Original Research Article

Forest Core Demarcation Using Geo-Spatial Techniques: A Habitat Management Approach in Panchet Forest Division, Bankura, West Bengal, India.

Abstract:

Habitat interaction referrers to an area in a forest patch with specific edge depth. Every habitat has obviously an interior area small or large size. Structurally it depends on shape and edge depth ratio of the specific patch. Amount of interior present in a habitat is strengthening movement, connectivity, protection and availability of species especially for large animal. Habitat interior plays a vital role to sustain their biological behavior and activities. Forest habitat is developed by plantation after 1980 through different social forestry programs in Panchet Forest division. For this reason forest cover is increased and it is spatially fragmented in nature. Fragmented habitat has a negative impact on forest interior. So demarcation of habitat interior or core is very urgent for biodiversity conservation and managing. Thus the present study tries to investigate and identify amount of habitat core using geospatial technical indices and field verification. Major objectives is to suggest practicable methods to increases amount of interior as well as to minimize gap between isolated patches to enhance the functional capability of habitat core in Panchet Forest Division in Bankura District.

Keywords: landscape, habitat colonization, habitat core, ecological behavior, fragmented habitat, connectivity.

Introduction:

Core area is defined "as the area within patch beyond some specified depth of edge influence (i.e., edge distance) or buffer width" (McGarigal, *et. al* 2002). So every patch has a core but its amount or effectiveness depends on its shape (Fig-1). Therefore a large patch may not be hold large amount of core area when it becomes more complex in shape. Most of conservation importance animal species required large habitat core for their biological function (Dramstad, *et.al*. 1996). Forest core is often vital to many wildlife species and essential to the proper function of much ecological process (Couvillion, 2005). Area sensitive animal species richness, colonization, remoteness from disturbing activities, resting is directly influenced by habitat core area. Interior animal species those are roaming in different homogeneous habitat patch, they can try to relax in a deep core area in a habitat patch for their biological metabolism (Forman, 2012; Farina, 2006). Interior portion of a habitat is different in micro-climatic condition in case of temperature, wind speed, energy penetration, canopy cover, shading from the edge (Forman, 1995). For that reason wilderness exists in the core than edge. Wilder animal species therefore want

to get larger and undisturbed core area. Elephants becoming a wild animal preferred such condition for their biological interaction with habitat. Same condition was happening due to increase forest cover in Bankura district from last few decades as well as in Panchet forest division. After 1980 degraded forest become not only protected but also increased forest area by social forestry (Sudhakar and Raha, 1994). On that situation a small population of elephants of Dalma Wildlife Sanctuary (Jharkhand State) has been making deep foray eastward into the state of West Bengal, make use of small patches of regenerating forest (Sukumar, 2003). It is interesting to know that some migrated bull elephants are also residential in nature using existing forest core as their permanent habitat (Mandal, *et. al*. 2016).

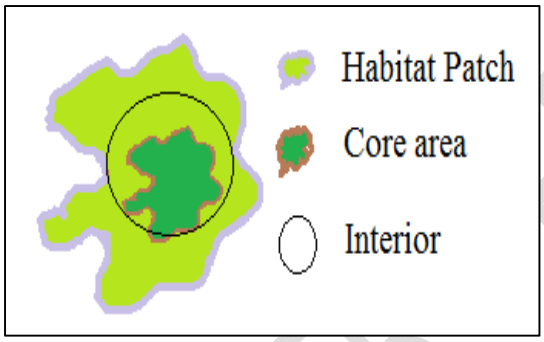

Fig-1: Concept of habitat core and interior area.

Objectives:

Panchet Forest Division (PFD) is consisting of isolated forest patch with high structural fragmentation. In spite of wildlife activities are more frequent and also gradually increase (Chatterjee, 2016; Mandal, *et.al.* 2018). In forest core area of PFD many selective herbivore species ecological activities have been found (Kulandaivel, 2010). Now elephants take rest at the time of movement to select some forest patch depending upon core condition. Therefore forest core is becoming a commendable factor ecologically. To understand the nature of core of the forest patches and improve the quality of core areas of PFD, study construct appropriate three objectives.

a. Identification of forest habitat patches with exact shape from categorical map
b. Core area demarcation and estimate at specified edge depth against each and every forest patch.
c. Improve core area effectiveness by structural management methods for wildlife conservation in future.

Study area:

Panchet Forest Division (PFD) is one of the wildest divisions among other three forest division in Bankura district. The latitudinal extension of the study area is 22°53N to 23°12N and longitudinal location is 87°03E to 87°42E. Total geographical area of PFD is 1355.62 sq.km. Among this Reserved Forest is 12.90 sqkm and Protected Forest is 335.11sq.km (Anon. 2016-17). Generally forest is sub-tropical dry deciduous in nature with dominated by sal *(Shorea robusta)* tree and some of Akasmoni and Eucalyptus mixed.

Materials:

The study considers forest patch is a wildlife habitat. 27 forest habitat patch polygons were demarcated. All forest patches have been digitized from IRS LISS-III P6 image 2016, keeping corresponding structure and shape. Extended three forest patches from PFD to adjoining district have taken into consideration for the purpose of the study (fig-2). These forest patch polygons are named as the name of nearest or adjust village name. These patches also place ID value against each and every patch accordingly. After that these habitat patches are analyzed through ArcGIS 10.1 version software and it's Patch Extension Tool.

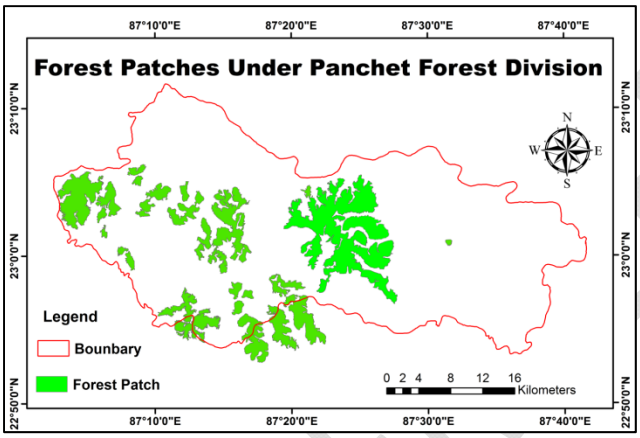

Fig-2: Forest patches from landuse land cover map of PFD. IRS LISS-III P6 image 2016

Methods:

From existing 27 forests habitat patches structural core area have been measured. Core area is measured at specified edge depth at 300 m. No of disjoint core area in each patch is not considered for study. Percentage of core area accepted as an important parameter for the purpose of the study due to size variety of habitat patches. Finally the output value against every habitat patches will be discussed ecologically.

1. Core Area (CA) (Mc Garigal and Marks, 1994)

$$CA=a_i^c$$

a_i^c= core area (m^2) of patch i based on specified- edge depth at 300 m or buffer distance.

At this fixed edge depth the value of CA increasing with increasing habitat quality. Practically patch has a larger core is meaning that it offers better condition for wildlife habitation. This forest patch will be focused more attention for management due to frequent man-animal conflict in the surroundings.

2. Percentage of Core Area (PCA)

$$PCA=\frac{a_i^c}{a_i}\times 100$$

a_i^c= core area (m^2) of patch i based on specified- edge depth (300m) and a_i is the area (m^2) of i patch.

This geometric technique signifies the area weighted core of the target patch. The index value increasing approach shows that patch structure quality is better. Simple word standard structure habitat shape has a good quantity core than a more complex habitat shape when patch size is same.

Result and Discussion:

Core area (CA):

After analysis the study find out the larger core holding forest patch Joypur (29779794.91sq.m) Taldangra 11046878.57sq.m Kalabagan4361352.221sq.m, Joypur-ii 5053611.78, Bridabanpur2780911.929sq.m accordingly in PFD (Fig-3). The lowest core area has been found in Pearbandh forest patch 274.1642sq.m and core area is nil in Chatrakrishnanagar forest patch. Medium size core area patches are Upper Arrha1801929.698sq.m, Sabrakona 339258.7728sq.m,Amdangra 286813.3655sq.m, Krishnasingpur819628.7489sq.m respectively. For structural high complexity in Joypur, Majuriprasadpur, Upper Arrha consist several disjoint core area that is number of core is high. This scenario shows that these forest patches have more fragmented in nature and land encroachment is high. Ecologically this fact reduced the quality of habitat.

Percentage of core area (PCA):

Large habitat patch has dominancy on the landscape in response of animal behavior and animal ecological function acting on the landscape. When large habitat patch has minimum core due to its complex shape structure, it would be same suitable like medium size habitat patch. Same situation has found the study that Joypur forest (81973085 sq.m 36.33% PCA) is the largest patch in PFD in spite of its percentage of core area is smaller than Taldangra forest patch (22240596 sq.m 49.66% PCA) which is a medium size patch (fig-5). Generally above 30% PCA have been found only four forest patches Joypur, Joupur-ii 50.98%, Kalabagan 34.2% and Taldangra. In between (15-30) % PCA have been found in seven forest patches like Sabrakona 20.48% Brindabanpur 23.35%, Valuka 21.6%, Peardoba 27.87% and Chandabelia 18.07%. All other patches have scored below 15% PCA. It is interesting to know that Chatrakrishnanagar forest patch has no core area at specified edge depth.

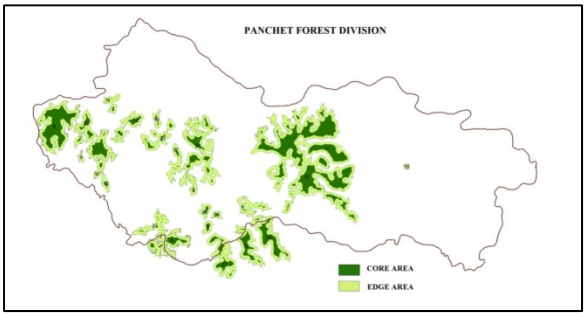

Fig-3: Core area map of forest habitat patches in PFD at 300m edge depth

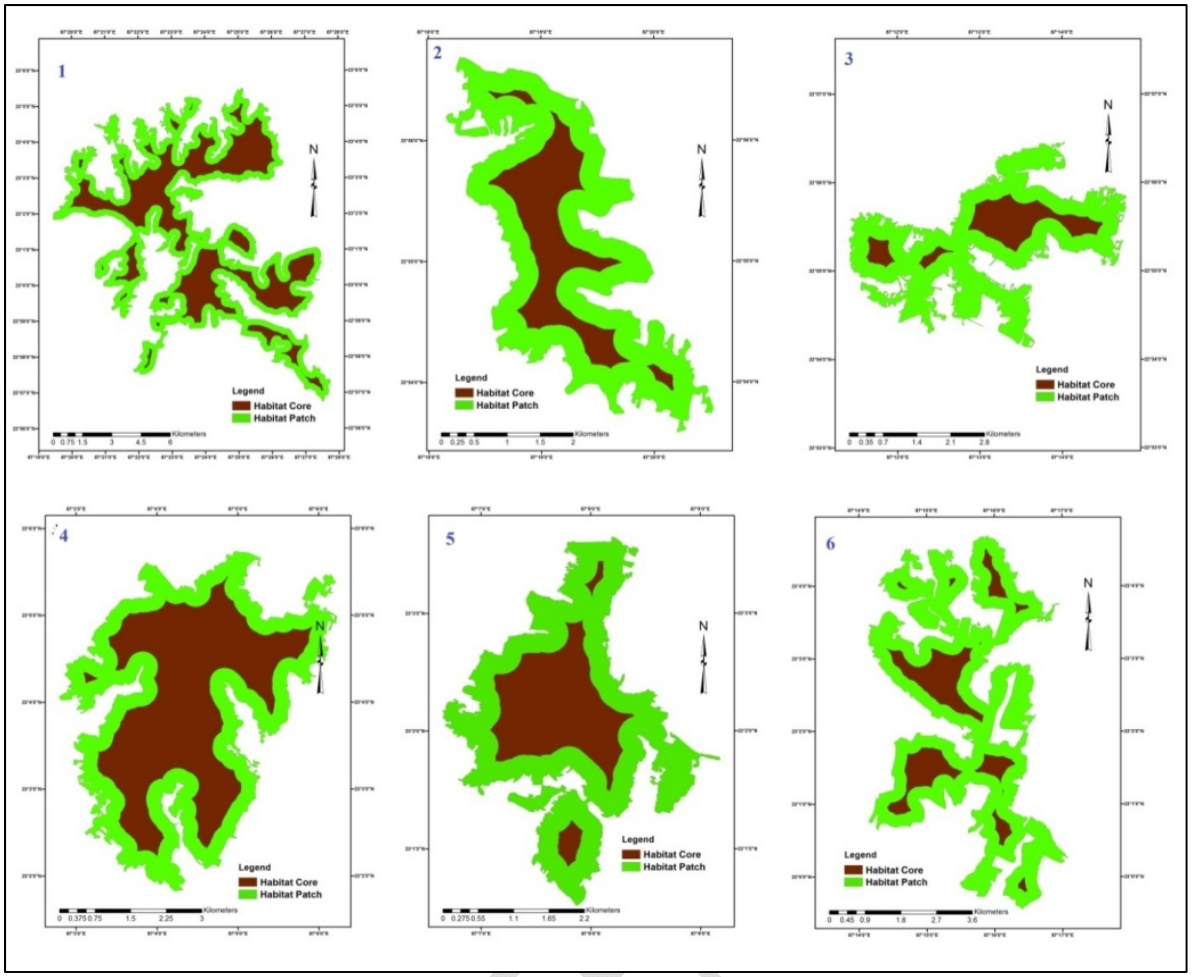

Fig- 4: showing different six forest patches (**1.** Joypur-ID 14, **2.**Peardoba-ID 9, **3.**Upperpartarrha –ID 4, **4.** Taldangra-ID 5, **5.**Valuka-ID 21, **6.** Majuriprasadpur-ID 11) core area at 300 m edge depth.

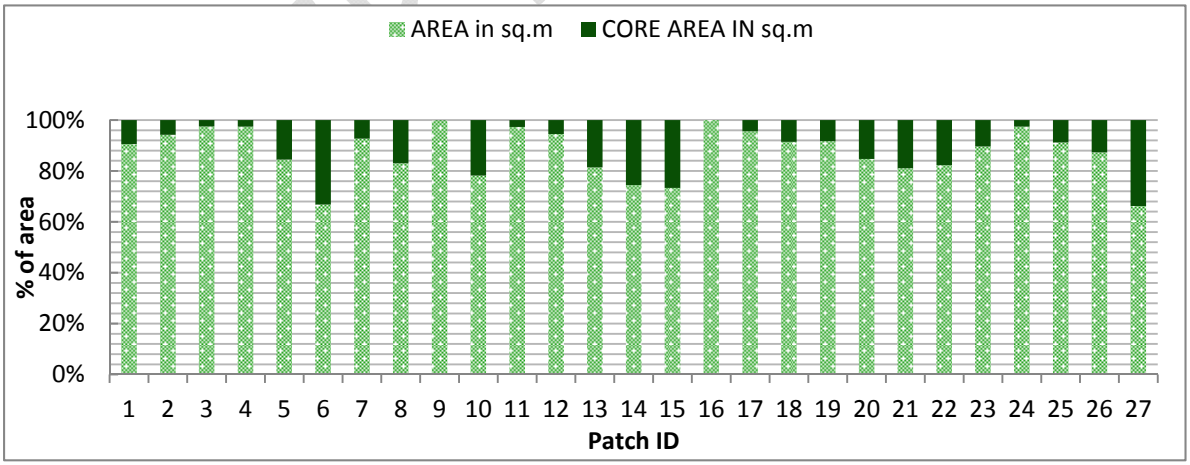

Fig- 5: Patch wise graphical presentation of forest core area in % respect of individual patch area.

ID	PATCH NAME	AREA in sq.m	CORE AREA IN sq.m at 300 m edge depth	Percentage of Core Area %
0	WEST NAKAIJURI	2529096.279	263512.1207	10.42
1	MATIALA	986100.1896	60594.80815	6.14
2	UPPERSOLE	3326697.456	85541.75746	2.57
3	UPPERPEARDOBA	4879204.117	128831.8222	2.64
4	UPPERPART ARRHA	9810942.525	1801929.698	18.36
5	TALDANGRA	22240596	11046878.57	49.66
6	SIBDANGA EAST	1211205.628	95141.07887	7.85
7	SABRAKONA	1656711.375	339258.7728	20.48
8	PEARBANDH	690521.9122	274.1642	0.04
9	PEARDOBA	9307834.331	2593695.911	27.87
10	MATIALAUPPER	1697585.205	47330.73472	2.79
11	MAJURIPRASADPUR	4452819.459	258142.5681	5.8
12	KRISHNASINGPUR	3580857.339	819628.7489	22.89
13	KALABAGAN	12715712	4361352.221	34.3
14	JAYPUR	81973085	29779794.91	36.33
15	CHATRAKRISHNANAGAR	443065.2	0	0
16	CHAKSHYAMPUR	817982.1528	37944.10013	4.64
17	CHAKSHYAMPUR LOWER	1519637.129	142470.5517	9.38
18	UPPERPART OF NAKAIJURI	1656602.348	149752.7394	9.04
19	CHANDABALIA	20857306	3768282.013	18.07
20	BRINDABANPUR	11908903	2780911.929	23.35
21	VALUKA	5726010.499	1237023.099	21.6
22	LOWER PART OF NAKAIJURI	6537355.299	757292.4141	11.58
23	BARKHULIA	6345656.639	169545.0575	2.67
24	ASTHASOL	1085338.076	104777.1091	9.65
25	AMDANGRA	1968690.896	286813.3655	14.57
26	JAYPUR-ii	9911730	5053611.78	50.98

Table- 1: Forest patch wise parameters calculated value in Panchet Forest Division

Structural management:

Core area development in forest ecosystem is an important part of biodiversity management (Li, *et. al.* 2007). Habitat fragmentation and encroachment is a natural phenomenon in human modified landscape. According to Sudhakar and Raha, (1994) amount of forest cover had been increased in the past three decades. Increase of forest area does not mean enhancement of ecological quality of habitat interior or core. For increasing quality of core area, habitat structural management is needed. Especially the non-forest land near the center of the habitat patches are considered for plantation or forest regeneration. It should be the first step to develop core of the habitat. It is also effective to reduce habitat structural fragmentation and edge effect (Desai 199, 2010; McGarigal, *et. al.* 2009; Cushman, 2006). In the study area Joypur forest patch is the largest patch but highly fragmented and more complex in shape due to agricultural encroachment rather than

Taldangra and Valuka East patch (Fig-6). If in Joypur forest patch's encroached area altered in forest cover by plantation or forest regeneration then it will be a good core habitat for wildlife.

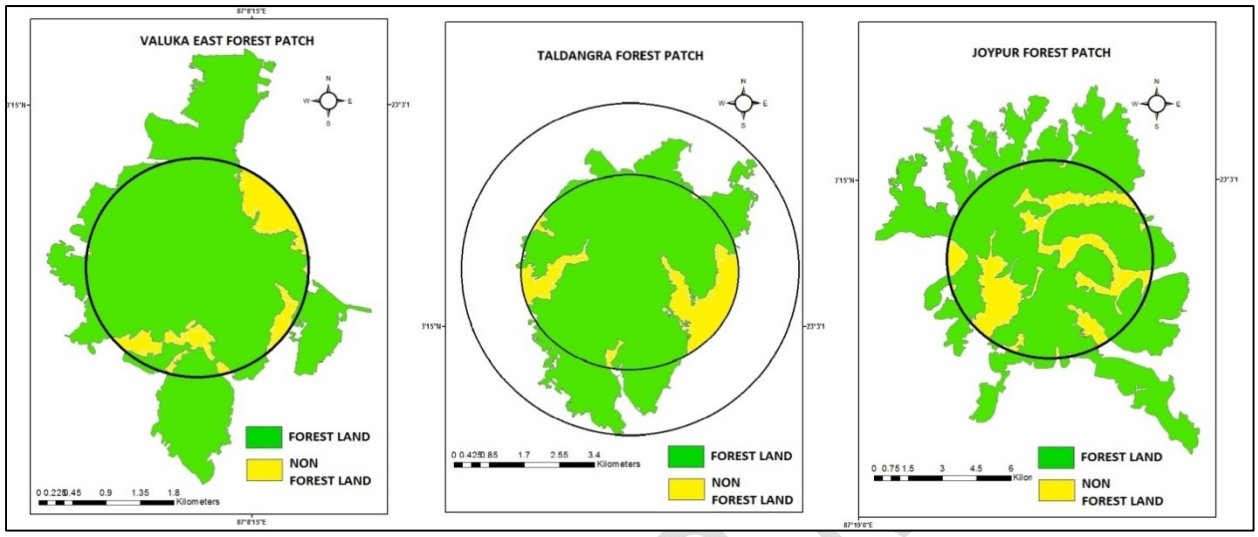

Fig-6: Three patches with their non forest area at specified circle distance from the centre of the patch

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Selection of plant species and planted area: Selection of the plant species and planted area is an important objective for any forest regeneration program (Das Gupta, 1989; Banks, *et. al.* 2005). In the study area forest department takes several forestation and reforestation program. Generally they planted Sal (*Shorea robusta*), Akashmoni (*Acacia auriculiformis*), and Euklepatus (*Eucalyptus globulus*) in the vacant land for economic benefit. This study suggests that plantation must be considering two things. First is selection of local plant species which has capability to improve under growth, maximum canopy and layering of forest. Plant species which is producing forage for herbivores animal (elephants) in the core area of the forest. Second is area selection for plantation. Encroachment area or non-forest area near the center surrounding of the forest patch is the suitable place for forest plantation to improve core or interior habitat (Dauber, *et. al.* 2003). Thus approaches considerably rises quality of habitat and changes nature of man-animal conflict in the study area.

Plates: real photographs were taken at the time of survey in Joypur Forest

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