kutchha roads. Road network is very essential for fish farming because it is very difficult to keep fish long time. So in the present study road buffers were also created to find out the site suitability in the village. The 30 meters buffer ranked 3rd position because water source is on long distance from this site, 60 meters buffer ranked 1st position because of transportation and water facilities easily available and 90 meters buffer layers is suggested as moderate site because of easily availability of water source.

The road buffer site suitability map of the village is shown as figure- 5.

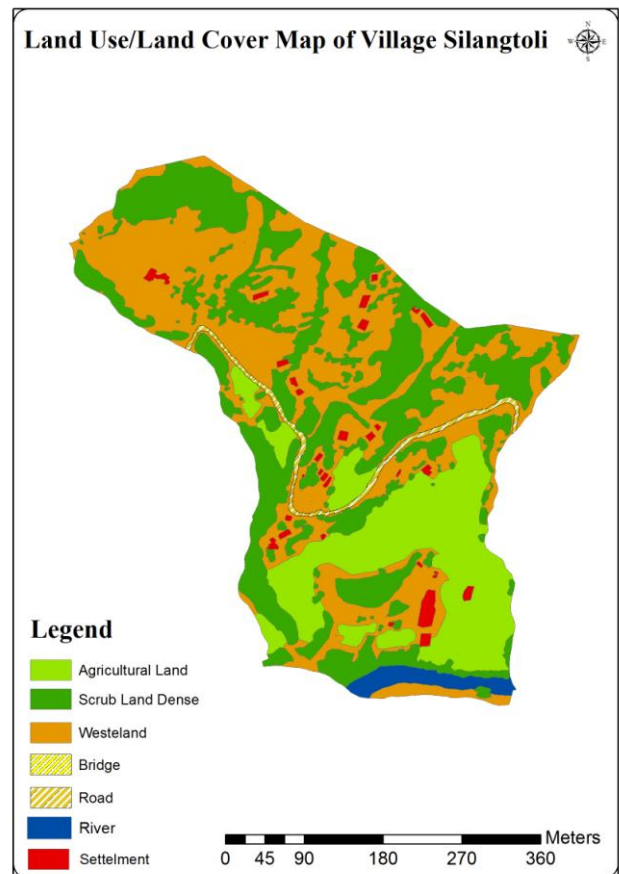


Figure-3



Figure-4

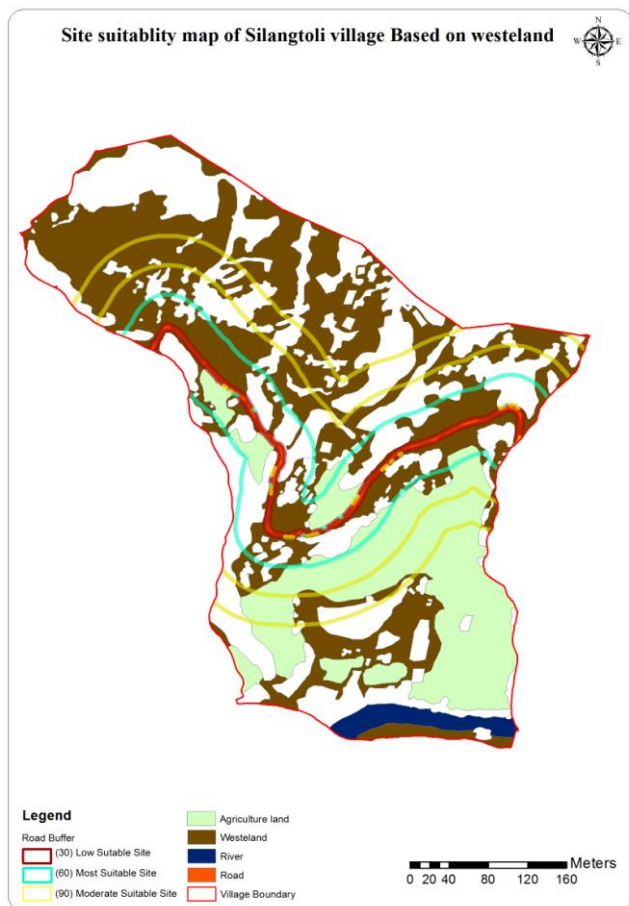


Figure-5

VI. CONCLUSIONS

The present study is conducted for site suitability analysis for fish farming using heuristic approach and LISS-IV data on 1:50000 scale. The conclusions are as under:-

1. The main aim of this work is to use of wasteland area of the village because it has two advantages. The barren land has no use at present, and it is near with water availability so it would become fertile after some time.
2. The mostly suitable site for fish farming are found in the southern part of the village because it near to river as well as road.
3. The present study is an effort to apply the GIS in selecting suitable site for fish farming development in the study area.
4. The Buffer zones are created for the road, river on the bases of wasteland are the important source to find out the sites for fish farming and to improve the economy and living standard of the villagers.
5. Heuristic approach is an important method to find out the suitable sites because it is knowledge based approach. So we can suggested the sites on ground base knowledge.

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