International Journal on Emerging Technologies **8**(1): 535-540(2017)

ISSN No. (Print) : 0975-8364
ISSN No. (Online) : 2249-3255

Natural Resource Assessment for a Hill Ecosystem in a Semi-Arid Region: A Case study of Mount Abu town.

Anita Tikoo Matange* **and** ***Komal Agarwal*****
**Landscape Architect, Adjunct Professor of Environmental Planning, School of Planning and Architecture, New Delhi*
***Environmental Planner*

(Corresponding author: Anita Tikoo Matange)
(Received 25 December, 2016 Accepted 22 January, 2017)
(Published by Research Trend, Website: www.researchtrend.net*)*

ABSTRACT: Mount Abu is one of nine national Ecologically Sensitive Areas (ESAs). Its unique ecology which harbours various rare and endemic species in a setting of rich natural and cultural heritage establishes Mount Abu as an ESA. This status of a Special Protected Area acknowledges the interconnections between human inhabitants, their livelihood, and their natural and cultural landscape. The paper outlines the planning approach behind the preparation of the recently notified Zonal Master Plan that preserves and enriches the unique ecology of the region, promotes tourism and integrated growth, and encourages economic development that will benefit local communities. Geomorphology, Drainage, Vegetation, Land Cover, Water, Soils, and Wildlife were evaluated to assess their vulnerabilities to change. All resources were combined to prepare a Composite Vulnerability Map. This forms the basis for Land Use Planning and allocation of zones with varying development potentials. The comprehensive Master Plan provides a powerful road map for a sustainable basis for future development and includes land use planning, and landscape and urban design guidelines, all based on intrinsic resources, tourism potential, and infrastructural realities. The planning process demonstrates how an ecological approach can guide the future development of an area in harmony with nature while preserving its unique sense-of-place and resource base.

Keywords: Natural resource assessment, Ecological planning, Overlay Method, Suitability Analysis.

I. INTRODUCTION

Acknowledging the ecological significance, its heritage, and the threat of environmental degradation, the Ministry of Environment and Forests (MoEF), Government of India (GoI) notified Abu and its surroundings villages as an ESA in 2009 under the Environment (Protection) Act, 1986. The Ministry of Environment and Forests defines Ecological Sensitivity or Fragility as the imminent possibility of permanent and irreparable loss of extant life-forms from the world, and of significant damage to the natural processes of evolution and speciation (MoEF, 2000).

A Development Plan for the entire ESA was prepared to address sustainable development of the region that will enhance the quality of life, ensure socio-economic development, and promote tourism while assuring resource conservation. The proposed plan has emerged from the identification of issues, the potentials and constraints in the region vis-a-vis natural and cultural resources, demographic and socio-economic structure, tourism, housing, transport, infrastructural provisions and existing sectoral developmental policies and programmes.

The ecological planning approach was used to guide the preparation of the recently notified Zonal Master Plan for Mount Abu Ecologically Sensitive Area (ESA) which lies in the semi-arid region of Rajasthan. Based on this approach, land use and density zoning in the proposed Master Plan are derived from the unique ecology of the region in an effort to promote tourism and encourages economic development that will benefit local communities while protecting local ecosystems. This paper presents the natural resource assessment that formed the basis for the Master Plan for Abu municipal area, which is spread over an area of 21.41 sq.km. and has a population of 22000 people. (GoI, 2001).

A. Mount Abu Municipal Area

Mount Abu (Sirohi district) is a small town in the southern-most part of the Aravali ranges marked by isolated hillocks and chains of hills stretching from the Southern Rajasthan and tapering into Delhi.

These ranges form the eastern fringe of the Thar Desert. Based on the biogeographic classification of India (Chauhan, 2008 and Venkataraman, Chattopadhyay, and Subramanian, 2013) the region is categoriosed as semi-arid. The native vegetation consists of thorny forest characterized by discontinuous vegetative cover with open areas of bare soil, and soil-water deficit throughout the year. Mount Abu constitutes a transitional zone between the dry desert and the denser forests of the Western Ghats that witnesses hot summers and chilling winters, though less extreme than the true desert climate. Sitting on a raised forested plateau enveloped by a wildlife sanctuary, Abu is the only hill-town in Rajasthan. With its picturesque landscapes, unique rock formations, lakes, cliffs, mist-clad hills, waterfalls, an abundant cultural heritage of majestic forts and palaces, sculptured temples and sacred groves Abu provides more than a respite from the scorching heat in the region.

B. The Ecological Planning Approach

Ecological planning models view cities as a part of the natural landscape with which they interact and, in turn, are impacted by. Such an approach recognises the importance of natural processes along with other socio-economic and cultural factors in shaping cities and towns. The ecological planning approach tries to establish a synergy between development and conservation to minimize anthropogenic impacts to natural systems. The success of such an approach lies in its ability to identify and assess the intrinsic character and natural features, and associated ecological processes, of a given region.

II. NATURAL RESOURCE ASSESSMENT

A. Methodology

Extensive primary and secondary data were collected and analysed. The overlay method was adopted for carrying out the natural resource assessment.

The natural resource assessment began with mapping of resources and analysing them against established parameters to assess sensitivity to development. Each resource was first mapped and then evaluated for its intrinsic sensitivity to change. These were then all over-layed to prepare a composite sensitivity map.

This map was used to assess the resources viz-a-viz development suitability. The natural determinants were established for low and high impact land uses.

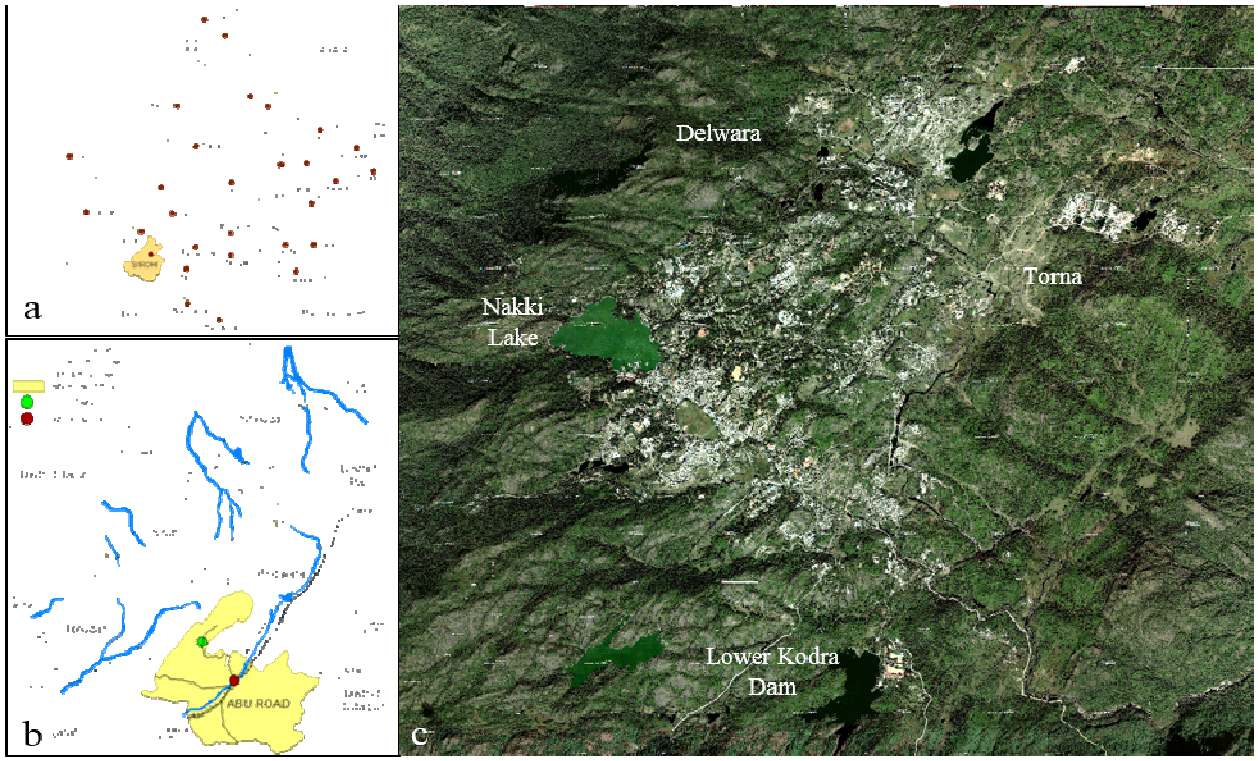

Fig. 1. a. Location of Sirohi District in Rajasthan b. Location of Abu Tehsil in Sirohi District c. Google Image of Mount Abu town. Source: Environmental Planning Department, SPA (2010) Zonal Plan for Mount Abu Eco-sensitive Zone. Unpublished Report.

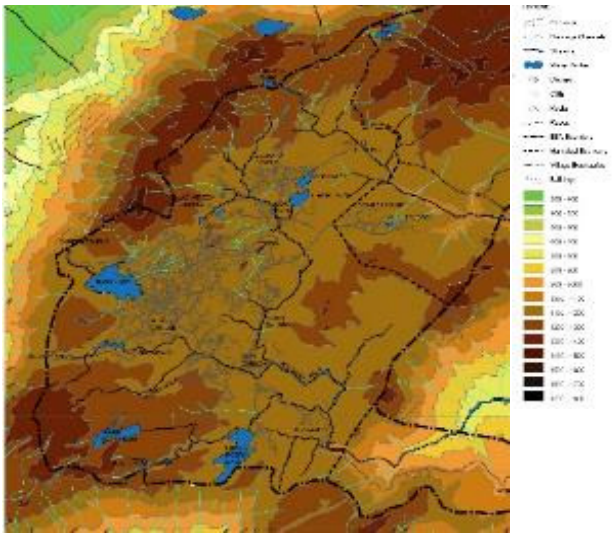

Fig. 2. Elevation Map.

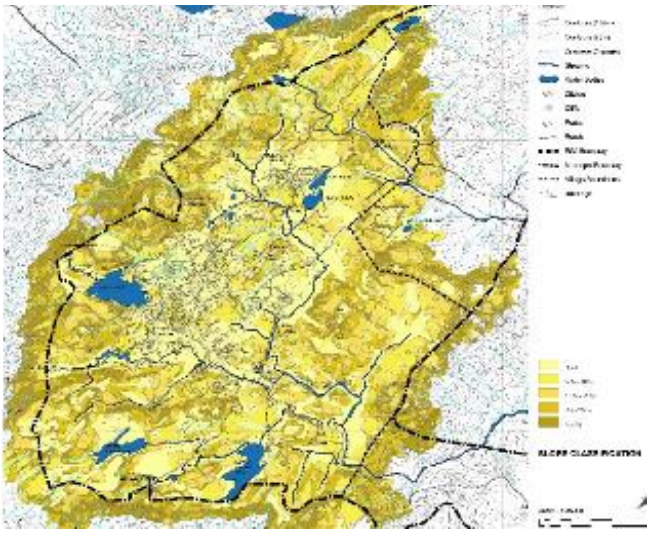

Fig. 3. Slope Map (20m Contour Interval).

The assessment was rooted in the rationale that resource conservation is critical for the sustainable socio-economic development of people especially when nature tourism forms the backbone of the economy in the region. The area is habitat for many rare and endemic species which grants it additional ecological significance.

B. Geomorphology and Drainage

Mount Abu town is situated at about 1219m AMSL and occupies an irregular plateau which is surrounded by several projecting peaks and ridges. Most of the town accommodates itself in an elevational range of 80m, from 1120m AMSL to 1200m AMSL. (refer Fig 2). The hills are marked by a well-developed drainage system. Banas is the most important river of the district draining almost all the area east of the Abu - Sirohi range in Pindwara and Abu Road blocks. A small portion of the western part of the ESA drains into river Sipu. There are no natural lakes in this area. All water bodies have been created by impounding of streams and drainage channels.

In any hilly terrain, surface gradient is a critical limiting factor governing development. Based on the correlation between land use and slope classes, a slope sensitivity map indicating least sensitive, moderately sensitive, and highly sensitive slopes was prepared (Fig. 3). Relatively flat areas were classified as least sensitive for their intrinsic suitability for higher-intensity development or active recreation, while moderate slopes were classified as more suitable for low-impact development or passive recreation. Slopes above 35% were classified as highly sensitive and marked unsuitable for any development activity.

C. Land Cover and Vegetation

The vegetation of the area is predominantly Tropical Dry Deciduous forest type (Champion and Seth, 1968) with relict patches of Dry Tropical Riverine Forests along water courses and valleys at higher altitudes. The vegetation here is sometimes also classified as broad leaved hill forest and is unique to Mount Abu Wildlife Sanctuary of Sirohi district (Reddy, Krishna, and Kiran, 2010). Scrub is the other major vegetative type in the ESA. Scrub is classified by a vegetative cover that is predominantly shrubs with poor tree growth of small or stunted trees with a crown density less than 10%.

The land cover-vegetation map illustrates the unique landscape typologies in the town such as moderately dense forest, open scrub-grassland, meadow, wetlands, farmland, woodlot, moderately modified landscapes, squatted upon land, landscaped open spaces and built-up area (Fig. 4). The vegetative associations were scored against three criteria – rarity, refurbishment period, and species richness. The cumulative scores then produced a sensitivity map. It was observed that most of the area around the town falls in the moderately sensitive category (Fig. 5).

D. Surface Water

Water is a scarce commodity in a semi-arid region and needs to be given the utmost importance. Steep slopes, exposed rocks and shallower soil layer of the region contribute more to runoff than to recharge. Not only the streams but also the surface water bodies support rich biodiversity while contributing to better water quality.

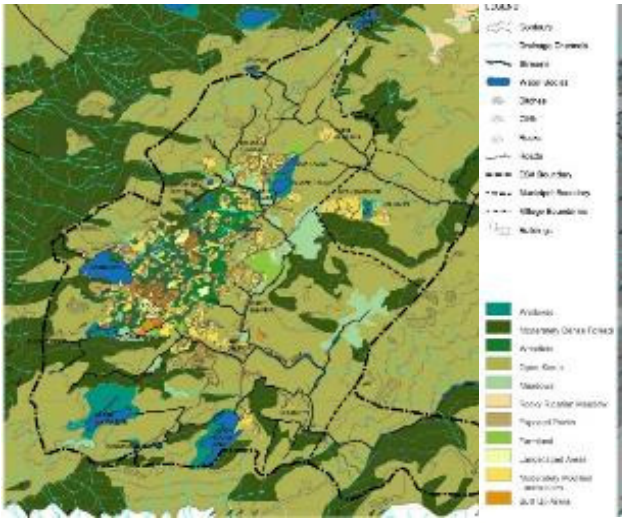

Fig. 4. Land Cover and Vegetation Map.

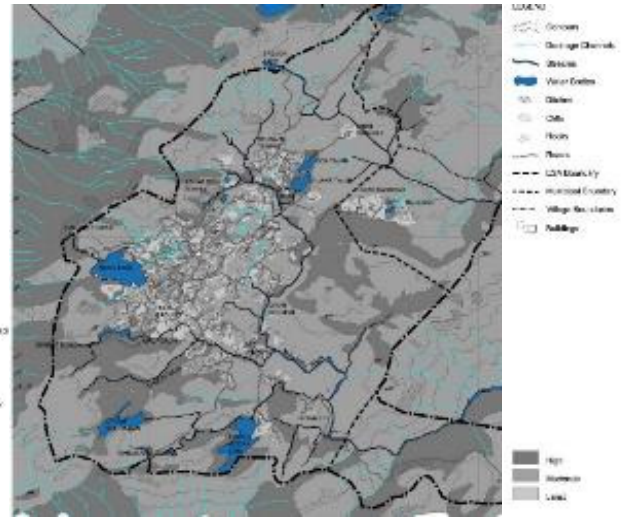

Fig. 5. Land Cover and Vegetation Sensitivity Map.

Therefore, wherever possible, a buffer of 100 to 200m was proposed along the water bodies. This buffer was marked as high sensitivity zone. The buffer, which will ensure greater recharge and a better water quality, was accorded an additional weightage given the criticalityof the resource especially in an arid region.

E. Soil Productivity

Soils constitute some of the most basic natural resources we have because they form the substrate in which terrestrial plant life is rooted. Existing vegetation was used as an indicator of soil productivity with denser vegetation signifying more productive soils. Dense vegetation found on NW slopes and within stream channels along with farmlands, woodlots, and wetland areas constituted areas with high productive potential (Fig. 6).

F. Wildlife

A large variety of mammals, birds, reptiles and fish are found in this area. Abu is a home to some of the rare animals such as the panther, sloth bear, pangoline, and sambar. Big game animals such as the panther, bear, hyena, blue-bull, chinkara and sambars, not all equally abundant, are known to be found in this area. The incidence of big game animals has dwindled over time, except in the core sanctuary areas. Small game animals such as fox, jackal, hare, langur, mongoose, wildcat, porcupine and squirrel are more abundant. The common birds found are rock pigeon, green pigeon, partridges, sandgrouse, quail, jungle fowl, parakeet, sparrow, babbler, peafowl, eagle, crow, dove, bulbul, myna, teals, blue jay and nightjar. Amongst the water birds darter, cormorant, saras-egret, ibis, stork, apwing teal and coots are noticed near the lakes and tanks.

Despite the addition of new species to the list of birds found at Mount Abu, a decline in the overall species population has been observed (Sangha and Devarshi, 2006). This may be attributed to habitat degradation and reduction of key habitats areas such as open scrub and grasslands. Deteriorating water quality of lakes and ponds has been correlated with decreasing bird populations as well as near reduced sightings of certain species. Hence, existing wildlife habitats need to be preserved.

Areas with varying value as habitat for wildlife were demarcated based on an interpretation of the vegetation and topography and correlated with the habitat requirements of wildlife species known to be found in the surrounding sanctuary area. Habitats that support a high diversity of fauna (areas of high floral diversity), habitats of threatened or vulnerable species (as identified in the IUCN list), watering holes (all stream channels, water-bodies, and wetlands zones), rare or threatened habitats and edges of habitats were classified as areas with high wildlife habitat value. These include rocky outcrops, exposed rocks, wetlands, meadows, forests, grasslands, rocky riparian meadows and cliffs (Fig. 7).

G. Composite Ecological Value

As described above, individual resources were mapped based on their inherent value and sensitivity - land cover, slope, wetland-riparian buffer zone, soil productivity, and wildlife habitat - in shades of grey, light to dark gradient signifying successively higher sensitivities.

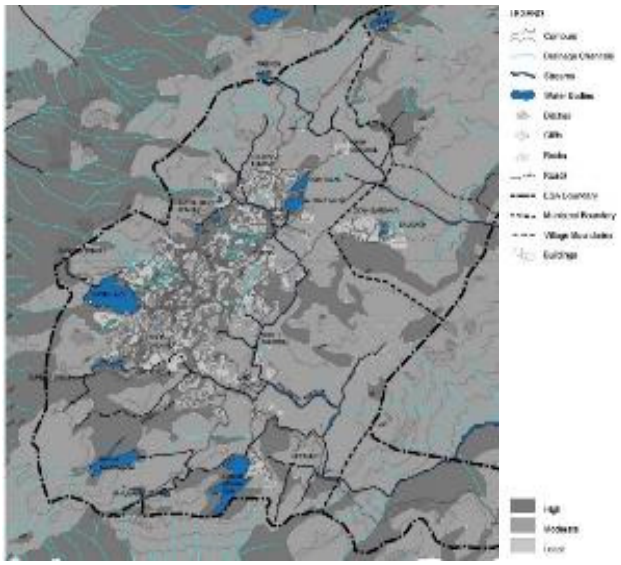

Fig. 6. Soil Productivity Sensitivity Map.

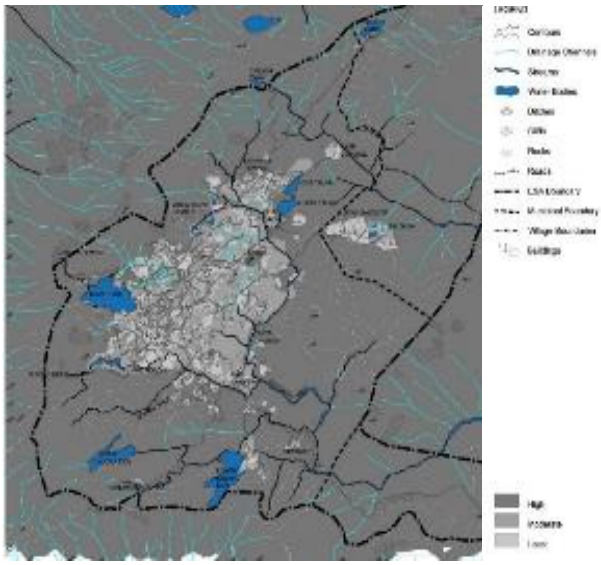

Fig. 7. Wildlife Sensitivity Map.

In order to identify potential areas for development, these maps were overlaid to produce a composite ecological value map illustrating areas with high, moderate, and low ecological values for all the resources combined. Highly sensitive slopes (slope >35%) and high value Wetland-Riparian buffer zone classes emerge as areas of the highest value. This is because, irrespective of their resilience for other resource assessment, steep slopes are intrinsically unsuitable for any development use that might involve regrading, and buffer zones along water-source are critical to water quality and quantity, a resource much constrained in this hilly, arid region.

The composite sensitivity map became the base for land use zoning with varying development potentials based on the level of sensitivity of the land under consideration. It clearly revealed that the town had limited potential to expand within its Municipal limits. A similar exercise for the whole ESA, which is outside the scope of this paper, revealed an alternate location for future expansion. Different resources exhibit varying levels of resilience for different land use activities.

Natural resources are not all equally incompatible with all activities. Each parcel of land was studied with respect to its composite ecological value in addition to the resource specific ecological sensitivity before allocating a specific use. Most of land use zoning was adopted as proposed with little revision.

To accommodate some objectives of the development plan the buffer zone had to be reduced to 50m at certain locations with consideration for site characteristics and potential uses requirements.

III. CONCLUSIONS

The Master Plan for Mount Abu Municipal Area arrived at through an ecological planning process provides a powerful road map for a sustainable basis for future development. The Master plan included land use planning, and landscape and urban design guidelines, tourism potential, and infrastructural realities, all based on resource (intrinsic and human-made) assessment. The planning process demonstrated that an ecological approach can be the basis for guiding future development of any area in harmony with nature and while preserving its unique sense-of-place and resource base. All that it needs is identification and assessment of the natural resources and the ecological processes that lie underneath. Assessment of the resources through a scientific and objective method presents the pros and cons of a given development scenario in an irrefutable manner, removing any subjective judgment. The Master Plan demonstrates how a simplified overlay method can be an optimum tool to capture the comprehensive ecological values of any region. Such an approach can channel growth in an appropriate direction to result in sustainable development.

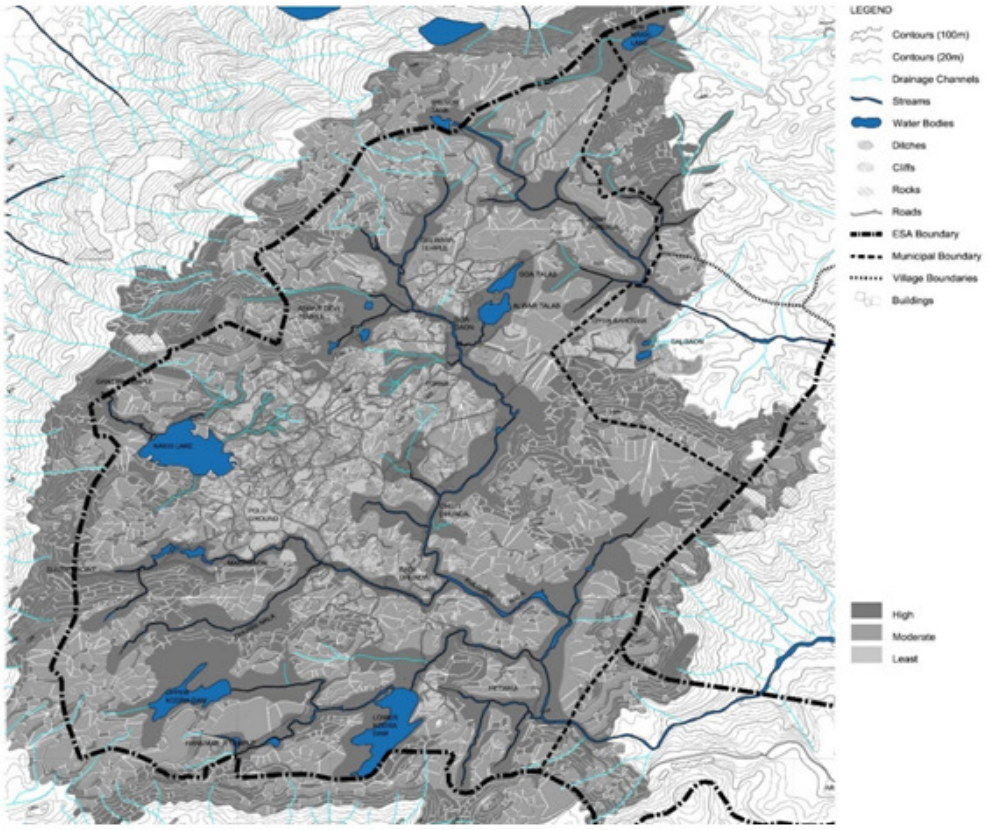

Fig. 8. Composite Sensitivity Map.

REFERENCES

[1]. Champion HG and Seth SK (1968). A Revised Survey of Forest Types of India. Delhi: Govt. of India Press.

[2]. Chauhan BS (2008). Environmental Studies. Firewall Media.

[3]. Government of India (2001). Census of India, 2001. Delhi:

[4]. MoEF (2000). Report of the Committee on Identifying Parameters for Designating Ecologically Sensitive Areas in India.

[5]. MoEF (2009). Notification. New Delhi. Available at envfor.nic.in/legis/eia/1545E.pdf (accessed 2 July 2010).

[6]. Reddy CS, Krishna PH and Kiran AR (2010). Mapping the Vegetation Types of Rajasthan, India, Using Remote Sensing Data. E3 Journal of Environmental Management 2(1): 001-009.

[7]. Sangha HS and Devarshi D (2006). Birds of Mount Abu Wildlife Sanctuary, Rajasthan, India. *Indian Birds* **2** (2): 26-31.

[8]. Venkataraman K, Chattopadhyay A and Subramanian KA (Editors) (2013). Endemic Animals of India (Vertebrates). Report, Zoological Survey of India, Kolkata.