Chapter 5
Significance of Social Systems in Forest and Biodiversity Conservation: Experiences from *Jangal Mahals* of West Bengal, India

Giyasuddin Siddique, Zeeshan Faiez Siddique, and Livleen Kahlon

Abstract Biodiversity is a manifestation of an ecological system specific to a geographical region and shapes the social systems established and pursued by the human community rooted in that region. Biodiversity is thus deeply embedded in the material, social, and even spiritual perceptions of people sharing a particular ecosystem. West Bengal, though is predominantly a region of mono-crop culture growing rice, is endowed with several subregions rich in biodiversity. These are the wetlands of riparian, estuarine, and coastal areas, foothill forest area of the north, mangrove forest area of the deltaic south, and the deciduous forest area of the southwest plateau-fringe districts. The last one among them is unique in a sense that the indigenous species of plants and animals have been the basis of social systems followed for long by a number of tribal communities. The ecological systems interactive therein are protective to the unique social system of the "first people," and the social systems enriched with "traditional ecological knowledge" are equally protective to the ecology and biodiversity. An integration of administrative, judicial, economic, and social systems formed of traditional ecological knowledge can conserve forest and biodiversity. This paper is an endeavor to explore the chances of conservation of forest and diversity in a combined management system. Analyses have been made with field-based primary and secondary data available for the last five decades; methodology includes qualitative, quantitative, and remote sensing techniques.

Keywords Biodiversity · Ecological system · Indigenous species · Social system · Traditional ecological knowledge · Tribal communities

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5.1 Introduction

Ecological system of a space incorporates the soil system, the vegetation or floral system, and the animal or faunal system; the human community is a component as well as the principal recipient of the energy. The more the number and diversity of species present in those systems, more choices of nutrition and foundation the recipients enjoy of their social systems. In this context, biodiversity is the agency regulating the functions of the physical ecological systems and simultaneously functions as the base of the social ecology by attaching human community. This is truer evident among the community adapted to and reliant upon the productivity of their preferred ecosystem used with traditional knowledge of resource use. These communities in other words are distinguished as "ecosystem people" (Hart 1984) who maintain their livelihood within the boundaries of the ecosystem regions and exist in nearly pristine landscapes where the environment is less modified. The ecosystem people have instituted social systems that are synchronized with the specific elements of the ecosystem and hence concerned to conserve biodiversity.

"Ecosystem people" indigenous communities conserve traditional knowledge that has evolved over generations and is ancestrally inherited. This knowledge has foundationally shaped the cultural values and the social capital of the communities having unique experiences and pragmatic links with their ecosystems (Roué and Nakashima 2002). Berkes et al. (2000) claim that indigenous populations possess a wide range of knowledge about resources that are specific to the local ecosystem. They have developed a singular approach to ecosystem processes and functions. Bettencourt and Kaur (2011) postulate this process as traditional ethnoecology based on a system balanced on two pillars—ecology and anthropology. Studying biodiversity and community interactions, by coalescing traditional and scientific methods, allows new opportunities to adapt diverse sets of management practices. However, a new concept gaining momentum in the last quarter of the twentieth century and the first decade of the twenty-first century is biocultural diversity (BCD). It is a heterogeneous idea addressing the diversity of languages, culture, and life forms that necessitates the recognition of human cultures and languages as an integral part of the diversity of flora, fauna, habitats, and ecosystems. Such an understanding of biocultural diversity helps infer how various elements interact and affect each other in complex ways (Maffi 2005) projecting evolutionary trends through active interactions between humans and nature.

A social system is a patterned network of relationships constituting a coherent whole. According to the social system of the forest dwelling indigenous people, all the living and nonliving objects are integrated within its sphere. Their social system has a great role in determining the norms and beliefs of the human community living in a distinct ecosystem. The community institutionalizes the behavioral approaches toward the objects that they are in frequent contact with. For millennia, the interactions between them and the natural world have formed traditional ecological knowledge which has been preserved by these communities to protect and benefit one another as a rule of live and let live. The community activities constructed by the

social systems of traditional ecological knowledge are frequently manifested in their actions of saving the ecosystem (Kala 2011a, b). Therefore, such social systems have assured the restoration of the ecosystem and survival of the life forms inclusive of the forest dwelling tribal community, instead the system being beneficial for interdependence. The interconnectedness of the community of people and the ecology remains strongly influential upon social systems (Hart 1984) driven by and enriched with traditional ecological knowledge helpful to form distinctive worldview (LaDuke 1994). Such worldviews accommodate the exigency and intrinsic values of all the organisms as parts of the ecosystem. In an integrative sense, ecology entails mutual relations between the natural bases and the lives contingent upon them.

The practices of social systems foundationally derived from traditional ecological knowledge can be universally recognized, especially in India which is home to a plethora of ecological communities of tribal origin. India has a rich "tribal" history. Tribes in India are also called *Adivasis*, meaning the earliest settlers. The cultural ideas of these communities have been shaped by ecological knowledge and wisdom, pressing the need of sustainable practices associated with their religious beliefs and culture, evolved in a specific ecosystem/s of a landscape (Swain 2011). India is home to the second largest tribal population in the world after Africa. Over 700 tribes have been consolidated under Article 342 of the Constitution of India. Out of the total rural population in India, 10.4% is tribal population (Census of India 2001). These tribes are usually confined in their geographical pockets and speak their own language. *Gonds*, *Bhils*, *Oranos*, *Santals*, and *Minas* are some of the important tribes in India. Andamans and Nicobar Islands have a mixed population of *Onges*, *Jarawas*, *Sompens*, *Santanelese*, and *Great Andamanese*. To be able to fully construct the tribal history of India, it is important to understand the original ancestors of the current tribal population of India. The earliest inhabitants of peninsular India are the Negritos (Bhasin 2017). Tribes living in Assam, Meghalaya, Mizoram, Nagaland, and Manipur owe their inheritance to the Mongoloid clans. The remaining bulk of the tribal population are known as Dravidians whose origin is from the Mediterranean region. The Dravidian population exists densely over the parts of Peninsular India. Due to a long period of struggle, these tribal populations lived in stress periods. In order to maintain their identity, they finally settled down in remote hills and forests as their areas of inhabitation and are considered as the forefathers of the current tribes in India.

The indigenous tribal groups have settled in several areas of India since the antediluvian past and have maintained their metabolic and material needs from their preferred ecosystems. Their ultimate habitats have mostly been the upland forested zones or the complex hill-plateau-forest regions. These oldest inhabitants caused insignificant harm to nature, by keeping themselves in the role of responsible stewards. Their wisdom of interaction with the natural system for millennia has shaped their beliefs, reflected on their social systems intercepting every object of their distinct habitat.

These indigenous communities across the globe are now minorities and marginalized (Guzy and Kaparo 2018). These communities have mostly settled in the

relatively rural terrains that are remote and inaccessible for the people who are settled in urban sectors and adapted to high carbon culture. These nature worshipers have articulated systems that compile all members of the group and pass on to generations (Sponsel 2012). The concept of common property—land, water, and forest—remained isolated only within their established social systems. Eventually, the concept became vulnerable to the market economy imposed by the colonial rulers and then carried forward by the post-independent neoliberal governments. In India, this was accentuated through various Policies and Acts framed and implemented by the authoritarian administrative system. Series of protests and revolts were repeatedly staged by various groups of those forest-based tribal communities joined by other organizations, against the non-tribal entrants and rulers since colonial time.

Discourses on the worldview of tribal groups towards nature and the life system have invited global attention to the knowledge system developed by those groups for millennia. The wisdom of such social groups on use of the natural resources for endurance without any harm to ecology has attracted the current scientific world to comprehend the ways they instituted ecosystems they banked upon (Staff 2018). Knowledge and worldview of indigenous and tribal people on ecology, ecosystem, life, and conservation on local and global perspectives have initiated one of the current fields of research in biological and social sciences (Palmer 1996). It spins around the comprehension of the ideas and practices to protect and conserve the typical ecologies they have adapted for thousands of years. The phrase for marking the insight "ecological knowledge" (Reo 2011) is sought from "indigenous"/ 'traditional" (Taylor 2005), the tribal people in fact, who has sustained generations for thousands of years with minimum demand and maintaining the health of ecosystems (Redfield 1952). The present industrial nations, who consume resources and pollute the environment more than their developing counterparts, now tend to regard the worldview of the tribal people centering on the protection of the environment.

The abodes of the indigenous groups are sometimes visited by the urban folks as places of leisure but remain unaware of the belief system and worldview of the local people who have maintained the ecosystem with their traditional commensalism (Mishra 2009). Even the very nucleus of the latest philosophical approach to ecology like Gaianism, Deep Ecology, and the knowledge of Spiritual Ecology has intricately addressed the worldview possessed by the indigenous people (Sponsel 2012) scattered in remote places.

The ecosystem communities perform, perceive, and explain in specific ways the natural phenomenon, social and cultural events, and relationships within themselves and outside. They manifest their concepts on diverse aspects of life referred to as "worldview," in other sense "mental appreciation of reality" (Sire 2009). It is further expressed not only in their belief but also among their customs, rituals, and actions to believe intricately linked between the beliefs and the contexts that arise. The concept of worldview subsumes both scientific and the ontological perceptions, which might be pragmatic (Tsosie 1996). However, they instill their faith in the code of internal self-determination, inclusive of respecting the customary rights, resources to sustain, and their own sociocultural practices.

Traditionally, the tribal societies practice and enjoy festivities and rituals that are closely linked with natural resources and have evolved over a period of time in particular landscapes. Biocultural knowledge recognizes the interlinks between culture and biodiversity. Wherever there is evidence of inter-mixing of tribes with other members of the society, instances of social assimilation are observed. There are festivals central to indigenous populations and those that were celebrated by members of rural communities and general castes. The festivals of the indigenous tribes were linked to forests, because the inhabitants directly depend on them for meeting their daily requirements. The villagers have a strong belief that these festivals, which they have inherited from their ancestors and are continuing to do, will also protect them from any harm. A few species of plants are regular part of the rituals and cultural festivities observed by many tribal societies including mango (*Mangifera indica*), rajkusumo (), genda (*Tagetes erecta*), muchkundu (*Pterospermum acerifolium*), barh (*Ficus benghalensis*), hambu, limbo (*Azadirachta indica*), and palasho (*Butea monosperma*). Collective knowledge of mixed population groups has led to an increase in observance of cultural practices.

Most of the festivals of the forest dwelling tribal groups put either a nonliving or living entity at the center. They honor the mountains with a faith that it shelters and protects them; worship plants from which they receive food, fodder, and fuel; and share the hills with other animals of various species. The totems and taboos they follow are purposeful to preserve or protect plants or animals (Murugesan 2014), and these will be elaborated with their relevance of biodiversity conservation in the relevant chapters. In a nutshell, the study will reveal that the social systems rooted in the forest dwelling tribal society rich in traditional ecological knowledge possess significant potentiality of biodiversity conservation of the area under review. This paper is an endeavor to analyze the importance of the social systems and based upon the beliefs and worldview of the indigenous forest dwelling tribal people equipped with traditional ecological knowledge in conservation of ecosystem and its biodiversity.

It seems essential to mention that the abodes and bioregions not only inhabited first by the older indigenous tribal groups were colonized by the Western and the Northern Whites through weapons of enlightenment, industrial revolution, market economy, and technocentrism but colonized the non-white indigenous communities too (Nadasdy 2005). They were not merely uprooted from their ecosystems, but their traditional knowledge on nature, belief system, and eco-friendly simple life bases and worldviews enveloped in their customs and rituals were disrupted and marginalized (Nadasdy 1999). Until recently, it is evident that to retard the present ecological crises can be learnt from the worldview on ecological system developed by the tribal groups scattered mostly in various corners of the old world like Cree Indians of North America, Cherokees of the SE USA, Tribes of Australia, the Gonds, the Bhils, the Baigas, the Mundas, the Sabars, the Birhors, the Santals, and a number of other groups of India (Table 5.1).

The aboriginal tribal communities rooted in the densely forested southwestern districts of West Bengal, in the recent past known as the Jangal Mahals. These communities were more directly associated with and dependent upon various types

Table 5.1 List of tribes and races in the world

S. no	Tribes and races	Global regions
1.	Abhors	Mongolians living in the Assam region
2.	Afridis	Inhabitants of the northwest frontier in Pakistan
3.	Afrikaner	Dutch-born South African race
4.	Bedouins	Wandering tribe of Arabia and North Africa
5.	Bhils	Ancient Dravidians of central India
6.	Cossacks	Inhabitants of southern and eastern frontiers of Russia
7.	Croats	Inhabitants of Croatia
8.	Dravidians	Ancient people of South India (non-Aryans)
9.	Eskimos	Inhabitants of the Arctic Circle and Greenland
10.	Filipinos	Natives of the Philippines
11.	Flemish	Original inhabitants of Belgium
12.	Garos	Hill tribe of Assam
13.	Gorkhas	Martial race of Nepal
14.	Hottentots	Pastoral nomads of southwest Africa
15.	Kaffris	Martial race of South Africa
16.	Kardars	Descendants of the Austric race, now living in the forests of central and northern India
17.	Khasis	Tribes of Meghalaya
18.	Khirgiz	Tribe living in Central Asia
19.	Kiwis	People of New Zealand
20.	Magyars	Inhabitants of Hungary
21.	Masuds	Tribe living in Waziristan (Pakistan)
22.	Maoris	Natives of New Zealand
23.	Moor	A mixed tribe of Arab and Berber people of Morocco
24.	Blacks	Dark-skinned race of Africa
25.	Nipponese	People living in Japan
26.	Red Indians	Original inhabitants of North America
27.	Sherpas	Tribe on the border of Tibet and Nepal
28.	Slovenes	People living in former Yugoslavia; of Slavic origin
29.	Swahili	People living in parts of Kenya and Tanzania
30.	Todas	Natives of Nilgiri Hills
31.	Zulus	People living in South Africa; belonging to the Bantu family

Source: The above table is finalized as per the data available under the 1991 census (Adapted from https://www.jagranjosh.com/general-knowledge/tribes-and-races-in-the-world)

of plant and animal species of forests for their material, nutritional, and sociocultural requisites (Bhattacharjee 2016). These people living for generations through millennia within or at the periphery of the forests have been known as "Forest People" belonging to tribal communities, and the "Other Traditional Forest Dwellers" not bracketed in tribal entity. Enforced by the market economy introduced by the colonial rulers at the end of the eighteenth century, wanton destruction of forests and extensive land use-land cover change became evident. Consequential soil

erosion and gradual degradation of the health of the forest ecosystem in those areas deployed threats to the simple and forest-based living system of those tribal communities.

A series of forest policies framed and implemented in pre- and post-independent India that practically favored the traders and rulers in extracting and sharing economic benefits. However, almost all the policies kept the tribal or forest people out of forests enforcing several Acts and Laws (Siddique 2012). Exploitation made to the forest ecology and the "Forest People" or "ecosystem people" was not as simple as the narrative is. First they lost the source of their nutrition and resources essential for their livelihood; second, they were turned into "ecosystem refugee" by being ousted from or deprived of the forest ecosystem (Hart 1984); and third, they had to bear with silence the difficulty in continuation of various traits of their social systems like festivals, rituals, practices, belief systems, etc., due to absence of a number of species placed at the center of their social systems (Siddique 2020). Their reliance on material including nutritional, fiscal, and social systems, long established by the forest people, helped grow and enrich traditional ecological knowledge which is protective about the forest ecosystem and germane to preservation and conservation of biodiversity (Purshottam and Dhingra 2017). The accumulated traditional ecological knowledge of the forest people gradually constructed their nature-based worldview, which is now prescribed by ecologists for ecosystem conservation.

5.2 Database

The present study is based basically on secondary data, but primary data, facts, and figures also assert equal importance. The database pertinent to the objective of the study has been amassed and generated from repeated field works carried out in some selected CD Blocks of the western districts of West Bengal where the presence of the forests and forest dwelling tribal communities is significantly high in the total population. Oral interactions and group discussions with them have been helpful in receiving and documenting the belief system, social systems, significance of biodiversity in ecosystem, and worldview. The database thus accounts for the appraisals of those people on the present economic, social, medical, spiritual, and political systems effective upon their life and livelihood. The secondary database of the study comprises a number of literatures including novels, research papers, theses, books, records and reports, memoirs, and census handbooks. Assorted websites have helped in realizing the social systems formed and followed by the native people living in various ecologies of different continents. Numerous literary writings on culture and social systems of indigenous people, forest and tribal ecology, postcolonialism, and ecocriticism have been important sources of databases of the present study. Several folk tales, folklore, folk songs, proverbs, and metaphors of different tribal groups have been assorted as sources of information.

5.2.1 Methodology

This study is based on behaviorism, pragmatism, and a holistic environmentalist approach. The discourses have been structured with an empiric and mostly qualitative methodological approach, for quantification of views and beliefs entrenched in social systems, which is seldom rational, rather unrealistic. Information collected from field visits have been analyzed and restructured to arrive at a cogent conclusion.

5.2.2 The Study Area

The area under study comprises the western Districts of West Bengal: Birbhum, Paschim Bardhaman, Bankura, Puruliya, Paschim Medinipur, and Jhargram, altogether known as *Jangal Mahal Districts* (Fig. 5.1). The rationale behind selection of these six districts remains in the sub-humid dry deciduous forest, the distribution and density of which are relatively higher. Also, the percentage of forest land shared by the forest dwelling tribal communities in total population is higher than any other districts of West Bengal. This coexistence is significantly self-convincing that the forests and the tribes have an intricate link to form a distinct ecology and social systems attuned to that ecology.

5.2.3 Geographic Specialty

West Bengal is characterized with three forest belts: the northern Himalayan foothills which are significantly destroyed to accommodate tea gardens since the colonial period; the sub-humid dry deciduous forests in the southwestern plateau-plain fringe area; and the mangrove forest zone of the southeast coastal belt. Among these, the Himalayan foothill forests of the Terai region do not show affinities to the Tibeto-Burmese tribal groups who rather practice terrace cultivation but follow their own culture and belief in which forests have very less sway (Munshi 2012). The mangrove forests of the coastal southern West Bengal are inhabited and not by tribes but people of various castes from ancient times. The people in this particular forest ecosystem are dependent much on aquatic resources compared to forest resources. Historically, the southwestern forested tract is significantly inhabited by a number of tribal communities who have been reliant substantially on the forests (Siddique 2012) for material, social, and spiritual needs, influencing them to develop their own belief systems, social systems, and worldview. Figure 5.2 will be helpful to understand the distribution of forests and tribes and the forest-tribe association in southwestern West Bengal.

Gondwanaland, the ancient landmass of India, is named after the Gond tribe who were the oldest settlers. The Bhils, the Kols, the Mundas, and others are the other

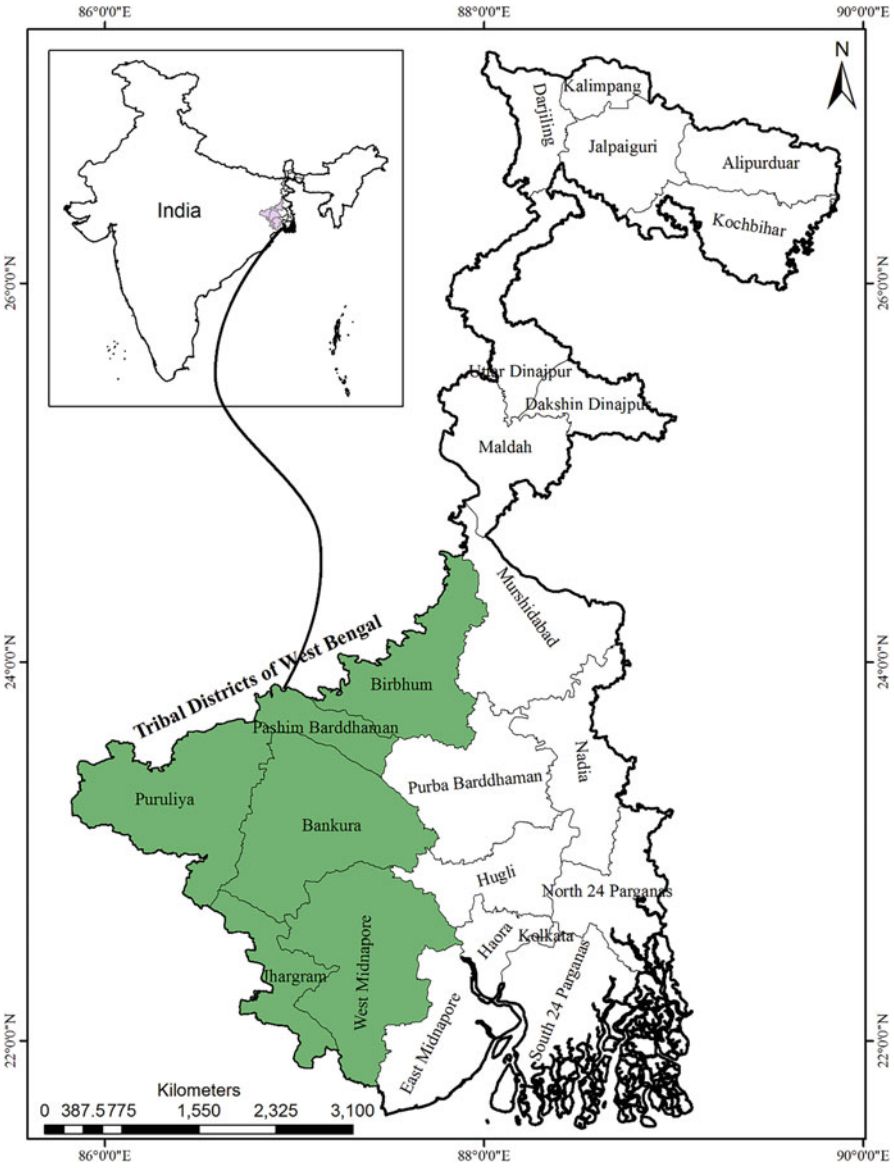

Fig. 5.1 The location of the tribal Districts of West Bengal: Birbhum, Paschim Bardhaman, Bankura, Puruliya, Paschim Medinipur, and Jhargram, altogether known as *Jangal Mahal Districts*

major tribal groups of the same antiquity. Ethnologists from India and other countries have confirmed that the tribal communities of India are the oldest settled people of the Indian subcontinent. India has been ascribed as a "centroid" of the early human prehistory and a series of migration for Anatomically Modern Human

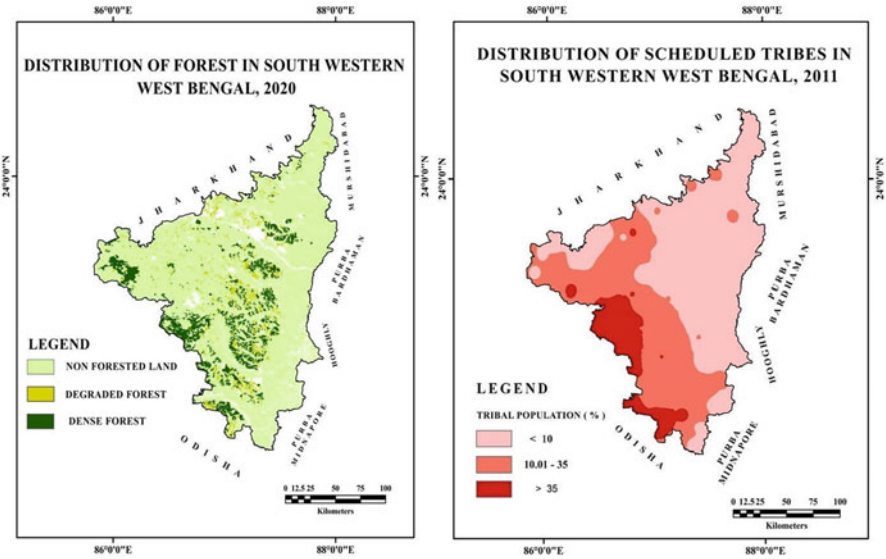

Fig. 5.2 The forest-tribe association of western West Bengal

(AMH) from Africa to Australia during the Late Pleistocene period (Petraglia and Allchin 2007; Borkar et al. 2011). In contemporary science, the lineage of population can be easily traced by associating historic events like migration, linguistic, and archeological data. Human colonization of the Indian subcontinent by tribes and castes representing different genetics provides unique source for the understanding of human evolution (Kivisild et al. 2011; Borkar et al. 2011) in India, and the Mundary-speaking people of the current Jangal Mahal districts of West Bengal are their distant relatives.

5.2.4 The Human Communities

The tribal population of the southwestern West Bengal, partially influenced by Aryan, may rightly be designated as "aboriginals." The term "aboriginal" does not indicate that they were or are the original autochthones of this land. It implies that these people were non-Aryans, less exposed to admixture of the Aryan blood and culture, which has left its impressions upon the residents of Bengal's riverine plains (Hunter 1882). With the waves of immigration of different races, most of the tribes in India had been successively pushed on, endangering their existence. The aboriginals currently settled in this tract had followed the same fate (Dalton 1872). The tribes, who first immigrated in this area before a few thousand years, were first pushed on by the Aryanized intruders from the north, and later by the plains' agriculturists from the east, ultimately outcasted to the rugged plateau-hill forests (Chakraborty 1982).

Table 5.2 District wise Trible population in the selected districts of west Bengal

District	Purulia	Bankura	Jhargram	Paschim Midnapore	Purba Bardhaman	Birbhum
Tribal population (%)	18.40	10.20	30.50	10.90	5.00	6.80

Source: Census Handbook of West Bengal, Census of India 2011

The following tables demonstrate the district level (Table 5.2) and block level (Table 5.3) presence of the tribal people within the area under review. It is important to mention that the sects and groups of the tribal communities could not be placed as such is not readily available and could not be enumerated because of the COVID-19 situation.

The people belonging to the Santal, the Bhumij, the Birhore, the Lodha, etc. communities are pre-Dravidian in physical characteristics like stature, nasal, and cephalic structure, color of the skin, and coarse hair and Austric and Dravidian in linguistic features. But it should be noted that the aboriginals of this area may be grouped into the "forest tribes" (Kol, Santal, Bheels, etc.) and Dravidians (the other tribals and semi-tribals) (Dalton 1872).

The forests and the tribes in this lateritic tract of the southwestern West Bengal has a readily observable association shown in Fig. 5.3. This type of logistical union is hardly present in other forest areas of West Bengal. Various records and analyses shows that the aboriginal tribes in this tract are prone to this area in the long past as they were driven out from the forests of central Indian highlands by the Aryans and Aryanized high-caste people (Dalton 1872) and were also driven back by the plains' agriculturists, toward the plateau-hill-forest complex (Chakraborty 1982). Still now, this tract has retained a considerable forest cover and tribal habitations in several locations, though the original tribal populations were much higher in number in the past. The people in this area now exhibit a variety of associations, beginning from forest-covered hills to the cultivated river valleys, though essentially it was a hill-plateau-forest complex in the past.

5.2.5 Biodiversity as Base of Ecological Systems

Biological diversity or simply biodiversity refers to the diversity of plants and animals, along with other living organisms in a particular area or region. Biodiversity is the totality of the genes, species, and ecosystems in a region (UNEP), which is otherwise defined as a bioregion. Literally and metaphorically, bioregion may be defined in short as "natural countries that cannot be found in Atlas" with "soft borders" which are "populated by native plants and animals that have endured since the last Ice Age" (Clark et al. 2018). Everything that lives in an ecosystem is part of the web of life, including humans which altogether constitutes the foundation of a bioregion. Each species of vegetation and each creature of an ecosystem has a place

Table 5.3 Community development block wise Trible population in the study area

District	CD BLOCK	TOTAL_POP	TRIBAL_POP	%
Jhargram	BINPUR-2	164,522	65,722	39.95
	BINPUR-1	156,153	43,962	28.15
	JAMBONI	113,197	32,369	28.60
	JHARGRAM	170,097	38,625	22.71
	GOPIBALLAVPUR-2	104,996	24,562	23.40
	SANKRAIL	115,418	28,825	24.97
	GOPIBALLAVPUR-1	108,254	36,819	34.01
	NAYAGRAM	142,199	56,887	40.00
Purulia	JHALDA-1	137,143	15,608	11.38
	JHALDA-2	148,156	18,917	12.77
	BAGHMUNDI	135,579	34,038	25.11
	ARSHA	154,736	33,568	21.69
	JOYPUR	133,349	13,074	9.80
	PURULIYA-1	151,188	12,655	8.37
	BALARAMPUR	137,950	43,738	31.71
	PURULIYA-2	169,488	8213	4.85
	BARABAZAR	170,564	33,096	19.40
	PARA	200,621	10,335	5.15
	RAGHUNATHPUR-2	113,790	7302	6.42
	NETURIA	101,427	22,616	22.30
	SANTURI	78,515	25,083	31.95
	RAGHUNATHPUR-1	117,760	12,599	10.70
	KASHIPUR	200,083	49,537	24.76
	HURA	143,575	36,561	25.46
	PUNCHA	123,855	30,641	24.74
	MANBAZAR-1	154,071	33,942	22.03
	MANBAZAR-2	97,164	47,580	48.97
	BANDWAN	94,929	49,232	51.86
Paschim Medinipur	GARHBETA-2	148,410	29,669	19.99
	SALBONI	188,653	32,771	17.37
	MIDNAPORE	191,705	33,869	17.67
	KHARGAPUR-1	258,040	42,453	16.45
	KESHIARY	149,260	51,128	34.25
	DANTAN-1	172,107	28,183	16.38
	MOHANPUR	111,901	6026	5.39
	DANTAN-2	155,017	10,861	7.01
	NARAYANGARH	302,620	68,080	22.50
	SABONG	270,492	16,818	6.22
	PINGLA	194,809	19,332	9.92
	DEBRA	288,619	59,122	20.48
	DASPUR-2	238,529	585	0.25
	DASPUR-1	203,987	5695	2.79

(continued)

Table 5.3 (continued)

District	CD BLOCK	TOTAL_POP	TRIBAL_POP	%
	GHATAL	219,555	3861	1.76
	CHANDRAKONA-1	136,006	7516	5.53
	GARHBETA-1	228,513	18,134	7.94
	GARBETA-3	169,528	23,955	14.13
	CHANDRAKANA-2	123,269	6841	5.55
	KESHPUR	339,248	19,616	5.78
	KHARGAPUR-2	183,440	46,899	25.57

Source: Census Handbook of West Bengal, Census of India 2011

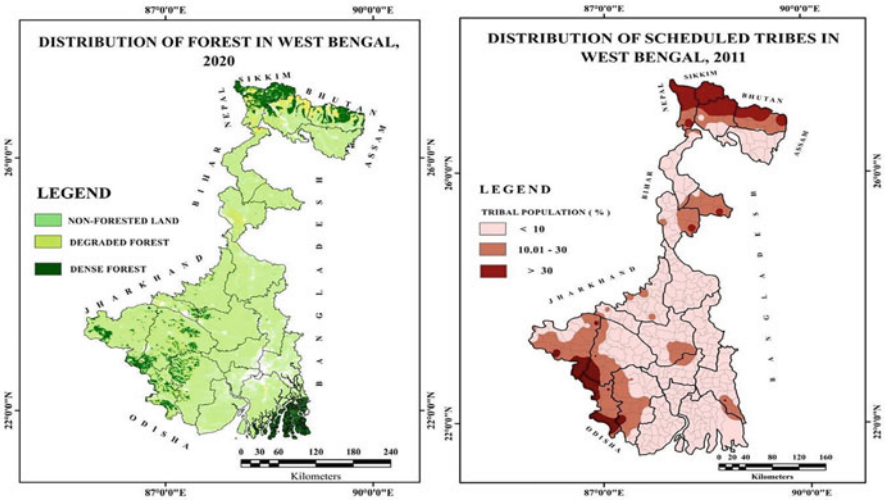

Fig. 5.3 Distribution of forest cover and scheduled tribes in west Bengal

in it and plays a vital role in the circle of life in totality. Plant, animal, microbes, and insect species together interact and depend upon one another for what each offers, such as food, shelter, oxygen, and soil enrichment. Any substantial break in the chain of interaction enforces metabolic rift. Reduction or extermination of species diversity in a bioregion ultimately invites threat to humanity itself, primarily to the local people. This was perceived and experienced by the indigenous tribal communities, who are reliant upon distinct ecosystems and whose social systems were attuned with that natural system. The energy produced by green vegetation is received by animals which clung at distinct trophic levels in accordance with the second law of thermodynamics; the energy pyramid determines the number pyramid (Kormondy 1976). The forest ecosystems of tropical belts like the forests of the area under review are productive ecosystems having the capacity to support a large range of diverse species from grazing animals to avifauna. All forest ecosystems are essentially biodiversity hotspots where green vegetation forms the base of the system

(Odum 1971). The tribal forest dwellers are just a community of consumers of excess energy of all trophic levels. However, it is important to mention that innumerable trees, shrubs, herbs, and succulents form the bases of the ecosystem.

5.2.6 Biodiversity as Base of Social Systems

It has been mentioned earlier that the social system is a patterned network of relationships constituting a coherent whole. The social systems of the forest dwelling tribal people ensemble all the living and nonliving objects of an ecosystem. They live within or at the periphery of the boundary of the forest ecosystem as their distant forefathers continued doing for centuries (Guha 1988). Never have they lived resource-intensive life, but been experts of a narrow energy balance. They have developed a belief system in social life that their life will sustain, only if the forests do sustain without degradation and deforestation (Gadgil and Guha 1995). They were well aware about the health of the forest vegetation and learnt a lot on the growth, propagation, and even disease of the forest trees as well their care for. The basic material needs like shelter, food, fiber, fodder, and fire were all met up with forest produce. Therefore, their social, fiscal, political (Alier 2014), and spiritual lives revolved around forest as they either collect or produce their nutrition and needs from forests at different seasons. Forests supply them all kinds of necessary nutrients at the time of crisis, and generally they do not have to starve who knows well the plants that produce bulbs or edible roots. They have vivid knowledge in replenishment of soil fertility without application of chemical fertilizer and never go for chemical pesticides.

They have devised a number of norms in their social system which commends the need to protect, save, and thrive various lives—plants and animals—the purpose being conservation and regeneration of species and restoration of habitat. The knowledge on nature and life systems they have accumulated by generation is acknowledged as traditional ecological knowledge which has enriched their social systems (Kala 2013). Different norms prescribed by the social system in turn have been beneficial to conserve biodiversity. For example, the sites of sacred groves where the souls of their ancestors reside, as they believe, have conserved a plethora of plants, especially medicinal plant species.

The tribal people dependent upon wild species of fruits, seeds, bulbs, roots, and tubers, used for edible purposes is a way of conservation and such activities protect biodiversity.

Tribal communities follow the laws of conservation in harvesting edible plants which ascertain ecological care. Fruits of edible plants like those of *Dioscorea* spp. are harvested only when they become mature (Rai and Nath 2013). The wild tubers from the forest floor are dug out carefully, saving the associated species. Such activities are normal, rather than practical, and helpful to species conservation (Tables 5.4 and 5.5).

Table 5.4 Tribal communities and the harvesting edible plants in the study area

Scientific name	Local name	Family name	Uses	As per POWO
Aegle marmelos	Bel	Rutaceae	Fruits are roasted and eaten	*Aegle marmelos* (L.) Correa
Amorphophallus paenonflodium	Suran	Araceae	Petiole/bulb as vegetable	Not found
Achyranthes aspera L.	Chirchita	Amaranthaceae	Tender shoots as vegetable	*Achyranthes asper* L.
Bauhinia purpurea	Keolar bhaji	Convolvulaceae	Leaves, flowers, seeds as vegetable	*Bauhinia purpurea* L.
Bauhinia vahlii	Sehar	Caesalpiniaceae	Leaves as vegetable	*Bauhinia vahlii* Wight and Arn.
Dioscorea alata	Dudhia aru	Dioscoreaceae	Tubers as Vegetable	*Dioscorea alata* L.
Curculigo orchioides	Kali musli	Amaryllidaceae	Roots and Tubers as vegetable	*Curculigo orchioides* Gaertn.
Xylia xylocarpa	Jambu	Mimosaceae	Seeds as vegetable	*Xylia xylocarpa (Roxb.) W.Theob*
Entada pursaetha		Mimosaceae	Seeds as vegetable	*Entada pursaetha D.C.*
Dioscorea bulbifera	Ratalu	Dioscoreaceae	Tubers as vegetable	*Dioscorea bulbifera* L.

Source: Rajiv Rai and Vijendra Nath (Rai and Nath 2013)

Table 5.5 Plants growing in sacred groves in India

S. no	Name of plant	Uses	Scientific name
1	*Butea monosperma*	Medicinal, Dye	*Butea monosperma* (Lam.) Kuntze
2.	*Cordia dichotoma*	Food, Medicinal	*Cordia dichotoma* (Ruiz & Pav.)
3.	*Rauvolfia serpentina*	Medicinal	*Rauvolfia serpentina* (L.) Benth. ex Kurz
4.	*Alstonia scholaris*	Medicinal	*Alstonia scholaris* (L.) R.Br.
5.	*Helicteres isora*	Medicinal	*Helicteres isora* L.
6.	*Boswellia serrata*	Medicinal	*Boswellia serrata* Roxb.
7.	*Calotropis gigantea*	Medicinal	*Calotropis gigantea* (L.) W.T. Aiton
8.	*Carissa congesta*	Medicinal	*Carissa congesta* Wight
9.	*Diospyros montana*	Medicinal	*Not found*
10.	*Bambusa arundinacea* (wild bamboo)	Miscellaneous	(Retz.) Willd

Source: Jain, S.K. Ethnobiology in Human welfare

Being determined and equipped with social norms and activities, management, extension, and re-stabilization of forest cover and forest ecosystems have been realized in Jhargram District, which has visually extended its services to the forest dwellers. However, more importance needs to be given on the use of the traditional knowledge of the forest dwellers to care for the health of the forest ecosystem through regeneration and restoration of the indigenous tree species of the forest with its natural fervor. The participation of forest dwellers equipped with such knowledge helps maintain the balance of the forest ecosystem and also strengthens the efficiency of the forest management system (Gupta 2016). These ecosystems establish and follow symbiotic relationships of plants, wild animals, and forest dwellers. Thus, the traditional knowledge of forest dwellers has been essential for the sustainable conservation of forests (Parotta et al. 2016). Forests have a direct role in protecting soil from erosion, increasing soil fertility with addition of humus, and maintaining micro-climatic situations by controlling local temperature. The destruction and overuse of forest ecosystems have been directly detrimental to the livelihood of forest dwellers of the districts under study (Atrayee and Choudhury 2013). Emphasizing and linking social values and proper conservation of forest and animal species may further be improved by adding together the traditional knowledge of the indigenous forest dwellers.

The SWOT analysis focusing the ecosystem services rendered by the forest ecosystem of the area to the forest dwellers is self-explanatory that it embraces the group priority factors that actually involve direct links to the social, fiscal, societal, and political questions. Exploration of the avenues for minimizing the threats and maximizing the opportunities cannot circumvent the society and the social customs, beliefs, worldview, festivals, and rituals—all insist on the social system.

The analysis has been made based on the data and information collected from five forest patches located in four blocks of the Jhargram District of West Bengal. The combined process of SWOT-AHP [analytical hierarchy process] is usually accomplished through three functional steps. *The first step* identifies the four main components (**strengths, weaknesses, potentials, threats**) of SWOT analysis. *The Second step* using the **pairwise fundamental scale** developed by Wind and Saaty (1980), compares the parallels between each section of the SWOT analysis (Tables 5.6 and 5.7), and the method is that if attribute **S1** is absolutely more important than attribute **S2** and is rated at **3**, then **S2** must be absolutely less important than **S1**. And **S1** Value is **3** and **S2** is valued is **1/3**. The value of another factor is determined based on the relative importance of one factor for comparisons (Table 5.8).

The values concentrated in the NW quarter of the diagram represent Opportunities; similarly the NE quarter highlights Strength, the SW quarter signifies Weakness, and the SE quarter denotes the Threats. It may be recommended that the varieties of weaknesses and the threats may gradually be eliminated or at least minimized through restoration and conservation of preferred species that renders

Table 5.6 Pairwise fundamental scale for comparison

Magnitude of importance	Definition	Explanation
1	Equivalent importance	Two factors contribute equally to the objectives
2	Weak	Experience and judgment
3	Moderate importance	Slightly favor one activity one another
4	Moderate plus	Experience and judgment
5	Strong importance	Strongly favor one activity one another
6	Strong plus	An activity is favored very
7	Very strong and demonstrated	Strongly favor, and its dominance is demonstrated in practice
8	Very, very strong	The evidence favoring one
9	Excessive importance	Importance of one over another affirmed on the highest possible order

Comparison scale (Adapted from Wind and Saaty (1980), Birendra (2014))

Table 5.7 Comparisons scale of SWOT factors

SWOT groups	Strength	Weakness	Opportunities	Threats	Group priority of SWOT categories
Strength (S)	1.000	3.000	1.000	5.000	–
Weakness (W)	1/3	1.000	1/4	2.000	–
Opportunities (O)	1.000	4.000	1.000	2.000	–
Threats (T)	1/5	1/2	1/2	1.000	–
SWOT groups	Strength	Weakness	Opportunities	Threats	Group priority of SWOT categories
Strength (S)	1.000	3.000	1.000	5.000	**0.421**
Weakness (W)	0.333	1.000	0.250	2.000	0.151
Opportunities (O)	1.000	4.000	1.000	2.000	0.336
Threats (T)	0.200	0.500	0.500	1.000	0.093

Strength = 1 + 3 + 1 + 5 = **10**, Weakness = 0.333 + 1 + 0.250 + 2 = **3.583**, Opportunities = 1 + 4 + 1 + 2 = **8**, Threats = 0.200 + 0.500 + 0.500 + 1.00 = **2.2**
Sum of SWOT group is 10 + 3.580 + 8 + 2.2 = **23.783**
Group priority of **strength (S)** categories is **10/23.783 = 0.421**
The values of the other three categories will come out in the same way

single- or multiple-ecosystem service (Fig. 5.4). In most cases, these are achieved through participation of the local beneficiaries, habitually the local tribal dwellers equipped with traditional ecological knowledge even passed on to their social norms and traits like festivals, rituals, etc.

Table 5.8 SWOT factors overall priority scores for the ecosystem service framework of Jhargram District

SWOT group	Group priority	Factors of group priority (SWOT)	Priority factor within the group	Overall priority factor
Strength	0.421	(S_1) Coexistence of forest people	0.208	0.088
		(S_2) Social and cultural values of forest dwellers	0.199	0.084
		(S_3) Worship of trees as a religious institution of forest dwellers	0.385	0.162
		(S_4) Use of traditional knowledge for forest management by forest dwellers	0.114	0.048
		(S_5) Sustainable use of timber and non-timber forest resources	0.094	0.040
Weakness	0.151	(W_1) Efforts to reduce the rights of forest dwellers	0.209	0.034
		(W_2) Widespread poverty in the STs and OTFDs Communities	0.249	0.038
		(W_3) Use of forest resources by the government for commercial use	0.110	0.017
		(W_4) Decreased power to access forest production for forest dwellers	0.265	0.040
		(W_5) Traditional knowledge of forest resources of STs and OTFDs is not used	0.166	0.025
Opportunities	0.336	(O_1) Increasing reforestation activities by the use of traditional knowledge of forest dwellers	0.240	0.081
		(O_2) To recognize the coexistence of forests and forest dwellers	0.091	0.031
		(O_3) Improving the socioeconomic status of forest dwellers	0.240	0.081
		(O_4) Participation of forest dwellers in improving eco-tourism development	0.189	0.064
		(O_5) Use of participatory management in conservation of forest resources	0.240	0.081
Threats	0.093	(T_1) Illegal exploitation of forest resources by exogenesis people	0.150	0.014
		(T_2) Loss of biodiversity	0.100	0.009
		(T_3) Lack of lucid discussion on forest right of forest dwellers in the forest policy	0.250	0.023
		(T_4) Control of collection of dried wood from the forest	0.300	0.028
		(T_5) Political instability	0.200	0.019

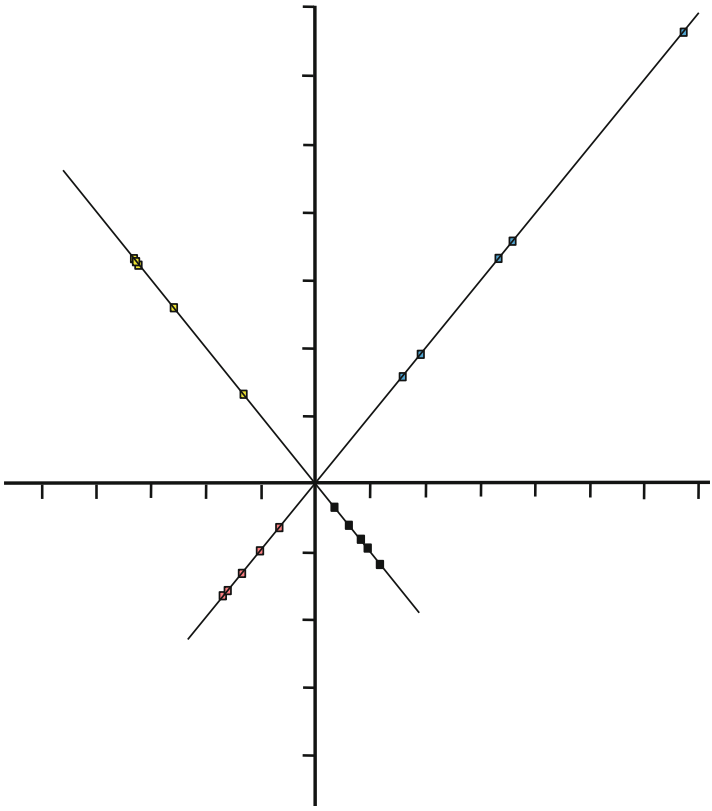

Fig. 5.4 Graphical representation of the model with factor and value more clearly reveals the forest-people relationship in the Jhargram District

5.2.7 Forces and Factors of Biodiversity Depletion

Our planet is losing numbers of biodiversity in every moment, and several species of plants and animals are either becoming extinct, endangered, or facing threats. The region under review is accruing similar experiences because of certain forces and factors. Here, the natural processes, mainly related to climatic shifts, and seasonal temperature extremities are deemed as factors of depletion. In reality, the pre-and post-independence revenues and forest policies combined with market economy need to be reckoned as forces of biodiversity depletion facilitated by forces of deforestation. However, the forest people or the tribal residents who are never part of it have been successful in conserving a number of species (Pallavi 2015).

Threats to biodiversity are largely caused by:

- Habitat destruction: Is enforced with both public and private organizations, though the public concern is more powerful involving mainly infrastructure

development—like extension of transport corridors, setting up industrial units, dam building, etc. that obliterates a large forest area. A number of dams built in the area under the management of Damodar Valley Corporation (DVC) may be mentioned.

- Overharvesting of local species: Demand of indigenous vegetable and animal products within and outside the area impacts the supply by causing overharvesting which leads to threat.
- Overexploitation and non-replenishment of soil nutrients: Reduction in area increases the density of species pressing upon the demands of nutrients of soil of a limited area, and disruption of the nutrient cycles invites metabolic rift for other species in the same food chain, ultimately causing degradation of the ecosystem and retardation of species.
- Climatic uncertainty: Irregular or scanty rainfall and prolonged dry spells sometimes harm the growth and health of local species.
- Displacement of native species and invasion of exotic species: The regional ecosystem and the material needs of the local people attached to that ecosystem are mainly reliant upon the indigenous plants and animal species. Invasion of exotic varieties of plants causes harm to the ecosystem and food chain.
- Associated social and economic conditions: The rural tribal communities especially those who are dwelling in and around the forested tracts are essentially economically poor and socially marginal. The forests in India from the colonial to the present times have been managed by the people who lived outside the forest regime; the policies and acts of forests passed by the non-tribal rulers have always excluded the tribal people who are protective about forests and reliant upon the energy excess of forest ecosystem—the minor forest produce. As a consequence, fragmentation of forest habitats, degradation of forest, despeciation, and deforestation are gradually occurring.

5.2.8 Social System, Norms, and Customs as Forces of Biodiversity Conservation

The belief systems and worldview of the forest dwelling tribal groups nowadays needed to be reviewed with ecological and sociopolitical connotation. Each species of the forest ecosystem is viewed as an indivisible entity together forming the unified whole which is a common resource pool for the members only; matter or energy excess of the ecosystem may be taken out of the ecosystem boundary. Thus, they have developed certain norms, customs, etc. to protect and conserve all the plant and animal species (Kala 2011a, b) in their ecosystem that they belong to. Some of the unique social group or community activities in the form of festivals have helped understand the importance of a single species and its conservation. For example:

1. **Karam Puja**: A festival followed by the tribal communities of Chhattisgarh, Bihar, Jharkhand, Odisha, and West Bengal. This festival is celebrated for a good harvest of local traditional cereal, seeds, and legumes. The ecosystem people visit

the jungle accompanied by groups of drummers and cut one or more branches of the Karam tree (*Neolamarckia cadamba*). After worshiping, the branches are brought to the village. Thus, it conserves indigenous vegetation species, the patch of forest housing the vegetation and the cultivators. The reality is the festival indirectly facilitates the conservation of local genetic resources.

2. They believe that the dense old forest patches or original dense groves contiguous to or reside beside their hamlets are the abodes of their predecessors; thus, these are "sacred" and honored as "sacred groves." Such types of groves, one or more, are rooted almost in each village. These certainly are the sites that embrace in situ conservation of local biodiversity playing the role of small biodiversity hotspots. Even these provide shelter to a number of rare birds, lizards, insects, and medicinal herbs.
3. A number of higher trees like *Shorea robusta*, *Schleichera oleosa*, and *Terminalia elliptica* have special importance in the cultural practices of the tribal communities. They oppose cutting of these trees and worship them. Especially *Shorea robusta* is connected with their economic and social life. They use its leaves for making wrappers and plates, while its flower is used for natural aroma and resins as insect repellent. Beyond such traditional knowledge, the tribal communities have special honor to this climax species in their mind and are always in favor of its conservation. Liquor from flowers and oil from the seeds of *Madhuca longifolia* have importance in the social life of the tribal communities. Different rituals are protective to different tree species.
4. In general, the tribal communities are nature worshipers, and some taboos followed by these communities have helped conservation of a number of species that are not allowed to kill and consume. Based on their belief and practice, they usually do not kill snakes. Some lizards are on their diet list but do no harm to them unless they are compelled to do so, rather utter repentance before they kill a life.
5. Based on their belief system and rich traditional ecological knowledge, they have developed therapeutic healthcare and disease control methods with application of medicinal plants, herbs, and lianas. Use and offerings of a number of leaves and flowers in various festivals and rituals as part of their customs have helped preservation of plants and herbs, those plants even unknown to common people.

5.3 Conclusion

Human society, from the stage of its emergence, has been associated with other species for its survival and progress. The forest-dwelling tribal communities still prefer the affinity of forest not for their habitual livelihood, rather than the forests and its innumerable plants and animal communities are living unharmed because of the presence of those tribal people in and around the forests. Their social system, customs, and rituals are oriented to the conservation of all lives sharing the forest ecosystem. Their belief system, worldview, moral, and societal life have blended

together as traditional ecological knowledge that always works for coexistence of all species—presence of forest species has become synonymous with presence of resident forest people. Inclusion of those people in the forest protection committees has been proved with the forest health of various forest belts West Bengal, as well as of India.

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