Population and distribution mapping of dispersed Asiatic wild ass in human dominated landscape using remote sensing & GIS.

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Abstract—Presence of wild animal in the farmlands (human dominated landscape) is observed at various places due to various reasons. Asiatic Wild Ass (Equus hemionus khur) is aboriginal inhabitant of Little Rann of Kutchchh (LRK), Gujarat state, India. But today (Jan'2018), it is well seen as far as 80 -100 km away from nearest fringe of its actual habitat. In this research paper, we have mapped population and distribution through the data of 10 years using Remote sensing and GIS in context to Asiatic wild ass in a selected patch of farmlands near Surendranagar town, Gujarat state, India. Geo-spacial techniques are much useful in analysis and mapping of wildlife in human dominated areas. ArcGIS and QGIS software were used for map preparation. Such maps are helpful to understand adaptation strategies of wild animals in human dominated areas. Study of movement maps of animal help us to understand the reasons of dispersal. It helps conservationist to mitigate the dispersal of wild animal in future.

Keywords—QGIS, Asiatic Wild Ass, Equus hemionus khur, Remote sensing, Dispersion, Man-Animal conflict, Little Rann of Kutchchh, LRK

I. INTRODUCTION

Man-Animal conflict is most common problem in and around biodiversly rich areas eg. Little Run of Kutchchh, Gir WLS&NP, Velavadar NP etc. due to many reasons viz. species conservation, population increase, crop depredation in the human dominated landscape near Wildlife Sanctuary or National Park in developed /developing countries [1]. Due to various causes, wild animals are well seen in the human dominated landscapes especially farmlands or cattle grazing areas just on the periphery of a wildlife sanctuary or a park. Asiatic wild Ass (inhabitant of LRK) are observed very well dispersed (up to 60-100Km from the nearest fringe of LRK) from their habitat [2]. Using developed tools like Remote Sensing and GIS, along with it precise systematic ground proofing, detail of animals' distribution can be mapped [3]. Frequency of presence in certain areas helps to identify the resourceful areas. In this paper, remote sensing has been used to locate the animals in the landscape, information regarding topography and vegetation of the area. On the other hand, GIS has been used to map distribution of animal, crop varieties, vegetation and water sources in the entire landscape through the selected time span.

Study contains,

1. Population variation of Wild ass in the landscape

2. Population distribution in the entire landscape over the years 2007-2017

3. Analysis of the landscape based on food and water resources for the animal

This paper is organized in five sections viz. Introduction contains review s of previous work and hypothesis of the study. Study area contains information about the landscape where the study has been conducted. Objectives contains possible outcome looking for. Research methodology introduces to the methods opted. Analysis, Result and Discussion section contains information about outputs obtained at the end of study. Conclusion informs about success proportions and limitations.

II. STUDY AREA

Gujarat State is located on the western edge of India, it stretches across 20° 01'N and 24° 07' N latitudes and 68° 10'E and 74° 28'E longitudes. With total geographic coverage of approx. 1,96,000 km^2 [4]. District Surendranagar is located exactly in the center of the State with the capital of

Surendranagr Town with population around 1,77,851 (Census'2011) [5]. The weather is seasonal with annual rainfall appx 87.35mm [6]. North-east end of the district is attached with arid mud / salt flat spreading across 4953.7 Km2 [7]. Gujarat, known as Little Rann of Kutchchh. Its fringe touches to Banaskantha, Surendranagar and Kutchcch districts [8]. Asiatic wild ass is permanent inhabitant of this landscape, but their large congregation is seen only at the shunt of Surendranagar. The town is approx. 45 km away from the nearest edge of LRK (Little Rann of Kutchch) in South- West direction [9].

Herds of Wild Asses are visible in the farmlands around the town up to 15 km. At 12.2 Km away from Western edge of the town, a cluster of 203 farmlands owned by local farmers of Danawada village are located covering the area of appx 600 hectors. Geographic location of the area is 220 44'N to 220 45'N latitudes and 710 31'E to 710 33.5'E longitudes. Topologically, surface has inclination of 1.14o towards north-west. There are two seasonal ponds: one with of water capacity 16000000 ltr at westward to the area and the other with the water capacity of 13200000 ltr south-west of the area. A single lane road crosses the area in to two sections heading towards the village Danawada, Digsar and Pandavara villages. Most of the farmers cultivate caster (ricinus communis) and juwar (sorghum), ones in the year. There are few uncultivated patches covered with prosopis (prosopis juliforalittle). The underneath surface is mostly dry in the year except in monsoon. Fig.1 shows the entire landscape (LRK) as Study Area and specific 5 different Zones
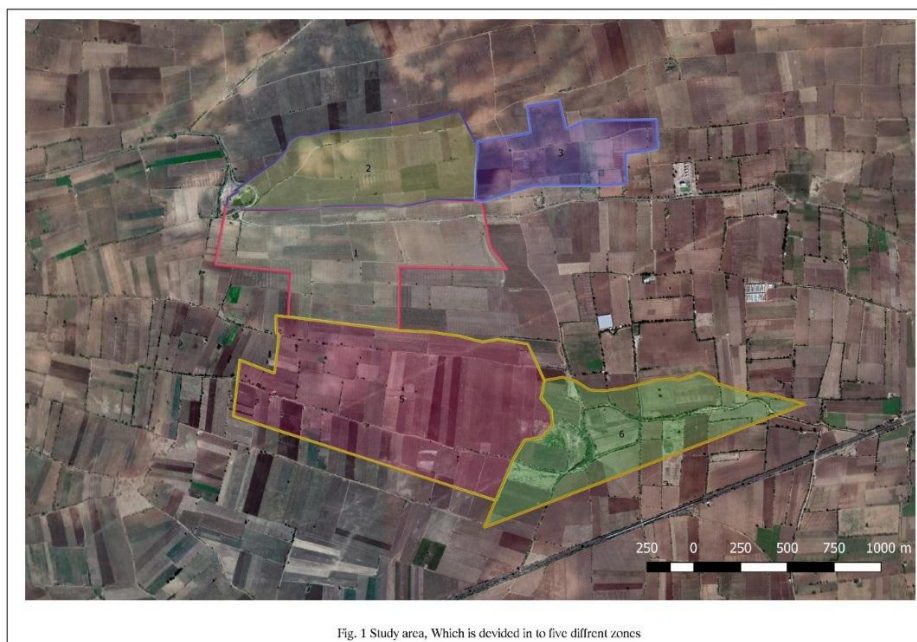

Fig. 1 Study area, Which is devided in to five diffrent zones

Figure 1 Study area (Source-BHUVAN Portal)

III. RESEARCH METHODOLOGY

 Software like QGIS, ArcGIS is used for demonstrating population of wild asses present in the area across last 10 years.

1. GIS database about population of wild ass in the region(landscape) has been created with regular field visits with minimum gap of 1 day/visit and maximum gap of 16 days/visit. GPS observations were recorded with Garmin GPS etrex10 device with the accuracy of around 30 ft.

2. Remote sensing data related to Topological information of the area was obtained from Bhuvan portal and GoogleMaps™, data related to presence of farmer in the farm has been obtained from observation during field visits and with routine interrogative conversations with them.

Water and food resources were identified through field observation with animals' visit for the water and food purposes with 8.2 /10 visit's accuracy.

IV. QGIS ANALYSIS

Database related to presents of wild ass in the landscape made with GPS points with field visits along with different attributes such as month-year of observation, gender, age-group, activity, latitude, longitude, Id signs, Photo ID etc.

Fig.2 was the analytic result of their (whose population) population estimate and distribution of the Month January' 2017.

As shown in Figure.3 (below), the selected landscape contains four main water resources for wild ass (indicated with 'W' in the map). Out of them two are ponds which remains partially filled with monsoon water. While other two are the dripping water points from the joint of water supply pipes running from Narmada canals at Surendranagar to the village Digsar, for drinking purpose. Grazing areas are mostly uncultivated farms or farmlands with seasonal cultivation. which contains different types of weeds as well. There are such patches in zone no. 2, 3 and 5. While zone 1 and 6 often cultivated with Sesame and Jowar.
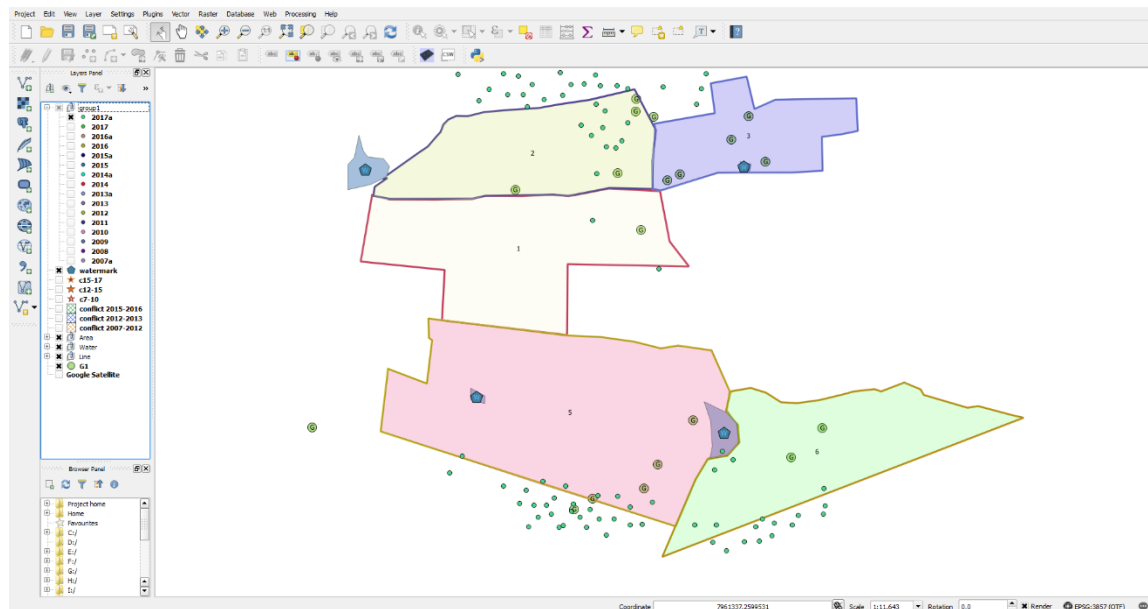

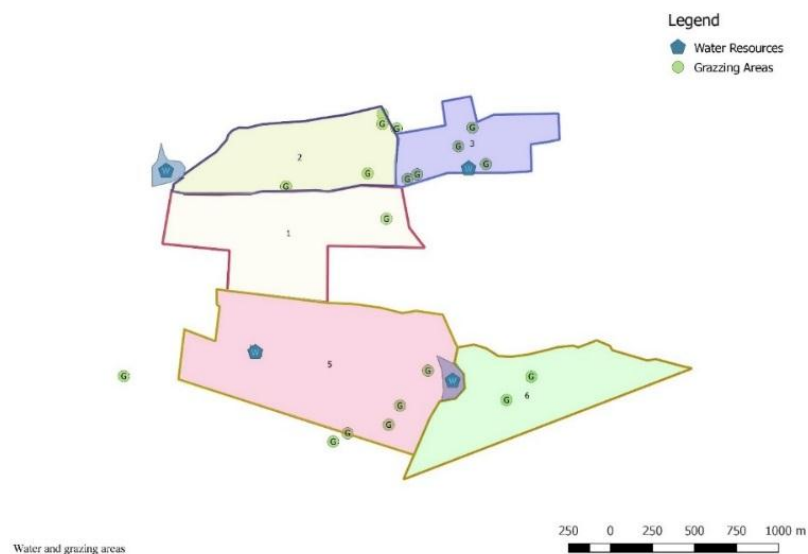**Figure.2 GIS analysis in QGIS for individuals present in the landscape in Jan'2017**

Figure.3 Water resources of and Grazing resources

V. RESULT AND DISCUSSION

Using GIS and remote sensing as a tool, the population variation of wild ass obtained is shown in Table I and Fig. 4(a). Zone wise population has increased compared to the previous years in all the zones except in zone 1 and zone 3 after 2012 and 2015 respectively.

The population of wild ass has decreased in zone.1 and zone 3 after said years. During field visits increased farming activity due to availability to water through canal was observed after the year 2012 in zone 1 and construction work at residential scheme under taken in zone 3 around 2012. It would be the cause of dispersion of the animals from the said zones.

Table. 1 Population variation in the selected zones

	Zone:1	Zone:2	Zone:3	Zone:5	Zone:6	Total
2007	0	2	0	1	0	3
2008	2	3	0	4	2	11
2009	5	5	2	6	6	24
2010	8	6	4	8	9	35
2011	11	8	5	10	11	45
2012	12	12	5	14	13	56
2013	7	18	8	17	14	64
2014	5	24	10	22	16	77
2015	5	26	12	25	16	84
2016	3	29	9	28	17	86
2017	1	30	4	30	18	83
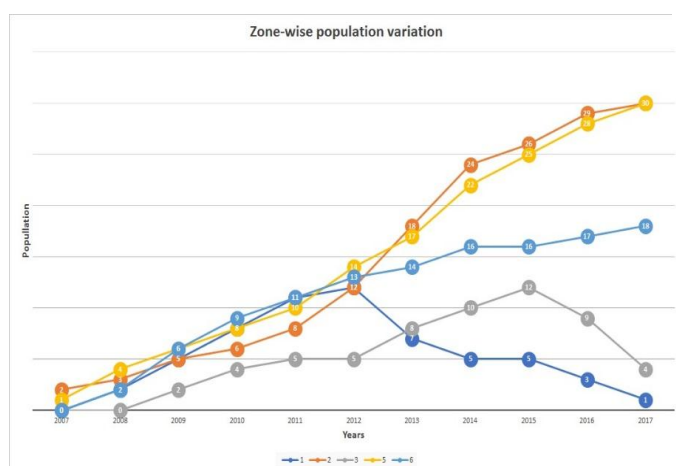
Figure.4(a) population variation chart in the selected zones.

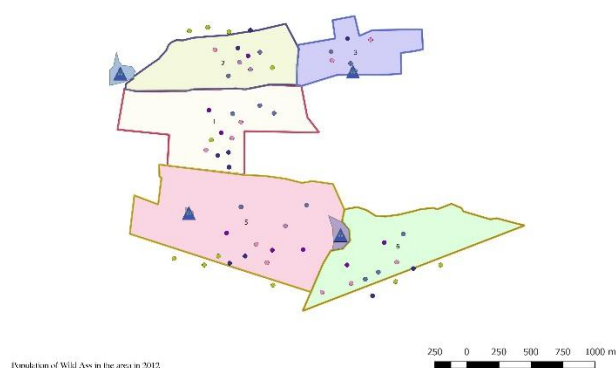**Figure 5(a). Population distribution in 2012**

Figure.4(b) Percentage growth in population compared to the previous year.
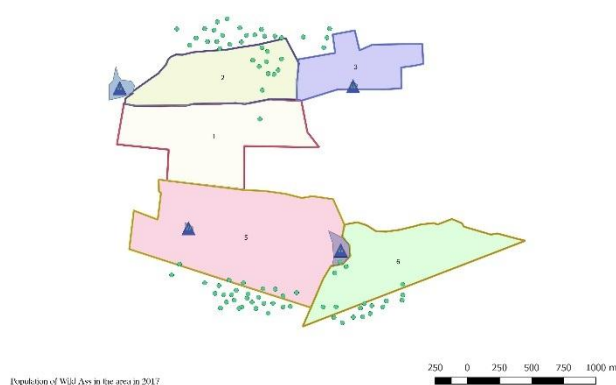

Figure.4(b) Percentage growth in population compared to the previous year.

VI. CONCLUSIONS

This research paper shows extensive use of remote sensing data and GIS in the population estimation and mapping of dispersed wild animal in human dominated landscape. This tool is helpful for such analysis, but it also demands high resolution satellite imagery for landscape analysis. Such analysis would provide further details about use of resources and causes of dispersion.

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