iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** V **Month of publication:** May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5419

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

An Assesment of Degrading Habitat of Barasingha in Hastinapur Wild Life Sanctuary using Satellite Remote Sensing Technologies

Satya Raj
Discipline of Geography, School of Sciences, IGNOU

Abstract: Remote Sensing Technologies are important in the assessment land use land cover changes in general and forest cover changes in particular. It is used to evaluate the habitat of different animal species which is in fact the first step towards meaningful wildlife conservation and management. The present study aims to study the degrading habitat of swamp deer or Barasingha in Hastinapur Wildlife Sanctuary. Once widely distributed its population has recently declined significantly due to loss of its habitat for cultivation or tree plantations, poaching and other human interventions. In this paper, spatio-temporal changes in land use land cover especially the forest cover has been made. Also the habitat problems faced by Swamp deer in the sanctuary have been enquired into. Data used for this were Landsat Satellite Imageries ETM+ (2006) and TM (1992) obtained from GLCF. Data both spatial and non-spatial regarding the sanctuary were obtained from the Divisional Forest Office at Meerut. Maps obtained from here were georeferenced with the help of reference points from google earth. Using these georeferenced maps of the sanctuary, the landsat imageries were subsetted. Satellite images were then classified using unsupervised classification to prepare land use and land cover map. The Signature file of the Unsupervised Classification was used for Supervised Classification. Thus a change in land use and land cover and also forest cover was found out leading to the loss of Barasingha habitat.

Keywords: Remote Sensing, Habitat, Barasingha, ETM+, TM, Landsat Unsupervised classification, Signatures, Supervised Classification

I. INTRODUCTION

Barasingha is hindi for 'twelve horn', which is an accurate description of this species of deers (*Rucervus duvaucelii duvaucelii*) which typically has twelved tines, or points, on its antlers. Each antler can grow to lengths of over 3 feet. They are basically inhabitants of Terai region of Uttar Pradesh, Assam and in the Sunderbans. They are basically found in marshy grasslands, floodplains and meadows. That is why they are called as ***'Swamp deer'***. At one time the Barasingha was distributed throughout the basins of the Indus, Ganges and Brahmaputra rivers, as well as in central India as far as the Godavari river. Today, however, the species has disappeared entirely from the western part of its range. Its population has declined significantly. Currently, it is restricted to India and Nepal in a northern population in the terai of Uttar Pradesh and adjoining Nepal and Assam, as well as a southern population in Madhya Pradesh. This decline of the barasingha population is most probably attributed to the loss or modification of its habitat for cultivation or tree plantations, such as the planting of eucalyptus. Poaching and shooting activities have made them more vulnerable [1].

Forest Survey of India (FSI) uses the latest satellite imageries to calculate the Forest cover. Up to 1999 the forest cover mapping was largely done on the basis of visual image interpretation. From 2001 onwards a complete switch over to digital image interpretation was made. As per the latest 'India State of Forest Report (ISFR 2019) released by the country's environment minister Prakash Javadekar on December 30, 2019, revealed that the total forest and tree cover of the country is 807,276 km^2 (which is 24.56 percent of the total geographical area India) compared to 802,088 km^2 (24.39 percent) in ISFR 2017. The report marked an increase of 5,188 km^2 of forest and tree cover combined, at the national level, as compared to the previous assessment. While the overall forest and tree cover marked an increase on a national level, the report highlighted a decrease in the forest area in the country's northeast region [2].

Forest inventory and management requirements are changing rapidly in the context of an increasingly complex set of economic, environmental, and social policy objectives. Advanced remote sensing technologies provide data to assist in addressing these escalating information needs and to support the subsequent development and parameterization of models for an even broader range of information needs. A variety of remote sensing technologies have been used to derive forest inventory or inventory-related

©IJRASET: All Rights are Reserved

information for strategic, tactical, and operational planning like airborne laser scanning (ALS), terrestrial laser scanning (TLS), digital aerial photogrammetry (DAP), and high spatial resolution (HSR)/very high spatial resolution (VHSR) satellite optical imagery [3]. Luojia et al. (2018) [4] have studied the importance of the use of remote sensing techniques in delineating mangrove forests and also find out the change in its extent. Gunay et al. (2007) has evaluated the consequences of human and natural impacts on changes in secondary forest succession land cover from 1972 to 2002 in the Artvin Forest Planning Unit, in NE Turkey with the help of Geographic Information System (GIS) and Remote Sensing (RS) technologies through aerial photos and high resolution satellite images (IKONOS) [5]. Michael et al. (2005) [6] has used Landsat MSS and ETM+ data to document forest cover change in the Toledo District, Belize, from 1975 to 1999 with the help of Supervised and sub-pixel classification methods and provide an initial assessment of why these changes took place.

II. THE STUDY AREA

The study area for this research work is Hastinapur Wildlife Sanctuary (HWS) which covers a total area of 2073 km^2 and is the biggest wildlife sanctuary in India spreading over Muzaffarnagar, Meerut, Ghaziabad, Bijnore and Jyotiba Phule Nagar districts of Uttar Pradesh. It is situated between 28^0 44' North and 29^0 33' North latitude and 77^0 54' East and 78^0 16' East longitude in Uttar Pradesh state of India (Fig.1). Its altitude ranges between 130-150m above the sea level. Spread along both sides of River Ganga it has one of the largest and open grasslands which is most suitable habitat for swamp deer or *Barasingha* Spread along both sides of River Ganga it has one of the largest and open grasslands which is most suitable habitat for swamp deer or Barasingha (Fig. 2). Hastinapur Wildlife Sanctuary has varied ecological niches. Though it is mainly known for Swamp deer and blue bull, there is a huge variety of animals like antelope, sambhar, cheetal, leopard and wildcat that inhabit this place. It is also famous for about 350 bird species especially migratory birds as well as Gangetic dolphins. Peacocks are also found here in plenty [7].

In a recent study conducted by Dehradun-based Wildlife Institute of India, it was found out that Uttar Pradesh and Uttarakhand lost 240 square kilometres (sq km) of grassland area in the last three decades from 418 sq km (in 1985) to 178 sq km (in 2015), a 57% decrease in the total pasture land of these states. This study reveals that due to the shrink in the grassland area, the swamp deer are losing their natural habitats and if the trend continues, this endangered species may even face extinction in the area [8]. In 1990, Sankaran had reported that Satiana grassland in the Dudhwa Tiger Reserve had 1200 barasingha in the early 1970's. This number had declined to 300 by 1990's [9].

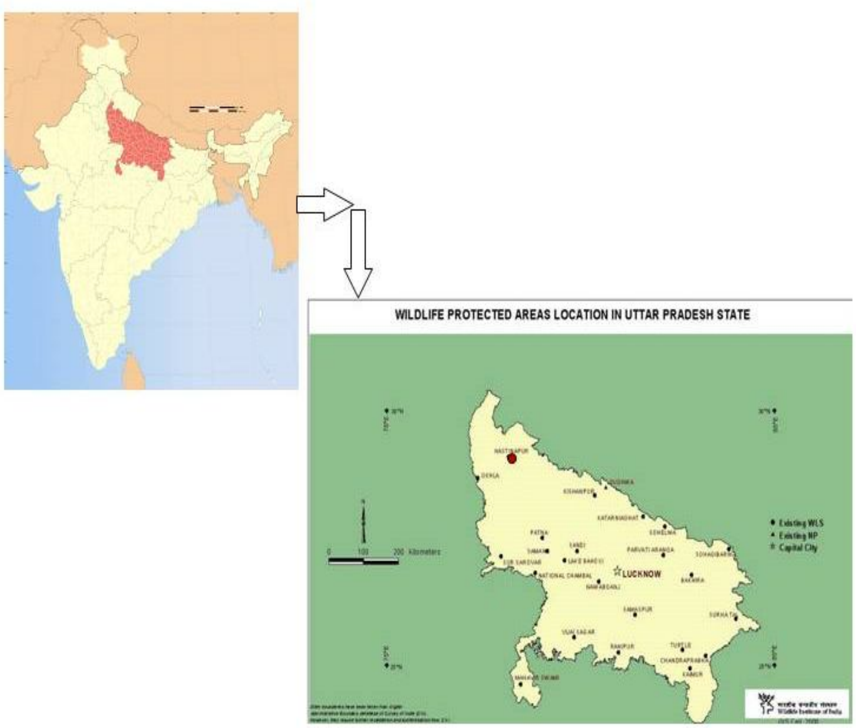


Fig. 1 Location of Uttar Pradesh in India and Hastinapur in UP

©IJRASET: All Rights are Reserved

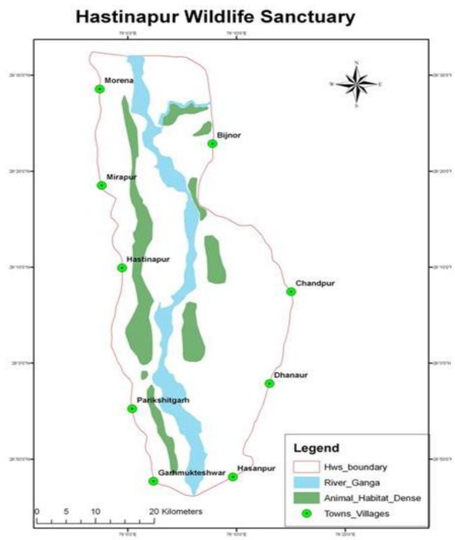


Fig. 2 Map of Hastinapur Wild Life Santuary

III. OBJECTIVES

The main objectives of this research work are:

A. Land-Use Land-Cover mapping of the entire area of the sanctuary.
B. Determine spatio-temporal changes in Land Use Land-Cover over a period of time ranging between1992 to 2006.

IV. MATERIAL AND METHODS

For this study Secondary data in the form of satellite imageries were downloaded from Global Land Cover Facility (GLCF). Two Landsat scenes were downloaded of which one Landsat TM with WRS path 146 and row 44 was dated Sept 24, 1992. The other Landsat satellite imagery was ETM+ with the same WRS path 146 and row 44 but dated Oct 25, 2006 (Fig. 3). Apart from this detailed maps of the sanctuary obtained from Divisional Forest Office (DFO), which was first georeferenced in Erdas (9) with the help of points identified through google earth imagery. Then these maps were digitised for preparing base maps of the sanctuary in QGIS 2.18. Through these gerefernced images, area of interest was subsetted from the Landsate imageries of both 1992 and 2006. Besides this, data was also collected primarily from the field with the help of a handheld GPS.

After subsetting the area of interest (AOI) of HWS from the landsat scenes (Fig. 4), the satellite images were classified in Erdas Imagine (9.2) using unsupervised classification technique and the signature file of the unsupervised classification was used for doing supervised classification. Land use and land cover maps were prepared in this way. Finally spatial and temporal changes in land use, land cover and in fact forest cover was found.

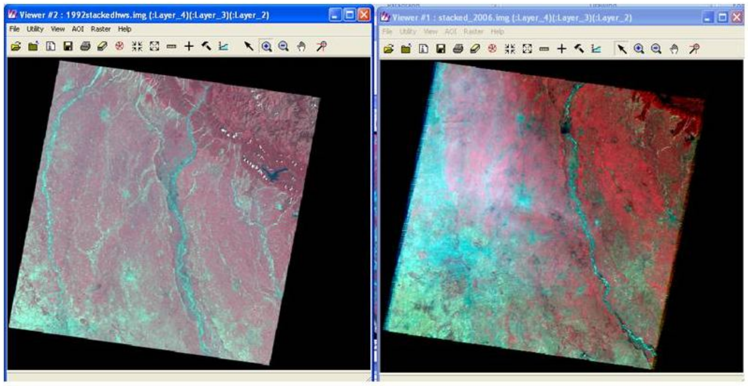


Fig. 3. Two Landsat Scenes 2006 ETM+ (left) and 1992 TM (right)

©IJRASET: All Rights are Reserved

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

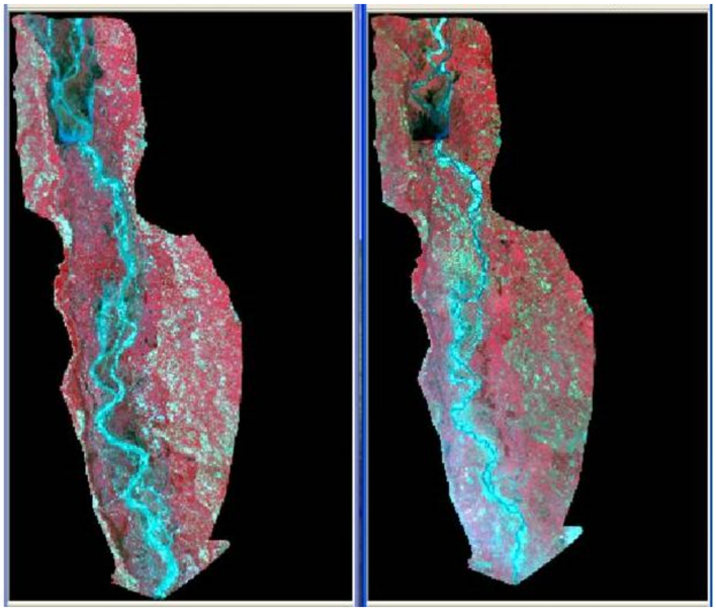
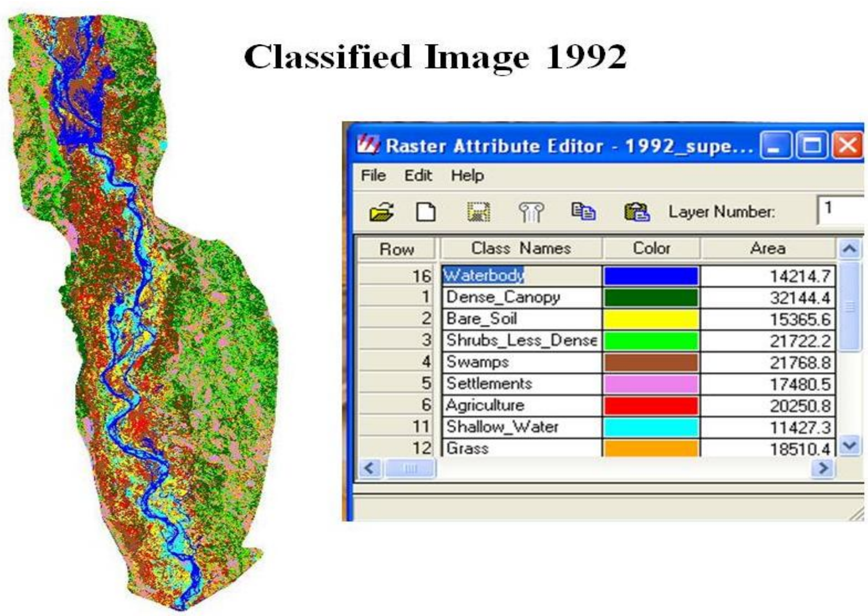


Fig. 4. Two Landsat Scenes after subsetting AOI of HWS 1992 TM (left) and 2006 ETM+ (right)

V. RESULTS AND DISCUSSION

Altogether nine land cover classes were identified while classifying 1992 imagery. They were waterbody, shallow water, areas having trees of dense canopy, swampy or marshy land, settlements, agriculture, grass or agricultural fallows, bare soil and shrubs less dense. The same classes were identified for 2006 imagery. However, the number of classes identified for 2006 imagery of HWS was 10. This is because due to shrinkage or recede of river water dry sandy area from the river bed appeared at places along the rivers which was also taken as a separate class. Fig. 5 shows the classified area of HWS for the year 1992 and Fig. 6 shows the classified area of HWS for the year 2006. Waterbodies are shown with dark blue colour while shallow water areas are taken as light blue area. Areas having trees with dense canopy are shown in dark green while lesser dense shrubs are shown in light green colour. Agricultural areas are denoted by red colour. Moist soil or swampy waterlogged areas are shown by brown colour and settlements are shown in pink colour. Grass or agricultural fallows are shown in orange colour while bare soil area is sown in yellow. A glimpse of both Fig.5 and Fig. 6 reveals that agricultural areas have increased exorbitantly in the protected area of the sanctuary



Row	Class Names	Color	Area
16	Waterbody		14214.7
1	Dense_Canopy		32144.4
2	Bare_Soil		15365.6
3	Shrubs_Less_Dense		21722.2
4	Swamps		21768.8
5	Settlements		17480.5
6	Agriculture		20250.8
11	Shallow_Water		11427.3
12	Grass		18510.4

Fig. 5. Classified Image of HWS for the year 1992

©IJRASET: All Rights are Reserved

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

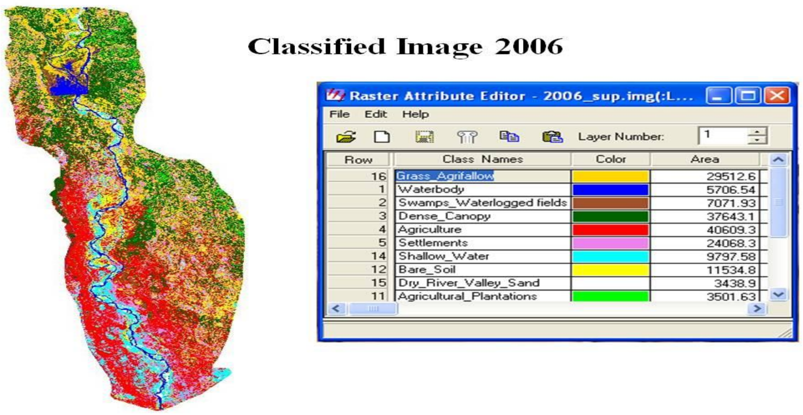


Fig. 6. Classified Image of HWS for the year 2006

Table 1 gives precisely the area of different land cover classes for the year 1992 and 2006 as a result of classification of both the imageries. It also shows the change in the area of all these classes and also the percent change for the same time duration that is between 1992 and 2006. The total area of the sanctuary demarcated for study was 1728.88 km^2. Of this area waterbodies showed a decrease of 59.85 per cent change from 142.147 km^2 in 1992 to 57.06 km^2 in 2006. Similarly swampy or marshy waterlogged areas showed a decrease of 67.51 per cent from 217.68 km^2 in 1992 to 70.71km^2 in 2006. Dense canopy areas showed a minor increase of 17 percent which may be attributed to plantation of orchards in recent times. Agricultural areas showed a phenomenal increase of about 100 per cent between 1992 and 2006. The area doubled from 202.51 km^2 in 1992 to 406.09 km^2 in 2006. Settlements or built-up areas showed an increase of about 37 per cent while agricultural fallows have increased by about 59.43 per cent. Shallow water, bare soil and less dense shrubs have shown a decrease of 14.26 per cent, 24.93 per cent and 83.88 per cent respectively.

Table I
Land Use Land Cover Change Of HWS Between 1992-2006

Sl.No.	Features	Area in 1992 (km^2)	Area in 2006 (km^2)	Change in Area (km^2)	Per Cent Change
1.	Waterbody	142.147	57.0654	-85.0816	-59.8547
2.	Swamps_Waterlogged Areas	217.6884	70.7193	-146.969	-67.5135
3.	Dense_Canopy	321.444	376.4313	54.9873	17.10634
4.	Agriculture	202.5081	406.0935	203.5854	100.532
5.	Settlements	174.8052	240.6834	65.8782	37.68664
6.	Grass_Agricultural_Fallows	185.104	295.126	110.022	59.43794
7.	Shallow_Water	114.273	97.9758	-16.2972	-14.2616
8.	Bare_Soil	153.6561	115.348	-38.3081	-24.9311
9.	Dry_River_Valley-Sand	0	34.389	34.389	
10.	Shrubs_less Dense	217.2222	35.0163	-182.206	-83.88
	Total Area	1728.888	1728.888	0	0

If we combine a few classes then we get six broad classes in HWS. For example waterbody were combined with shallow water to give the total area under river or waterbodies in the sanctuary. Similarly trees having dense canopy were combined with shrubs less dense to give the total tree cover in the sanctuary. Also agricultural areas were combined with fallows to give total area under agricultural activities in the sanctuary. Other classes like settlements, bare soil, swamps and dry river bed area remained as it was. The results have been compiled in Table 2.

©IJRASET: All Rights are Reserved

TABLE 2
Broad Land Use Land Cover Change Of HWS Between 1992-2006

Sl.No.	Broad Land Cover Classes	Area in 1992 (km2)	Area in 2006 (km2)	Per Cent Change
1.	Waterbody	256.43	155.04	-39.5391
2.	Treecover (Dense canopy and less dense)	538.67	411.45	-23.6174
3.	Swamps_Waterlogged areas	217.6884	70.7193	-67.5135
4.	Agriculture (including fallows)	387.62	701.22	80.90398
5.	Settlements	174.8052	240.6834	37.68664
6.	Bare_Soil	153.6561	115.348	-24.9311
7.	Dry_River_Valley-Sand	0	34.39	

Thus we see that there was about 39 per cent decline in area under waterbodies in the sanctuary from 1992 to 2006. Tree cover recorded a decline of about 23 per cent during the same time duration. Bare soil showed a decrease of about 24 per cent. Swampy areas declined by 67 per cent. Contrary to this, agricultural areas increased by 80 per cent and settlements increased by 37 per cent. Thus it suggests that since swampy areas have decreased to a great extent, it happens to be the habitat of swamp deer. So since the habitat of swamp deer is decreasing so their population is under risk and bound to decrease. Overall forest tree cover has also decreased coupled with declined in the area of waterbodies which means loss of habitat of several other species in the sanctuary including swamp deer or Barasingha.

VI. CONCLUSIONS

It is thus obvious that satellite remote sensing technologies can be a great help in assessing spatio-temporal change in land use land cover of an area and forests in particular. This is very much needed too follow a conversation approach for sustainable management of forests. Since HWS is close to NCR region, there is heavy urbanization in the vicinity which has an effect in the sanctuary area also. Settlements and agricultural activities are increasing at the cost of forest area. Poaching and other illegal activities like sand extraction from river Ganga has deteriorated the condition of several endangered species and swamp deer are no exception. The population of Swamp deer in this sanctuary has tremendous conservation value as it is geographically only 500-600 km away from the Dudhwa-Kishanpur-Katarniaghat conservation units, which is expected to be the last stronghold of this sub-species in India [10]. So their habitat should be preserved so as to sustain their population in the sanctuary. Recently in a rare occurrence it was reported that a herd of 23 swamp deers were spotted near the upper Ganga barrage at Haiderpur Wetland in Bijnor area of HWS. This is a good news as the swamp deer s are mostly spotted in the lower plains of Ganga barrage and spotting such a huge herd in upper reaches of the barrage was for the first time [11]. Further studies concerned with the sanctuary area conducted with recent satellite imagery would give a better insight to the change in situation after 2006. Satellite studies would thus provide a micro-level study of the sanctuary and expose illegal activities of farming, sand extraction and poaching inside the protected area and help the forest officials in the sustainable management of forests.

VII. ACKNOWLEDGMENT

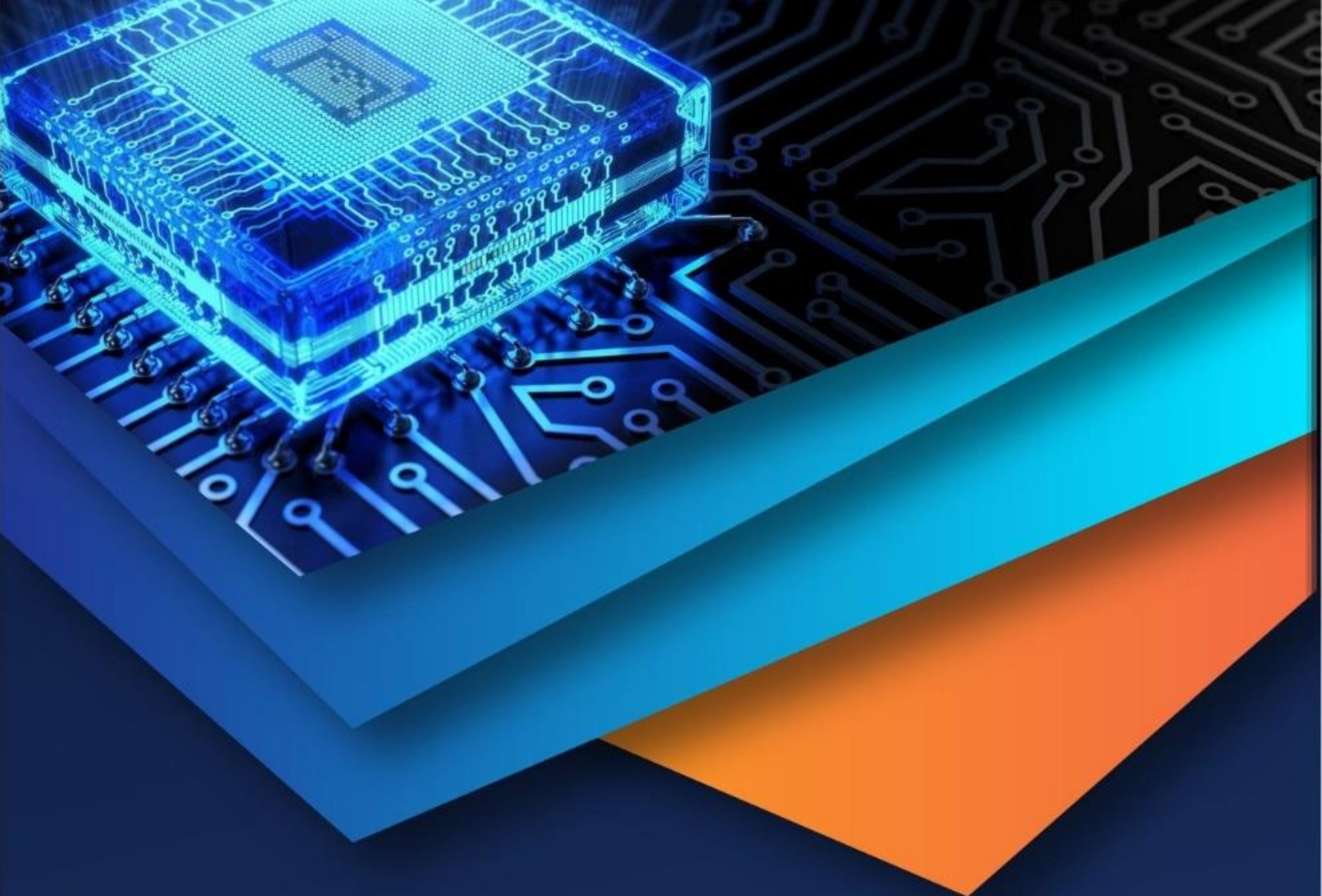
We are thankful to Divisional Forest Office at Meerut for providing information regarding HWS and also helping us with the booklet related to Hastinapur Wildlife Sanctuary Developmental Plan 2002-2012.

©IJRASET: All Rights are Reserved

REFERENCES

[1] Rucervus duvaucelii barasingha, https://animaldiversity.org/accounts/Rucervus_duvaucelii/ , Accessed, April 10, 2020.
[2] India State of Forest Report 2019, Forest Survey of India Report, http://fsi.nic.in/isfr-volume-i, Accessed, April 10, 2020
[3] Luojia Hu, Wenyu Li & Bing Xu . The role of remote sensing on studying mangrove forest extent change, International Journal of Remote Sensing, 39:19, 6440-6462, DOI: 10.1080/01431161.2018.1455239, 2019.
[4] Joanne C. White, Nicholas C. Coops, Michael A. Wulder, Mikko Vastaranta, Thomas Hilker & Piotr Tompalski. Remote Sensing Technologies for Enhancing Forest Inventories: A Review, Canadian Journal of Remote Sensing, 42:5, 619-641, DOI: 10.1080/07038992.2016.1207484, 2016
[5] Dr. Günay Çakir, Fatih Sivrikaya, Salih Terzioglu, Sedat Keles & Emin Zeki Baskent. Monitoring thirty years of land cover change: Secondary forest succession in the Artvin Forest planning unit of Northeastern Turkey, Scottish Geographical Journal, 123:3, 209-226, DOI: 10.1080/14702540701876697, 2007.
[6] Michael Emch, James W. Quinn, Marc Peterson & Mark Alexander. Forest Cover Change in the Toledo District, Belize from 1975 to 1999: A Remote Sensing Approach, The Professional Geographer, 57:2, 256-267, DOI: 10.1111/j.0033-0124.2005.476_1.x, 2005.
[7] Hastinapur Wildlife Sanctuary Developmental Plan 2002-2012.
[8] Uttarakhand , UP lost 57% grasslands in past 30 years, https://timesofindia.indiatimes.com/city/dehradun/ukhand-up-lost-57-grasslands-in-past-30-yrs-wii-study/articleshow/70864933.cms, Accessed, April 10, 2020.
[9] Sankaran, R., “Status of the swamp deer Cervus duvauceli duvauceli in Dudhwa National Park, Uttar Pradesh”, Journal of Bombay Natural History Society 87, pp. 250- 259, 1990.
[10] Khan, A. and Khan, Jamal A., “Conservation of swamp deer (Cervus duvauceli duvauceli) in Hastinapur Wildlife Sanctuary”, Proceedings of 4th International Deer Biology Congress, Hungary, pp 194-199, 1999.
[11] In a first, herd of swamp deer spotted near Ganga barrage, https://timesofindia.indiatimes.com/city/meerut/in-a-first-herd-of-swamp-deer-spotted-near-ganga-barrage-forest-dept-increases-vigil/articleshow/72430045.cms, Accessed, April 10, 2020.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)