

The contribution of sense of place to shifting cultivation sustenance: evidence from West Garo Hills, North East India

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Nowadays, sense of place is increasingly becoming prevalent in environmental research. It is an interesting concept to study both attachment and emotional relationships that individuals or groups hold for a specific place. In order to understand such bonds to forested landscape and shifting cultivation (SC) among tribal communities, we employed a four-dimensional place attachment model and empirically tested it using factor analysis. The results of this study revealed that besides socio-economic factors which affect the bonds to a place and the place-based practice, strong connections with the natural environment and lack of alternative occupations are significant factors which might explain tribal dependence to the land and SC. Indeed, sense of place would allow a better understanding of territorial issues and favour place management.

Keywords: Forested landscape, indigenous people, sense of place, shifting cultivation.

In Asia, shifting cultivation (SC) is at the core of cultural farming practice. As the heritage of indigenous people, SC depicts culture and life in most countries in Asia¹. Indeed, through various connections between people and lands or forests, SC contributes to livelihood and well-being of the people². However, this practice raises various questions about land issues³, and in some countries, particularly in Southeast Asia, there is an attempt by the Governments to replace it⁴⁻⁶.

Therefore, conflicts persist between the Governments and indigenous people, who despite the ban, continue to illegally practice SC. In the Eastern Himalayan region, SC contributes to livelihood security and ecosystem services^{7,8}. In North East India, SC is predominant indigenous practice and depicts the daily life of the tribal people. The Sixth Schedule of the Indian Constitution provided the tribal people of NE India a role in their land development. Moreover, the Indian Parliament has enacted the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006, which has two

purposes. Firstly, to undo the historical injustices suffered by tribal communities and recognize the rights of forest-dwelling communities. Secondly, by encouraging indigenous people to manage their lands, this Act helps harmonize the management of forests and wildlife⁹. In other words, the idea is to limit external influence or pressures, and respect the local traditions and needs¹⁰. The management of forests is transferred to the tribal councils, whose responsibilities are above those of the district Council regarding conservation of forests and wildlife within their areas in NE India¹¹. In such situations, focus on sense of place may help better understand SC, forest and wildlife management. Moreover, this would highlight the opportunities and challenges to collaborations between the different actors and ultimately the means of planning.

Sense of place is an important concept for understanding how people establish relations with their surroundings. Sense of place can be defined as the bonds and the emotional relationships attached to a spatial setting by a person or a group^{12,13}. It encompasses physical elements, but also reflects social and cultural experiences and interactions with the place^{14,15}. Indeed, sense of place is conceived as a multidimensional construct organized within a general framework of attitude structures that incorporate cognitive, affective and conative responses to spatial settings¹². These responses can take form through various place concepts encompassed in sense of place, like place attachment, identity or dependence and place meanings, etc. Place attachment is an emotional bond between individuals or groups and their environment¹⁶. It is often conceived as a bi-dimensional concept, with place identity and place dependence. Place dependence is considered as a feeling due to a positive evaluation of a place on the basis that it meets an individual's needs and enables them to fulfil their goals^{17,18}. It measures how a place can satisfy the needs of a person, or accomplish a specific goal^{19,20}. Place identity is defined as 'those dimensions of self that define the individual's personal identity in relation to the physical environment'²¹. Place elements thus become partial answers to the symbolic question of 'Who am I?'. Place meaning refers to symbolic or interpretive elements of the place. It refers to what a place means for people²². In the present study, these aspects have been observed through economic bonding, the lack of alternative occupations, traditional and nature bonding.

As suggested by the United Nation (2014), to address sustainable development issues, we need to understand the integrated socio-ecological systems. Hence, we have to understand the values, cognitions and perceptions around the nature-human relationships and the interconnections with the ecosystem²²⁻²⁵. Sense of place theory and methods reveal interconnections between social and biophysical reality. It is 'considered as a motivation for stewardship and actions to care for the environment'²². In fact, sense of place assessments can predict intention to

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accept or reject land-use planning decisions²⁶, and it can be used as baseline information for landscape management. As suggested in a study, place-based relationships can help identify specific landscape and cultural features and ultimately, it could bring appropriate model of planning¹³. For example, researchers showed that in planning for a national forest landscape in Colorado, USA, place-based meaning allowed better understanding and integrating traditional values in the decision-making processes²⁷. In the case of forest management, sense of place would help clarify the impacts of forest management policies on different communities²⁸. This would enhance our ability to formulate appropriate plans for the welfare of the local communities, and thus reduce polarization and related social and economic costs. Therefore, based on sense of place concept, this study sought to understand SC practice in NE India, its social reality and how to manage this practice for sustainable development and to avoid land-use conflict.

The present study was conducted during 2016–2017 in West Garo Hills district (25°34'4.57"N, 90°13'28.08"E), Meghalaya, NE India. The district is mostly covered by forest (77.16%)²⁹ and is sparsely populated (175 people per km²)³⁰. The Garos are the main tribe, and the other indigenous inhabitants are the Hajongs, Rabhas, Koches, Rajbansis, Meches, Kacharis and Dalus. In the Garo hills, a major proportion of the forest belongs to private ownership; the Government has only a few forest lands (>10%). The Garo Hills Autonomous District Council manages majority of the forest area and is in charge of its use and upkeep. This study was conducted among 90 households (tribal respondents) who are randomly selected from five village clusters from two Tribal Development Blocks, namely Rongram and Gambegre. Tippet's random number series was consulted for random selection. In order to collect qualitative and quantitative data, we used structured interview schedule. Sense of place was apprehended with a four-dimensional model of place attachment based on the study by Raymond *et al.*³¹. This model includes nature bonding (connections to the natural environment), economic bonding (subsistence link), social bonding (community attachment, attachment to traditional institutions) and lack of alternative occupations. These were rated on a five-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). For negatively worded statements, scoring was reversed. Factor analysis was used to determine the validity of the attachment scale. The survey instrument consisted of 23 place attachment statements taken from previous studies which demonstrated high internal consistency. Nature bonding scale was developed from affiliation nature concept³² and nature connectedness concept³³. Social bonding items were developed based on the measures proposed by Kyle *et al.*³⁴. Inter-item correlations and item-to-total correlations of each item were performed, followed by an exploratory factor analysis (principal component analysis

with varimax rotation) as enunciated by Pearson. The criterion used by Hammitt *et al.*³⁵ was followed in forming factors, i.e. eigenvalue ≥ 1.0 , factor loading ≥ 0.40 .

First, we observed demographical variables and their repartition in the sample, since place attachment varies according to demographic characteristics like age, education, family size, farm husbandry skills/experience and household's income^{16,36,37}. Data show that middle-aged (45.6%) and the advanced age groups (40%) were more represented in the sample. Maximum respondents (62.22%) had up to primary school level of education; only 24.44% were educated above high school (Table 1). There were approximately six persons per family who practiced SC. Among SC practitioners, 77.8% of them had medium size families having around 4 to 8 persons per family. Of the sample studied, 64% of the respondents had more than 25% level of dependence on SC. With regard to well-being, majority were concerned about their future. In the sample, 29% of the people considered that their well-being is in danger and 51% mentioned that they will have to struggle in the future. Table 1 summarizes these analyses.

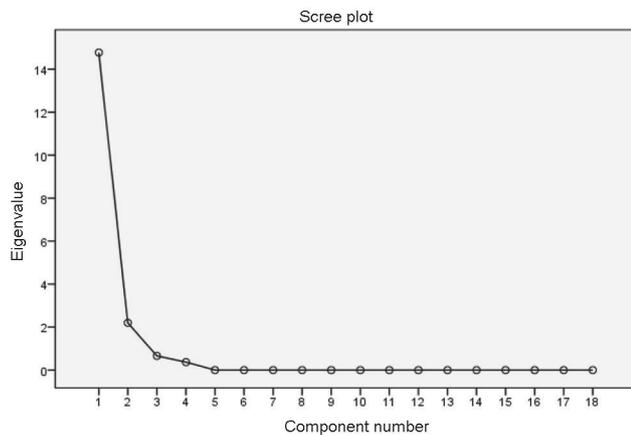
Principal component and reliability analyses indicated four underlying dimensions with high reliabilities (Table 2, Cronbach alphas: >0.70 or higher).

The eigenvalue showed the importance of each of principal component. On the basis of Cattell's scree plot (Figure 1), three factors were retained. Together these factors explained over 99.83% of the total variability in the data. This led us to the conclusion that a factor solution will probably be adequate. Factor loadings indicated the strength of the correlations between each of the three factors and the variables with a high reliability (Cronbach alpha >0.90). The study has validated three dimensions: economic bonding, traditional bonding and nature bonding. Four items were found to be related to economic bonding. The item, 'Non-timber based forest products (NTFP) fetches more income from the SC land' loaded less strongly on economic bonding dimension than that of other measures of economic bonding. However, this scale was still significant and contributed strongly (factor loading >0.88). Traditional institutional bonding emerged as a more efficient dimension with maximum of six loaded items. And, four items were loaded on nature bonding. Moreover, in this study, nature bonding emerged as the first significant factor of place attachment and for the maintenance of SC. Lack of alternative occupations appeared as the second most important factor, followed by economic bonding and traditional institutions' bonding.

The study revealed that in the West Garo Hills district people seem to be highly dependent on forested landscape for their survival. The sense of place concept allowed us to understand this dependency and to explain the maintenance of SC. In fact, this study emphasizes the importance of economic factors and the lack of alternative

Table 1. Summary of respondents' profile

Variables	Respondents				
	Frequency	Percentage	Mean	Standard deviation	Coefficient of variation (%)
Age (yrs)			44.84	10.84	24
Young (18–35)	13	14.44			
Middle (36–50)	41	45.56			
Old (Above 50)	36	40.00			
Educational attainment					
Illiterate	12	13.33			
Primary	56	62.22			
High school and above	22	24.44			
Family size			5.56	1.83	33
Small (<4)	10	11.11			
Medium (4–8)	70	77.78			
Large (>8)	10	11.11			
House type					
Thatch roofed with mud wall	10	11.11			
Corrugated steel roofed	67	74.45			
Cement concrete roofed	13	14.44			
Extent of dependence on shifting cultivation (SC; %)					
5–25	32	35.56			
25–50	43	47.78			
50–75	15	16.66			
75–100	0	0			
Well-being index					
Suffering (4 and below)	26	28.89			
Struggling (5 to 6)	46	51.11			
Thriving (7+)	18	20.00			
Household income (INR)			8240.56	8477.17	
Poverty					
Below international poverty line	35	48.29			
Above international poverty line	55	51.71			

**Figure 1.** Fraction of total variance in the data as explained by each principal component.

solutions as factor of place attachment among the tribals. It suggests that timber resources and food are predominant variables. In the West Garo Hills district, respondents by and large are dependent on SC which implies that SC guarantees economic security, where about 48% of the respondents are experiencing extreme poverty

(Table 1). Forests and culture system are essential for livelihood and subsistence income³⁸. Economic factors and place dependence seem to influence each other. In fact, poverty leads to strong dependency to forest activities which sustain SC³⁹ and places that provide income for residents influence place attachment⁴⁰. Nowadays, SC seems to be the only source of livelihood for the tribal population. Thus, in this study, tribals expressed the lack of other opportunities to ensure food security of their households (Table 2). There was absence of any off-farm employment^{10,41} and also other employment opportunities in the villages. Therefore, out of necessity, tribal populations continue their traditional practices. For example, the Supreme Court of India has banned timber extraction and coal mining in forest areas. Hence, cultivators returned to SC practices and also resorted to illegal practices like charcoal making (Meghalaya), and poppy and cannabis cultivation (Manipur) for income⁴². Tribals prefer to live near forest areas due to their higher dependency on natural resources. Moreover, they are aware of only poor and backward technologies⁴³, and therefore they have no other recourse than opt for SC.

In times of environmental or social changes, economic realities influence the extent of attachment to the place

Table 2. Principal component analysis of place attachment among tribals

Statement	Factor loading	Grand mean	Item mean	Standard deviation	Cronbach alpha
Economic bonding (eigenvalue = 3.64; variance explained = 91.10%)					
Tribals have better access to timber resources	0.99	3.91	4.39	0.60	0.92
Nowadays, in SC commercial-oriented crops are preferred to subsistence-based food crops	0.91		3.34	0.97	
Non-timber based forest products (NTFP) fetch more income from the SC land	0.95		3.94	0.57	
SC is a major source of food security for tribals	0.97		3.98	0.70	
Traditional institution bonding (eigenvalue = 0.33; variance explained = 8.18%)					
The collective process of decision-making is not observed in managing the SC land resources	0.94	4.02	3.77	0.95	0.92
Even now for <i>jhum</i> , the exchange of labour among family members is governed by ancient norms	0.67		3.65	1.14	
The customary laws are not as strong as in the past years	0.96		4.56	0.57	
SC has to be continued generation after generation	0.86		4.05	0.89	
The present generation does not manage SC resources well like their forefathers.	0.99		4.19	0.66	
The common property land tenure regime is best for SC maintenance	0.94		3.88	0.59	
Nature bonding (eigenvalue = 0.03; variance explained = 0.63%)					
SC activity is laborious than settled cultivation	0.98	4.04	4.24	0.55	0.99
Tribals have abundant SC land	0.99		3.95	0.72	
SC is more affected by climate change	0.98		4.26	0.56	
The failure of one crop in SC is not a problem as tribals grow a variety of food crops	1.00		3.72	0.84	
Lack of alternate occupation (eigenvalue = 0.004; variance explained = 0.09%)					
There is no livelihood opportunity apart from SC	0.98	3.69	3.60	0.86	0.96
Tribals do not have knowledge to pursue non-SC activities	0.90		3.32	0.98	
Off-farm opportunities of high income may prompt tribals to move away from SC	1.00		3.88	0.96	
Absence of good employment opportunities in the village forces the younger generation to continue ancestral occupation of SC	0.99		3.94	0.84	

and SC. This study suggests that stakeholders can benefit by examining the emotional and functional support that place provide for people and their implications for economic life. Authorities may consider collecting information on factors which improve place capacity to support the needs of indigenous people and also may have to understand the prevailing dynamic cause and effect linkages between the people and SC. Beyond economic criteria and livelihood, nature bonding and traditional institution's bonding are significant factors of place attachment among tribals. Beyond survival goals, nature is part of the daily life of tribals. There is a strong connection between tribal populations and nature (Table 2). This nature–man connection is rooted in their lifestyle and culture, and they consider plants and trees and surrounding areas as sacred and protect them with their indigenous knowledge⁴⁴. For example, people of Garo Hills used their varied traditional ecological knowledge and thus have a reasoned management of lands by practicing long fallow system. Such SC is generally sustainable and is the best cropping method in areas where flat land is not availa-

ble⁴⁵. Moreover, according to tribal farmers, despite climate change and its effects, their systems generate sufficient resources since they are varied. Moreover, SC is rooted in their culture and traditions, and this practice is the way of preserving their rich cultural tradition and diversity⁵. There are also many festivals celebrated in connection with SC in the Garo Hills, which keep people closer to their traditional practices and allow them to develop social bonding⁴⁶. Therefore, for tribal populations, SC shall continue, since it is intertwined with their identity and place identity. A study has pointed to the importance of understanding shared place specific emotional and functional relationships in building consensus and collective actions for transformation aided by supportive interventions⁴⁷. Therefore, we have to follow human-valued prioritization approach while making land-use planning and adopting consistent environmental and conservation planning¹⁹.

This is a preliminary study to bridge the gap between the sense of place literature and sustainability transition issues applied to SC. The aim of this study was to go

beyond the trivial argument that ‘the place matters for sustainability transitions’. Physical attributes of a place are not enough; we need a place-based perspective. Place-based approaches would allow clarifying local contexts, values and priorities⁴⁸, and the role of place–people relationship and ultimately, how relation to place can contribute to sustainability transitions policies. With evidence from this case study, we contend that the place becomes an attractor and a medium for sustainability of SC and other forest uses. We have shown that experimenting is one important way to address sustainability transitions, and not only a means to instigate or catalyse them per se. We can emphatically say that, not considering ‘people–place relationship’ does not guarantee a successful implementation of sustainable policies. In order to practice ‘just planning’ – an approach which considers the cultural dynamics of a place while planning any intervention – it is necessary to understand how people invest in a place, and how the place contributes to their daily life. Through sense of place study, we can explore alternative narratives, meanings and relations, and it would be possible to propose ideal, adapted transitions which are consistent with prevailing people–place relationship.

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Assessment of colour changes in Lonar lake, Buldhana district, Maharashtra, India using remote sensing data

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This communication presents results of a preliminary study to understand and assess the colour changes in Lonar lake, Buldhana district, Maharashtra, India, using remote sensing data of recent years (2019 and 2020). In addition, the study has utilized IMD gridded weather data and spectral profiles of algal pigments from the published literature. In order to verify whether the colour change is a cyclic event, long-term satellite data of Landsat 8-OLI and Sentinel 2-MSI sensors from 2014 onwards were analysed using spectral response in red and green bands. It was observed that even though a cyclic pattern exists, the colour change events occurred only during the 2019 and 2020 periods. The present analysis showed a change in colour of the lake from green to brown twice during April–June 2019. However, in 2020, there was a change in colour of the lake from green to brown and eventually to pinkish-red, which was not observed earlier. Rainfall and temperature were used to identify possible causes of abiotic stress on algae population of the lake. The study observed light rainfall and reduction in temperature just prior to the colour change event during both the years. In the absence of field data, the published literature on absorption spectra of different algal pigments was reviewed to identify pigments causing brown- and red-coloured appearance of the lake. Though cause of stress on the algae population is not known and is to be precisely identified by field surveys, the change in colour of Lonar lake appears to be caused by pigment(s), like phycoerythrin and carotenoids. However, this needs to be verified in the ground through water quality analysis.

Keywords: Colour changes, lake water, pigments, remote sensing, water quality analysis.

IN the second week of June 2020, several print and electronic media reported change in colour of Lonar lake, Buldhana district, Maharashtra, India^{1,2} from green to pink. This was attributed primarily to the presence of algae in saline water of the lake. It was also reported that though change in colour of the lake had been observed in the past, however, the extreme tone of red colour was witnessed this year. The National Remote Sensing Centre (NRSC), Hyderabad initiated a quick preliminary study to assess the change in colour of this lake using remote

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