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43/2 Varadarajulu Nagar, 5th Street West, Ganapathy, Coimbatore, Tamil Nadu 641006, India
Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India
Ph: +91 9385339863 | www.threatenedtaxa.org
Email: sanjay@threatenedtaxa.org

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ARTICLE

Identification, prioritization, and management of biodiversity hot specks: a case study of Western Ghats of Maharashtra, India

Shivam Trivedi [1] & **Erach Bharucha** [2]

[1] Naoroji Godrej Centre for Plant Research, 431, Lawkim Campus, Shindewadi, Shirwal, Satara, Maharashtra 412801, India.
[2] Bharati Vidyapeeth Institute of Environment Education and Research, Bharati Vidyapeeth University, Dhankawadi, Pune, Maharashtra 411043, India.
[1] trivedi.shivam07@gmail.com (corresponding author), [2] kapilabharucha@gmail.com

Abstract: The Western Ghats are globally recognized as a hotspot of rich, endemic, and threatened biodiversity. Within this hotspot of biological diversity, there are islands of natural landscapes that can be termed as 'hot specks'. These hot specks require careful prioritization and specific management strategies as they vary in objectives and ownership. Conserving hot specks of biodiversity is of great relevance because creating new protected areas with wildlife corridors between them has become relatively impossible in the present context of intensive land-use change in this rapidly developing region. Management strategies, however, must be based on scientific assessment and using a set of prioritization criteria for selecting the most appropriate forms of management. The conservation action plan for the Western Ghats has become a controversial issue based on the findings in the report submitted by the Western Ghats Expert Ecological Panel and the High Level Work Group on Western Ghats. In the present context of rapidly changing land-use patterns, economic development, forest fragmentation, isolation of habitats, linear intrusion, neo-urbanization and industrial growth are threats to the pristine nature of the ghats. Thus, there is an urgent need to identify, prioritize and manage the smaller fragments of biological importance within the larger ecologically sensitive landscape. A prioritization model for different types of hot specks is essential so that it can be easily replicated by training frontline forest staff, community-based organizations, Biodiversity Management Committees, and non-government organizations for implementing a strategy and action plans for the sites by using the Biological Diversity Act, 2002. Support of the local Biodiversity Management Committees and the State Biodiversity Board is essential for the conservation management of these biodiversity-rich sites. This study presents an innovative approach to prioritize areas outside the formally notified boundaries of the national parks and wildlife sanctuaries to assess the conservation value of hot specks of diversity through a rapid biodiversity assessment tool. This can lead to a rational conservation strategy that conservation planners and practitioners can use.

Keywords: Biological diversity, forts, hotspot, hot specks, management strategies, plateaus, rapid biodiversity assessment tool, sacred groves.

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Author details: Dr. Shivam Trivedi is a scientist at the Naoroji Godrej Centre for Plant Research. He is an experienced environment researcher and a nature conservation expert with a demonstrated history of working in the biodiversity and natural capital conservation research, corporate social responsibility, sustainability and academic sector for over 10 years. Dr. Trivedi is also a member of the international Education for Sustainable Development Expert Net Committee. Dr. Erach Bharucha is the director at the Bharati Vidyapeeth Institute of Environment Education and Research. He is a surgeon by profession, and a biodiversity conservation expert by passion. He has been active in the field of wildlife and nature conservation over the past five decades and has extensively studied the protected areas and tribal cultures of India. He is also the ex-chairman of the Maharashtra State Biodiversity Board.

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Naoroji Godrej Centre for Plant Research

INTRODUCTION

Western Ghats – a global biodiversity hotspot

The term 'biodiversity hotspot' was first introduced in the late 1980s by Norman Myers as 'specific areas on earth's land surface harbouring disproportionately large numbers of extant species' (Reid 1998). At first, a list of 18 biodiversity hotspots was identified based on the richness of higher plant species (Mittermeier et al. 1998). Later new areas were included, and the list of biodiversity hotspots was increased to 25 (Fisher & Christopher 2007; Laurance 2007b). Currently, 35 global biodiversity hotspots have been identified (Laurance 2007a; Williams et al. 2011).

The Western Ghats are one of the first 18 globally identified biodiversity-rich hotspots. The mountain range is believed to be older than the Himalayas and spreads across six western states of India, in Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu, and Kerala (Kumara & Singh 2004; Pai 2005). Among these six states, Maharashtra is the most urbanized and industrialized region making it vital to create a locale-specific viable management strategy for this ecologically sensitive area (Mohan & Pant 1982; Ghatge et al. 2013).

Biodiversity conservation – a significant concern

The impacts on the landscape of the Ghats have initiated unsustainable patterns of land management in the Western Ghats (Panayotou & Ashton 1992; Menon & Bawa 1997). This has become a serious concern for biodiversity conservation as new protected areas are not a feasible option in the present context. The notified protected areas are being conserved through the Wildlife Protection Act, 1972 and various rules and regulations. These formally recognized protected areas were considered an adequate strategy for conserving biodiversity two to three decades ago (Beresford & Phillips 2000). However, recent studies have shown that a large part of the floral and faunal species diversity is present in the landscape elements outside the protected area network (Bhagwat & Rutte 2006). The current protected areas are thus insufficient for conserving the species and ecosystems, which are critical biological assets at global, national and local scales (Lindenmayer & Franklin 2002; Bhagwat et al. 2005; Lindenmayer et al. 2006; Shrestha et al. 2010).

Due to the current rapid growth of urbanization, industrialization, mining, transportation facilities, and infrastructure development, it is not feasible to notify new protected areas under the Wildlife Protection Act, 1972 or extend the boundaries of the existing protected areas, or create viable corridors between the protected areas is also a contentious issue (Mathur & Sinha 2008). The existing pressures are leading to a loss of species diversity in the protected areas and potential forested corridors connecting them (Gardner et al. 2010). However, there are several small and large landscape elements in the Western Ghats with high species concentrations that are not confined within the boundaries of existing protected areas in this ecologically sensitive area (Gadgil et al. 2011). The surrounding landscape elements of the protected areas form a matrix of cultural landscape elements that are permeable to several species such as small mammals, avifauna, amphibia, reptiles and insect life. The specialized habitat fragments surrounded by human-dominated land-use are representatives of small patches of natural or semi-natural ecosystems of the Western Ghats (Anand et al. 2010). These biodiversity-rich islands of forests are referred to as 'hot specks' (Cherian 1995). As defined, these hot specks are miniscule areas of species concentration, varying in size from five to rarely a few hundreds or more square meters falling within of far outside todays recognized hotspots where species-packing of diverse groups, including many endemics is found (Cherian 2000). They constitute a mix of varied elements that are effective as a support system for biodiversity conservation and could constitute a second line of reserves that act as biodiversity rich islands between the protected areas for a variety of floral and faunal elements (Bharucha 2006a, b).

Need for identifying biodiversity hot specks

A greater ecosystem is present in the landscape matrix dominated by socio-ecological elements outside the protected area boundaries. Conserving this large ecosystem is not a possible solution considering the human dependency on these landscapes. There is a need to identify key locations within this ecosystem for managing important ecological functions (DeFries et al. 2007). Identifying and conserving the biodiversity-rich 'hot specks' in a mosaic of cultural landscapes has become a priority for developing a network of biodiversity rich islands that will support the effective movement of wild fauna between the protected areas, as creating continuous corridors between protected areas is not a feasible option (Bhagwat et al. 2014; Trivedi et al. 2018). The increasing pressures on land use thus requires an innovative strategy aimed at conserving these multiple biodiversity rich hot specks that can act as areas that fauna can use to cross from one forest patch to another. Hot specks of diversity nested between existing protected areas are essential elements within the matrix of man-modified cultural landscapes.

Purpose of the study

The purpose of this study was to:

1. Identify the different important landscape element typologies of hot specks present with the Western Ghats of Maharashtra (Figure 1).
2. Prioritize each site within these different landscape elements using a set of scientific assessment parameters based on the evaluation of their biodiversity and anthropogenic threats that affect them adversely.
3. Suggest a unique management strategy based on the prioritization of these hot specks.

This study can act as an up scalable model for the rest of a large number of hot specks in the Western Ghats.

METHODS

Identification of hot specks

A survey of relevant literature provided a list of 14 possible hot speck typologies (Bharucha 2010; Trivedi & Bharucha 2019). Based on the available secondary data, sacred groves, forts, and plateaus were selected for the survey as they are key areas easily demarcated and can be managed (Naravane 1995; Deshmukh et al. 1998; Watve 2013). Hot specks under the three typologies (sacred groves, forts and plateaus) were plotted on a study area map and were selected for the ground survey through a purposive sampling technique.

Assessment of the hot specks

The Rapid Biodiversity Assessment Tool was developed consisting of important parameters categorized into biodiversity and anthropogenic threats that were further divided into several relevant subcategories (Figure 2). These parameters included shape and size, structure of the forest and its condition, presence of faunal diversity, special features, surrounding matrix (Hopkins & Skellam 1954; Adams et al. 1998; Ranta et al. 1998; Vázquez-García & Givnish 1998; Plumptre 2000; Ricketts 2001; Hill et al. 2005; Ormsby 2011; Trivedi et al. 2018). Anthropogenic threats include various types of gradually increasing local livelihood threats such as clearing natural landscapes for expanding agriculture and grazing, forest fires, felling of trees and lopping branches and current modern threats arising from the rapid sale of land, development of roads and transportation, powerlines, mining, windmills, industries, neo-urbanization and tourism were included as a part of the evaluation (Padhye et al. 2006; Davidar et al. 2007; Anitha et al. 2009; Subramanian et al. 2011; Mehta & Kulkarni 2012; Trivedi et al. 2018). The assessment parameters were quantified using a score from 0 to 10 (0 – absent, 2.5 – poor/ low, 5 – fair/ moderate, 7.5 – good/ significant, and 10 – very good/ high) (Trivedi et al. 2018). This scoring system was developed based on the assessment technique used for assessing the management effectiveness evaluation (MEE) of tiger reserves in India (Mathur et al. 2011).

The rapid biodiversity assessment tool (RBAT) is modified from the rapid assessment and prioritization of protected area management (RAPPAM) technique developed for WWF's 'Forest for Life' programme (Ervin 2003a; Getzner et al. 2012). These tools were modified so that they can be used by ground level practitioners such as forest department staff and the local Biodiversity Management Committees under the provisions of the Biological Diversity Act, 2002 (National Biodiversity Authority 2002).

A set of questions was designed for conducting semi-structured interviews with the local people (Longhurst 2003). The interview data is an essential part of the RBAT. It fills the one-time temporal gaps from the survey and provides a time series over the last couple of decades. Interviews can be done relatively quickly and provide local insights that are not obvious in a biodiversity and vegetation-based site analysis (Ervin 2003b). Thus, social issues and cryptic faunal values have emerged through this exercise.

Developing a geospatial database of the hotspecks

A normalized difference vegetation index' (NDVI) was processed using LANDSAT 8 satellite images for the entire study area. The technique was first used in the early 1970s, and it uses visible and near-infrared bands of the electromagnetic spectrum for identifying the presence of live vegetation on the ground (Sahebjalal & Dashtekian 2013). A buffer of 2 km^2 was created around the hot specks surveyed to study the peripheral vegetation cover. The GPS coordinates of hot specks were documented during ground-truthing and were plotted for the Western Ghats of Maharashtra using the ArcGIS platform.

Road network was acquired from Open Street Map and overlaid on the study area to identify the type of road connectivity to the hot specks. A buffer of 2 km^2 was created around all the identified hot specks from the secondary database to develop a network of hot specks forming a potential wildlife corridor. The database of all the three hot speck typologies was linked with the hot speck maps, and a geospatial database was developed

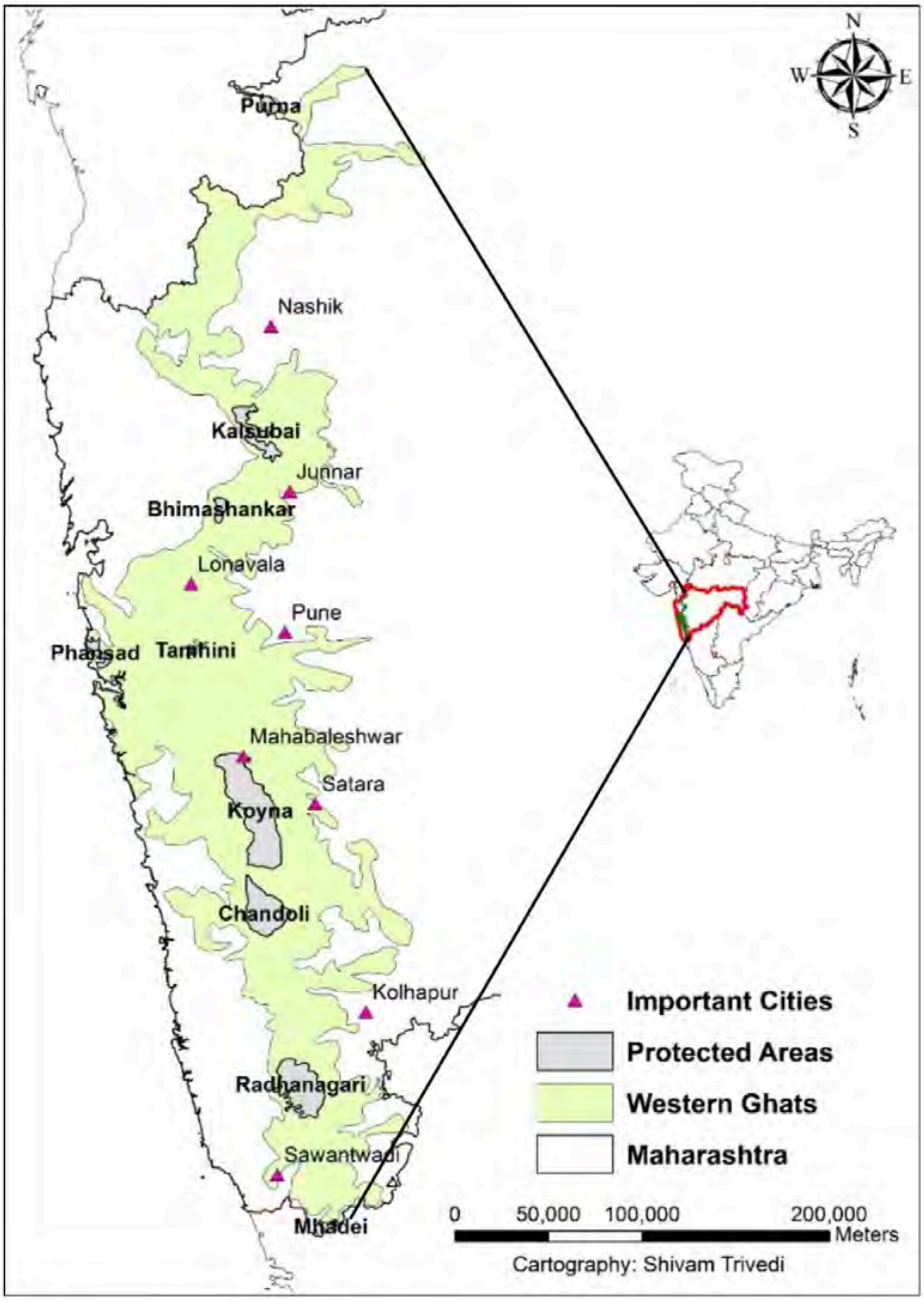

Figure 1. Study area – The Western Ghats of Maharashtra.

to acquire additional information on the hot specks (Kushwaha & Roy 2002).

A prioritization matrix was developed consisting of 16 categories for prioritizing the surveyed hot specks. These hot specks were then categorized in the matrix based on the biodiversity and anthropogenic threat values obtained from the field survey (Trivedi et al. 2018).

Developing management strategy for hot specks in the Western Ghats

Notifying these biodiversity hot specks as protected areas under the Wildlife Protection Act, 1972 can create new conflict issues. However, the Biological Diversity Act, 2002 is a feasible option since several local and tribal communities are dependent on these hot specks for their livelihood, and local Biodiversity Management

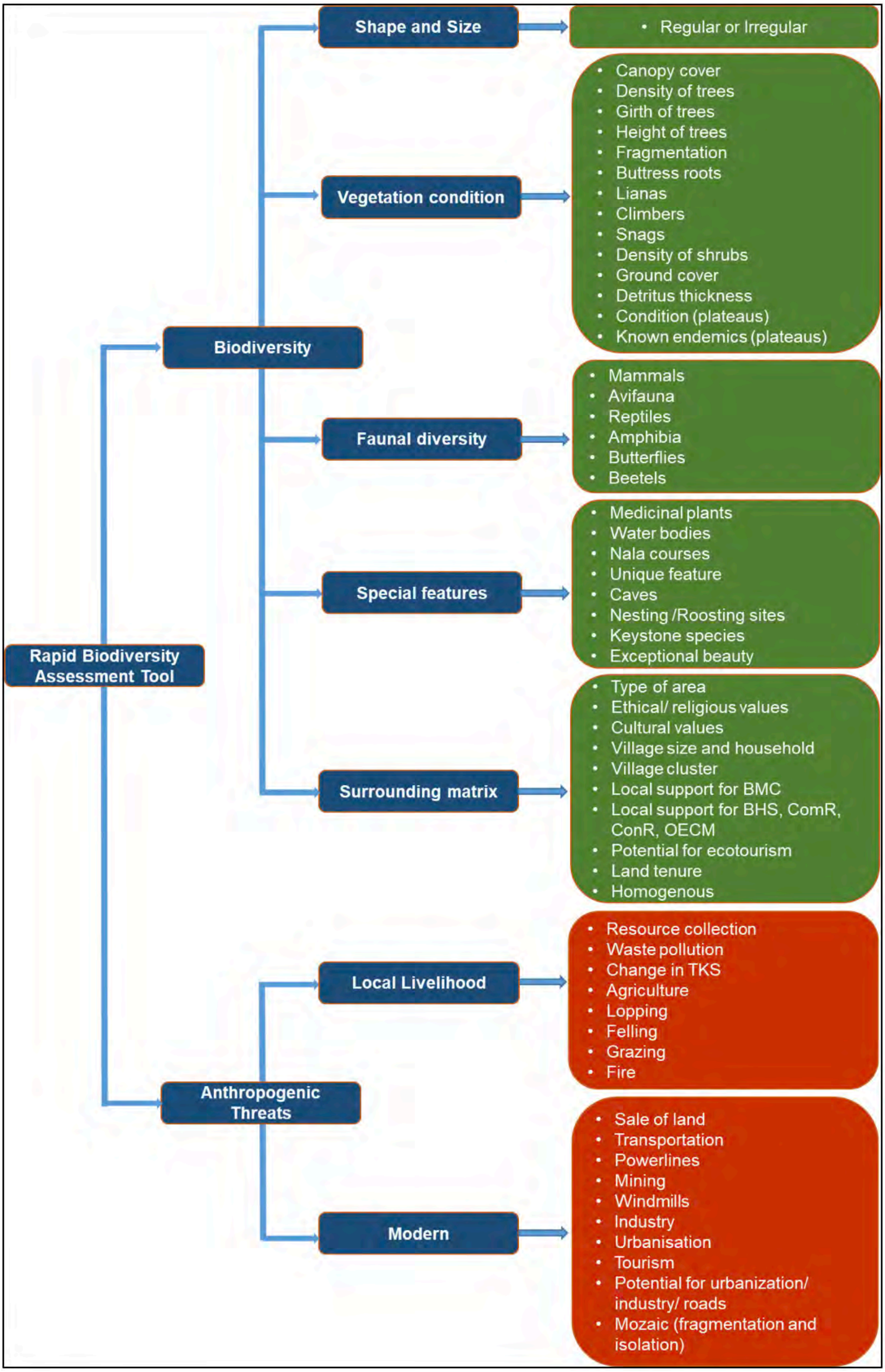

Figure 2. Rapid Biodiversity Assessment Tool.

Committees are empowered to legally take on this task (West & Brockington 2006). The conservation of these areas requires an innovative approach through which multi-stakeholder participation is incorporated into the management of the hot specks (Miller 2005).

A detailed literature of traditional, existing and new conservation approaches was reviewed for defining possible management strategies. Several new approaches under the rules and guidelines of the Convention on Biological Diversity and the Biological Diversity Act, 2002 were identified and can be used for conserving the prioritized hot specks based on the scores from assessment of biodiversity and anthropogenic threats (Gadgil et al. 2011).

The conservation of these hot specks requires active participation of various stakeholders. Government departments, especially the Forest Department and the Maharashtra State Biodiversity Board, as well as educational institutes and non-government organizations, have a crucial role in building and strengthening the capacity of the local communities and generating awareness for conserving these islands of rich biodiversity (Singh & Rahman 2012).

The Companies Act, 2013 has provided a potential pathway for corporates to initiate biodiversity conservation through their Corporate Social Responsibility (Ministry of Corporate Affairs 2013). Additional funding through corporates is an option for supporting these programs (National Biodiversity Authority 2019).

RESULTS

A sample size of 51 hot specks (19 sacred groves, 15 forts and 17 plateaus) were identified for the ground survey through purposive sampling from a total of 376 hot specks (Figure 3 & 4). The data collected from the ground survey and interviews were assessed for their biodiversity and anthropogenic threat scores (Table 1). They were depicted graphically and plotted in the prioritization matrix (Figure 5, 6 & 7; Table 2, 3 & 4). The combination of biodiversity and anthropogenic threats show that one sacred grove, one fort and one plateau recorded high biodiversity asset values. There is a significant negative correlation between biodiversity and anthropogenic threat scores, indicating that as anthropogenic threats increase, the value of biodiversity decreases (Table 5). Assessment of threats indicated that there had been a loss of traditional knowledge practices such as spiritual importance, agriculture and grazing while tourism, transportation, and urbanization had a more significant role in degrading the biodiversity of the hot specks and had spread across the surrounding matrix in the landscape.

Geospatial analysis

The results of geospatial analysis indicated that the scores of biodiversity and anthropogenic threats could be closely linked to the road connectivity of the hot specks (Figure 8). It provided an indicator of the overall anthropogenic threats that were degrading the biodiversity values of the hot specks. The anthropogenic threats showed that roads were linked to other threats as a cause- and- effect phenomenon which has increased over time. The effect of one threat that led to degrading the hot speck became a driving force for other threats. The analysis of road network connectivity to the hot specks has indicated that a total of nine hot specks (five sacred groves, two forts and two plateaus) are connected with a national highway, seven hot specks (two sacred groves, three forts and two plateaus) are connected with state highway, two hot specks (two forts) are connected with major district road, 32 hot specks (11 sacred groves, eight forts and 13 plateaus) are connected with other district roads and one hot speck (one sacred grove) is connected with a dust road. The road connectivity to a hot speck has led to other threats causing degradation of the biodiversity in the hot specks. Moderate to high anthropogenic threats have been recorded in four of the five hotspecks connected by national highways. The results showed that 32 out of 51 hot specks were connected by other district roads, which recorded moderate to high anthropogenic threats. A further analysis indicated that the stretch of the other district roads connecting the 17 hot specks were connected indirectly to either a national or state highway. In the case of Korigad fort, Khingar, Ambral, Dandeghar, Rajapuri, Mahabaleshwar 1, 2, & 3 plateaus, the hot specks are connected by other district roads, which is further connected to major district roads. The major district roads are in the near vicinity of popular tourist destinations.

A key concern is the quality of the surrounding matrix. A buffer of 2 km^2 created for the hot specks identified from the secondary database have resulted in a potential intermittent functional wildlife corridor connecting protected areas from Kalsubai Wildlife Sanctuary in Maharashtra State to Mhadei Wildlife Sanctuary in Goa State (Figure 9).

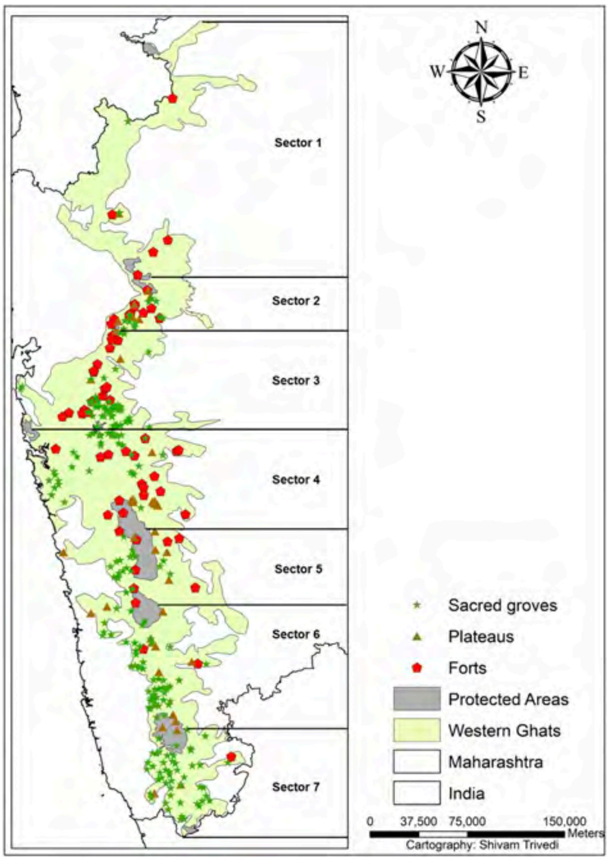

Figure 3. Hot specks identified from the secondary database.

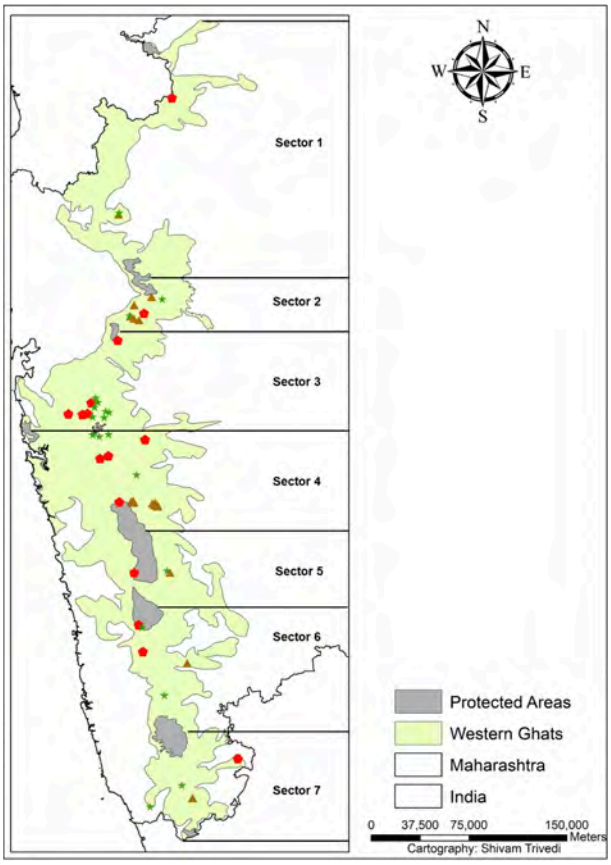

Figure 4. Hot specks identified for ground survey.

Management of hot specks – a dire need for conservation

The 51 hot specks (sacred groves, forts and plateaus) surveyed in this study are present outside the boundaries of the National Parks and Wildlife Sanctuaries. Hence, there are no stringent rules and regulations protecting these biodiversity rich hot specks. As a result, changes within the hot specks such as complete renovation or development of deity temples in the sacred groves were observed which has led to thinning of grove canopy and is attracting religious tourism (Image 1 & 2).

An important information recorded from the local interviews was that the sacred groves are not conserved for their biodiversity values but because of religious sentiments. However, the local people are aware of the changing landscapes leading to biodiversity loss. A growing demand of tourism for forts is leading to its beautification and attracting development of roads, small and medium scale eateries, and parking areas (Image 3,4).

These development processes are impacting the areas within fortified walls as well as the fort hill slopes. Unlike sacred groves and forts, plateaus are under pressure from tourism, roads passing through them, mining, power generation projects and grazing, all leading to loss of several seasonal endemic flora (Image 5).

Solid waste is a common threat observed in all the hot specks (Image 6). Land use change in the surrounding matrix is another anthropogenic threat found in hot specks that were connected to state or district highways. There is a dire need to develop and implement a sustainable management system for conserving these biodiversity hot specks taking into consideration the livelihood needs of the local communities.

DISCUSSION

The current study has highlighted that there are several fragments of biodiversity-rich areas outside the protected areas in the Western Ghats termed here as biodiversity hot specks which can act as transit areas across permeable areas for wildlife movements between protected areas (Das et al. 2006; Ray & Ramachandra 2010; Trivedi & Bharucha 2019). These hot specks

Table 1. Biodiversity and anthropogenic threat score of hot specks (SG—sacred groves, FT—forts, PL—plateaus).

	Hot specks	Hot speck code	Biodiversity	Anthropogenic threats
Sector 1: Purna Wildlife Sanctuary – Kalsubai Wildlife Sanctuary				
1	Inglaaj	SG1	4.38	5.69
2	Salher	FT1	4.51	3.97
3	Anjaneri	PL1	7.88	5.42
Sector 2: Kalsubai Wildlife Sanctuary – Bhimashankar Wildlife Sanctuary				
4	Durga	SG2	5	2.08
5	Kothmai	SG3	3.06	3.33
6	Chavand	FT2	4.44	3.68
7	Malshejghat	PL2	2.5	5.83
8	Naneghat	PL3	5.67	3.96
9	Durgawadi	PL4	4.9	0.63
10	Warsubai	PL5	3.27	2.92
11	Hatwij	PL6	3.08	2.29
Sector 3: Bhimashankar Wildlife Sanctuary – Tamhini and Phansad Wildlife Sanctuary				
12	Cheda	SG4	4.72	5.14
13	Waghjai (VS)	SG5	5.21	3.89
14	Waghjai (P)	SG6	5.21	4.44
15	Waghjai (W)	SG7	4.86	3.61
16	Waghjai (VL)	SG8	5.07	3.61
17	Bapujibuva	SG9	7.99	1.39
18	Ratnai	SG10	3.47	3.61
19	Bhorgiri	FT3	3.82	3.24
20	Korigadh	FT4	3.33	6.32
21	Ghangadh	FT5	5.28	3.53
22	Sarasgadh	FT6	2.78	6.03
23	Sudhagadh	FT7	6.32	3.59
Sector 4: Tamhini and Phansad Wildlife Sanctuary – Koyna Wildlife Sanctuary				
24	Kalkai (KR)	SG11	6.11	3.87
25	Somji	SG12	4.44	3.89
26	Somjai	SG13	0.69	6.94
27	Kalkai (KI)	SG14	4.17	4.31
28	Sinhagadh	FT8	5.28	5.15
29	Raigadh	FT9	4.58	5.15
30	Lingana	FT10	5.07	3.24
31	Pratapgadh	FT11	6.18	4.71
32	Panchgani tableland	PL7	3.75	6.88
33	Khingar	PL8	4.13	5.63
34	Dandeghar	PL9	4.04	5.42
35	Ambral	PL10	4.04	5.42
36	Rajapuri	PL11	4.04	5.42
37	Mahabaleshwar1	PL12	6.06	2.92
38	Mahabaleshwar2	PL13	5.77	2.71
39	Mahabaleshwar3	PL14	5.58	2.71
Sector 5: Koyna Wildlife Sanctuary – Chandoli National Park				
40	Mauli (SA)	SG15	3.47	7.5
41	Jungleejaygadh	FT12	7.78	1.32
42	Sadawaghapur	PL15	3.65	7.08
Sector 6: Chandoli National Park – Radhanagri Wildlife Sanctuary				
43	Marleshwar	SG16	7.15	3.33
44	Rasaai	SG17	4.79	4.58
45	Mahipatgadh	FT13	4.79	2.65
46	Vishalgadh	FT14	6.88	5.15
47	Masaai	PL16	2.31	5.21
Sector 7: Radhanagri Wildlife Sanctuary – Mhadei Wildlife Sanctuary				
48	Shankar	SG18	5.49	2.92
49	Mauli (SO)	SG19	5.07	4.03
50	Samangadh	FT15	4.38	4.85
51	Amboli	PL17	7.79	2.5

ensures the genetic viability of disjointed protected areas. There is currently sufficient evidence that they harbour significant levels of biodiversity and are used as transit areas for different species of wildlife (Trivedi et al. 2018). These identified hot specks have the potential to be developed as an additional conservation network. The hot specks support the protected areas system of National Parks and Wildlife Sanctuaries by forming multiple islands of biodiversity in a matrix of cultural landscapes by providing permeability for movement of wild faunal diversity (DeFries et al. 2007; Perfecto & Vandermeer 2008; Ormsby & Bhagwat 2010; Ray & Ramachandra 2010). These hot specks of biodiversity are essential in a situation where developing a continuous wildlife corridor is not possible due to the existing other land-use patterns (Blicharska et al. 2013). Urbanization, tourism, and windmill installation will place further stressors on conservation values in the near future.

The 'Rapid Biodiversity Assessment Tool' developed for this study is also referred to as Rapid Ecological Assessment, or 'Biorap'. This technique is used for conducting assessments for various ecosystems such as terrestrial, marine and freshwater where only a small amount of data or no information is available (Margules & Redhead 1995; Sayre et al. 1999; Patrick et al. 2014; Trivedi et al. 2018). Currently, in the Western Ghats,

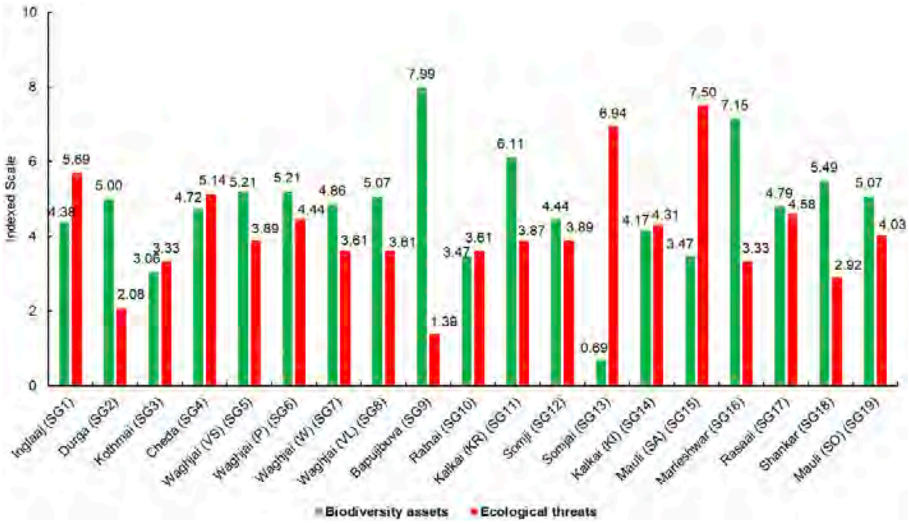

Figure 5. Sacred Groves – biodiversity and anthropogenic threats score.

Table 2. Sacred groves — prioritization matrix.

	Biodiversity				
Anthropogenic Threats	Prioritization matrix	High (7.5–10)	Significant (5–7.5)	Moderate (2.5–5)	Low (0–2.5)
	High (7.5–10)			SG15	
	Significant (5–7.5)			SG1, SG4	SG13
	Moderate (2.5–5)		SG5, SG6, SG8, SG11, SG16, SG19	SG3, SG7, SG10, SG12, SG14, SG17	
	Low (0–2.5)	SG9	SG18	SG2	

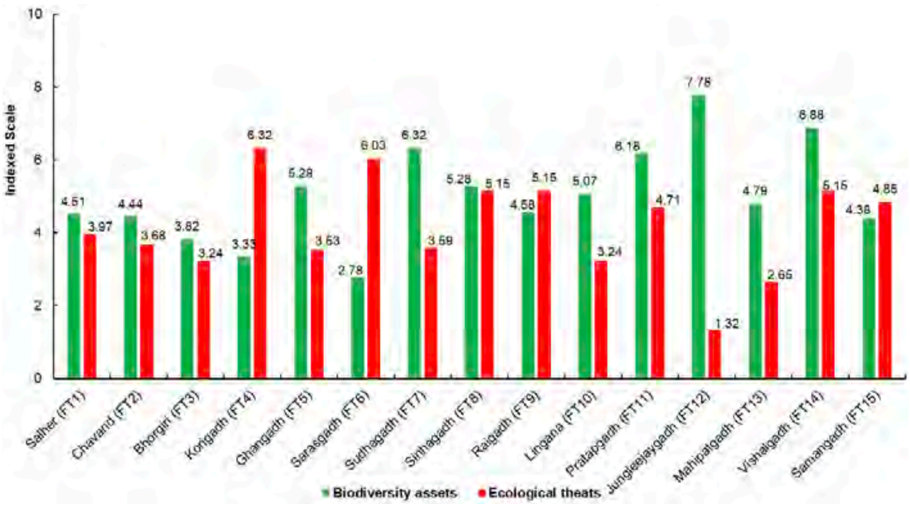

Figure 6. Forts — biodiversity and anthropogenic threats score.

Table 3. Forts — prioritization matrix

	Biodiversity				
Anthropogenic Threats	Prioritization matrix	High (7.5–10)	Significant (5–7.5)	Moderate (2.5–5)	Low (0–2.5)
	High (7.5–10)				
	Significant (5–7.5)		FT8, FT11, FT14	FT4, FT6, FT9	
	Moderate (2.5–5)		FT7	FT1, FT2, FT3, FT5, FT10, FT13, FT15	
	Low (0–2.5)	FT12			

Image 1. Old Kalkai Deity temple at Kondethar Sacred Grove.

Image 2. New Kalkai Deity temple at Kondethar Sacred Grove.

Image 3. Unsustainable tourism practices at Pratapgadh Fort.

Image 4. Expansion of parking area at Sinhagadh Fort.

Image 5. Mining on Sadawaghapur Plateau.

Image 6. Solid waste accumulation within and outside the hot specks.

there is only a list of these hot specks with little if any geospatial or quality indicators for prioritization. The RBAT has filled this gap with important information on the prioritization of areas so that management can be developed on locale-specific lines.

Participation of the local communities plays a crucial role in conserving these biodiversity rich hot specks. Under the Biological Diversity Act, 2002, the State Biodiversity Boards have formed the Biodiversity Management Committees (Venkataraman 2009; Laladhas et al. 2023). The Biodiversity Management Committees have developed Peoples Biodiversity Registers that contain information on the availability and knowledge of local biological resources present in the area (Gadgil et al. 2000). These prioritized hot specks outside the protected areas can be declared Biodiversity

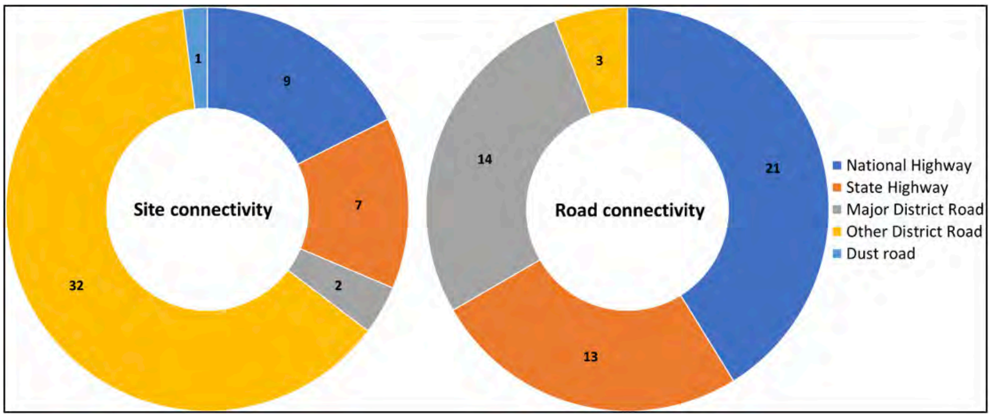

Figure 8. Road connectivity to hot specks.

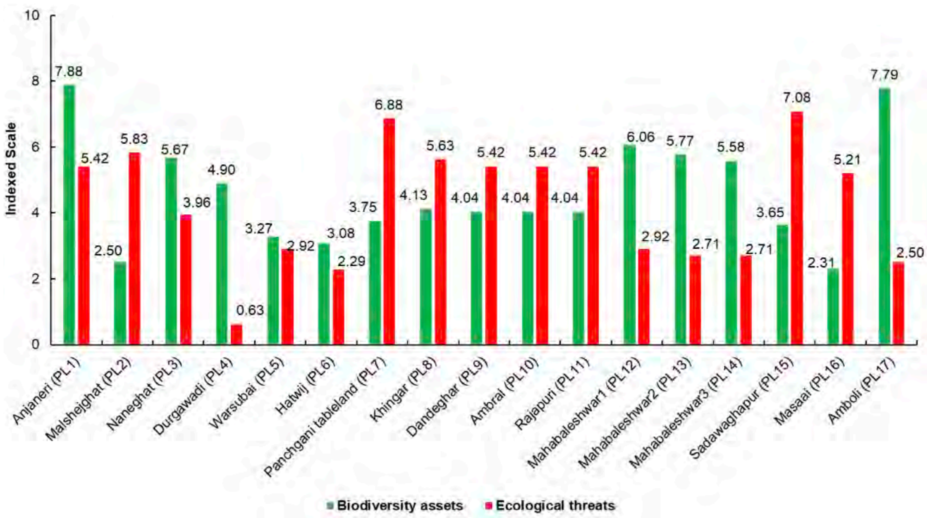

Figure 7. Plateaus — biodiversity and anthropogenic threats score.

Table 4. Plateaus — prioritization matrix.

		Biodiversity			
	Prioritization matrix	High (7.5–10)	Significant (5–7.5)	Moderate (2.5–5)	Low (0–2.5)
Anthropogenic Threats	High (7.5–10)				
	Significant (5–7.5)	PL1		PL2, PL7, PL8, PL9, PL10, PL11, PL15, PL16	
	Moderate (2.5–5)		PL3, PL12, PL13	PL5, PL14	
	Low (0–2.5)		PL17	PL4, PL6	

Heritage Sites under the Biological Diversity Act, 2002 or as Community Reserves or Conservation Reserves under the Wildlife Protection Act, 1972 (Singh & Kushwaha 2008; Raghavan et al. 2016). The RBAT helps choose an appropriate legal and administrative option.

Another approach for conservation is designating the hot specks under 'Other Effective (Area Based)

Table 5. Relation between biodiversity and anthropogenic threats.

	Hot speck type	Correlation 'r' (α = 0.05)
1	Sacred groves	-0.666 (p<0.05)
2	Forts	-0.518 (p<0.05)
3	Plateaus	-0.488 (p<0.05)

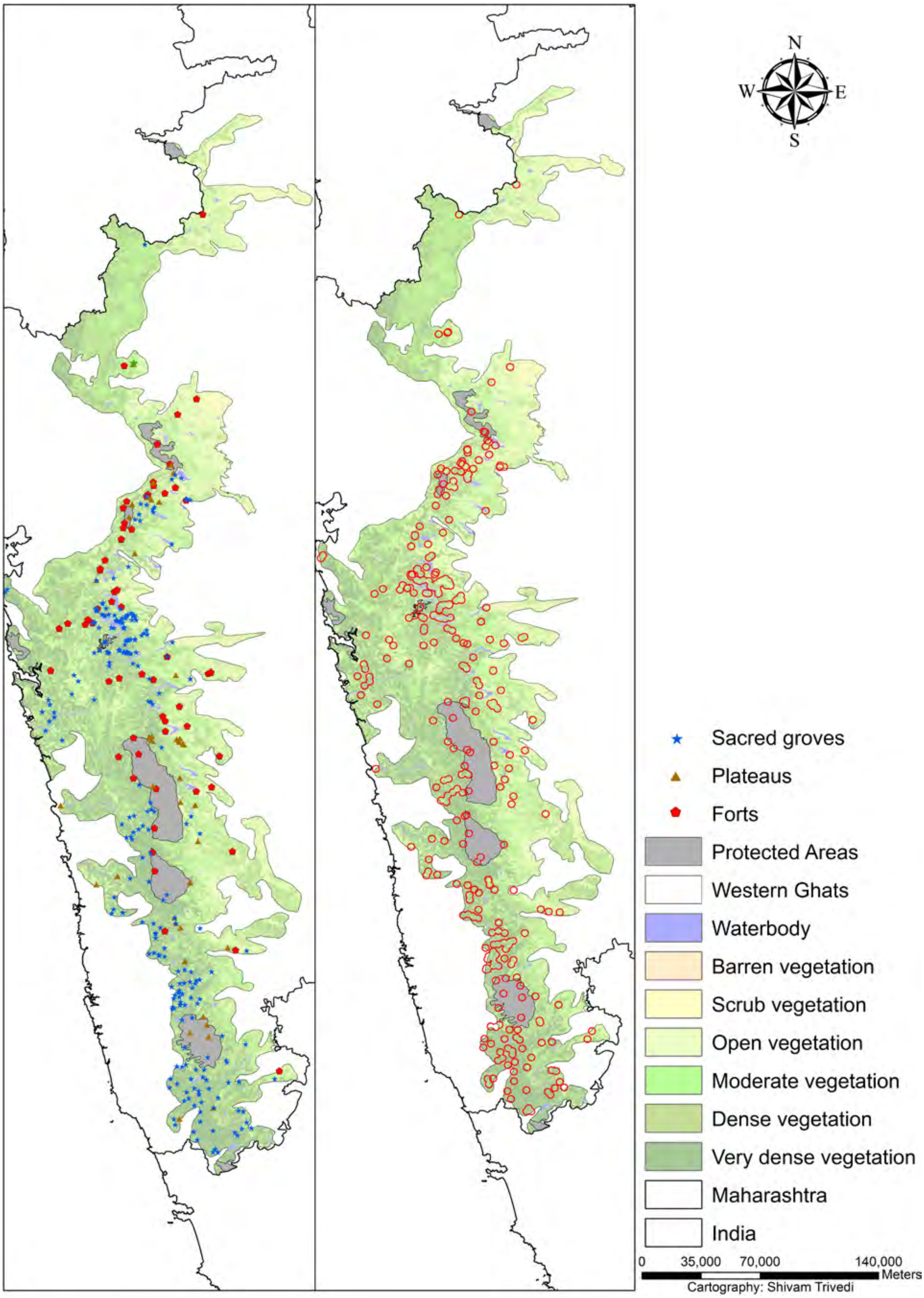

Figure 9. Hot specks - a potential network of contiguous biodiversity rich islands'

Conservation Measures' developed by the International Union for Conservation of Nature (Convention on Biological Diversity 2018). This is a strategy suggested in Sustainable Development Goals, Aichi Targets and the National Biodiversity Action Plan targets. Other stakeholders, such as corporates through their Corporate Social Responsibility, can provide funds. Non-government organizations, educational institutes and private landowners have an equally important role in supporting the local communities for conserving the hot specks (Kanagavel et al. 2013).

CONCLUSION

The Western Ghats is dotted with thousands of biodiversity rich hot specks present in the natural and cultural landscapes. The current study on 'Identification, prioritization, and management of hot specks in the Western Ghats of Maharashtra' has identified different typologies of biodiversity rich islands referred to as 'hot specks'. These are present in the socio-ecological landscape elements outside the boundaries of national parks and wildlife sanctuaries.

The Rapid Biodiversity Assessment Tool developed for evaluating the hot specks of biodiversity has proved to be effective in assessing sacred groves, forts and plateaus. With necessary modification, this assessment tool can be used for assessing a larger number of hot specks under different typologies present in a greater ecosystem of socio-ecological landscapes. This however requires a minimum necessary capacity building of frontline forest staff, community-based organizations, Biodiversity Management Committees, and non-government organizations for implementing the assessment tool in the field. The prioritization of hot specks based on the analysis of biodiversity and anthropogenic threat scores generated from RBAT enables the land use planners to classify the sites in 16 categories. These 16 categories mentioned in the prioritization matrix enables the planners with a freedom to identify priority categories and select hot specks that urgently need to be brought under the hot specks conservation action and management plan.

A multi-stakeholder management approach should be developed for implementing the hot speck conservation action and management plan under the National Biodiversity Action Plan. Under this management approach, funds and resources should be allocated to the State Biodiversity Board(s) which will be used by the frontline forest staff, community-based organizations, Biodiversity Management Committees for identifying and assessing hot specks and preparing peoples biodiversity hot specks register (PBHR). Peoples biodiversity hot specks register will consist of information on biodiversity and threat existing within and outside different hot specks identified and surveyed in the socio-ecological landscapes for the prioritization purpose. Once prioritized, these hot specks should then be brought under the hot speck conservation action and management plan. This can be achieved by notifying the prioritized hot specks as Biodiversity Heritage Sites, Community Reserve, Conservation Reserves, or as Other Effective (area based) Conservation Measures under the Wild Life (Protection) Act, 1972 and Biological Diversity Act, 2002. Funds can then be allocated to the respective Biodiversity Management Committee for the conservation and management of the hot specks. The capacity building and training of frontline forest staff and Biodiversity Management Committees will be an important part in this entire process which can be done with the support of non-government organizations and education institutes. A public-private partnerships could be established where corporates and other sectors can put in their funds and resources for conservation and management of these biodiversity hot specks.

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