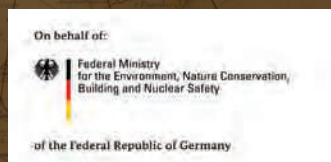
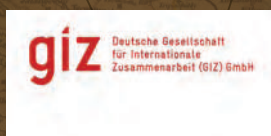


Contract No: 83156192

Representing Knowledge: LEK and Natural Resource Governance in India

Aarthi Sridhar and Meera Anna Oommen

2014



Citation: Sridhar, A. and Oommen, M.A. 2014. *Representing Knowledge: LEK and Natural Resource Governance in India*. Deutsche Gesellschaft für Internationale Zusammenarbeit, German Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety and Dakshin Foundation. 130p.

Database research: Seema Shenoy, Moushumi Ghosh, M. Muralidharan and Sajan John.

Design, layout and illustrations: Seema Shenoy

Advisors: Michael Adams and Kartik Shanker

Acknowledgements

Many individuals must be acknowledged for their assistance in the preparation of this report.

The following experts readily offered to help with lists of documents to include in our analysis: Ashish Kothari, Bejoy K. Thomas, Chandrika Sharma, Darshan Shankar, G. Hariramamurthi, Prof. John Kurien, Harry Jonas, Kabir Bhavikatte, Kanchi Kohli, Madhu Sarin, Madhulika Banerjee, Manish Chandi, Neema Pathak, Nitin Rai, Ramya Rajagopalan, Sagari Ramdas, Seema Bhatt, Shalini Bhutani, Shekhar Ojha, Siddhartha Krishnan, Suneetha Subramanian, Ventakesh Salagrama, V. Sujata, V. Arivudainambi and Unnikrishnan, P.

Seema, Moushumi, Murali and Sajan undertook the tedious task of compiling material for the database. Kavitha Manjunath oversaw the financial aspects of this project and ensured order and accuracy in accounts.

Neena Koshy and P.D. Francis of GIZ deserve special thanks for their patience and support.

We thank our advisors Prof. Michael Adams and Dr. Kartik Shanker for discussions on the subject and insightful comments on our ideas.

Produced by

Edgar Endrukaitis, Director

Indo-German Biodiversity Programme

For further information

Aarathi Sridhar, Programme Head, Dakshin Foundation

aarathi77@gmail.com

Written/ Compiled and Edited by Aarathi Sridhar and Meera Anna Oommen

Design and layout: Seema Shenoy and Muralidharan. M

Disclaimer

This study titled "Representing Knowledge: LEK and Natural Resource Governance in India" is a compilation of information gathered and analysed for the GIZ Project Conservation and Sustainable Management of Existing and Potential Coastal and Marine Protected Areas by Dakshin Foundation. While due care has been taken in preparing this document, the opinions expressed herein do not purport to reflect the opinions or views of GIZ. GIZ takes no responsibility for the authenticity, correctness, or sufficiency of the information of the content available herein and examples provided. The opinions expressed are solely those of the authors.

Representing Knowledge: LEK and Natural Resource Governance in India

Aarathi Sridhar and Meera Anna Oommen

2014



On behalf of:



Federal Ministry
for the Environment, Nature Conservation,
Building and Nuclear Safety

of the Federal Republic of Germany



Aarathi Sridhar is a Founder Trustee of Dakshin Foundation and a doctoral candidate at the Centre for Studies in Science Policy, Jawaharlal Nehru University.

Meera Anna Oommen is a Founder Trustee of Dakshin Foundation and a doctoral candidate at the School of the Environment, University of Technology, Sydney.

Contents

Preface.....	i
--------------	---

1 A Place for Knowledge: Tracing Governance from the Late Colonial to Contemporary India	1
<i>Meera Anna Oommen and Aarthi Sridhar</i>	

Introduction.....	2
<i>Different ways of knowing.....</i>	3
<i>The knowledge-power nexus.....</i>	4
Tracing sites and processes within the knowledge discourse	6
<i>Forestry</i>	6
<i>Fisheries and other maritime knowledges.....</i>	12
<i>Agriculture and water resources governance</i>	18
<i>Pastoral landscapes and common property resources</i>	23
<i>Conservation arenas.....</i>	26
The role of knowledge: Summary and critiques	31
<i>Colonising knowledges and ecological watersheds.....</i>	31
<i>Dismantling monoliths.....</i>	32
<i>Valorisation of pre-colonial traditions.....</i>	33
<i>Criticisms from post-colonial theory</i>	34
<i>Critical junctures</i>	35

2 LEK in India: A Biogeographic Analysis	37
<i>Meera Anna Oommen, Seema Shenoy and Aarthi Sridhar</i>	

Introduction.....	38
Methods and analysis	39
Types of publications	42
Tracing LEK research with respect to legislation.....	48
State-wise representation of studies.....	50
Biogeographic zones of India	51
Communities in India.....	55
Research themes	56
<i>Nutrition and health.....</i>	56
<i>Wild and domesticated species.....</i>	58
<i>Fisheries and aquaculture</i>	58
<i>Natural resource management, prediction, etc.....</i>	60
<i>Other important themes</i>	60

Regional focus.....	62
<i>Trans-Himalaya</i>	62
<i>Himalaya</i>	65
<i>Desert</i>	68
<i>Semi-arid</i>	70
<i>Western Ghats</i>	72
<i>Deccan Peninsula</i>	75
<i>Gangetic Plain</i>	78
<i>Coasts</i>	80
<i>Northeast</i>	82
<i>Islands</i>	85

3 Knowledge at the Margins: LEK on Coastal and Marine Systems of India.....87

Aarthi Sridhar

Introduction.....	88
Identifying LEK literature for analysis.....	88
LEK studies across publication types.....	92
LEK and technology.....	94
State-wise distribution of studies.....	95
Cross references and citations: Contributions to existing knowledge.....	98
LEK publications on traditional management.....	99
Challenges of making a place for LEK in modern legal frameworks.....	101
Knowledge management and documentation.....	102

4 Engaging the Divide: Knowledge and Democracy in India.....105

Aarthi Sridhar and Meera Anna Oommen

The problem of legibility: Language and the demarcation divide.....	106
TEK/LEK - Museumisation to practice.....	107
Knowledge as a constructed ideal.....	107
The relation between resources and knowledge.....	108
Interdisciplinarity in understanding education pathways and learning cultures... ..	108
Research agendas and collaborations.....	109
Plurality of knowledge as experiments with democracy.....	110

References	111
-------------------------	-----

Appendix	128
-----------------------	-----

Preface

This study was undertaken by Dakshin Foundation for Deutsche Gesellschaft für Internationale Zusammenarbeit (hereafter GIZ), as part of its project titled 'Conservation and Sustainable Management of Coastal and Marine Protected Areas, India' (hereafter CMPA). The CMPA is a joint project between the Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India and the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and implemented by GIZ.

The CMPA project aims to improve biodiversity conservation and management practice in a number of existing and potential Marine Protected Areas (MPA) in India while contributing positively to local livelihoods of people at these sites. In doing so, the project operates within the framework of the United Nations' Convention on Biological Diversity (CBD), in particular Article 8(j) which emphasises the promotion and engagement with the local, indigenous and traditional knowledge of communities which are relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval of the holders of such knowledge. The CBD along with associated legislation and policies have been instrumental in an increased focus on these issues. Reflecting these developments, over the last two decades an interest in what is widely called local or traditional ecological knowledge (LEK/TEK) has emerged within the global literature. Although there are nuances to the terminology – explained in Chapter 1 – for ease of understanding, we use the terms 'traditional', 'indigenous' and 'local' knowledge interchangeably within this document, unless specified otherwise. An array of anthropologists, conservation biologists, ethnobiologists and others have begun to point out the contributions that such systems could make to our modern systems of conservation and resource use. The present review of the literature on local ecological knowledge is aimed at enhancing our understanding of the place of local ecological knowledge in environmental governance in India, with a special focus on coastal and marine systems.

This review is structured within four broad sections, of which the first two focus on the Indian context in general, whereas the last two are dedicated to coastal and marine systems in the country. **Chapter 1** introduces key concepts related to knowledge and its relationship with power and politics. The conventional connotations of different forms of knowledge are evaluated along with a brief commentary on the knowledge-power nexus.

Chapter 1 further traces the trajectory of knowledge politics in governance related to different natural resource governance sectors in India. Ranging from the colonial period to the contemporary, this review evaluates a broad chronological sequence including several critical phases of India's recent history. **Chapter 2** is devoted to an analysis of a database of traditional knowledge that was compiled as part of this project. Contemporary Indian scholarship on TEK/LEK published between 1980 and 2014 is summarised with respect to the main thematic focus areas of the literature as well as the key human communities that derive their livelihoods from these landscapes. This analysis adopts India's primary biogeographic zones as the main units of exploration. Since the primary focus of our investigation has been natural resource governance and conservation, we only briefly explore related streams of literature such as ethnomedicine and intellectual property rights. Although marginal to the current exercise, it is important to stress that, over the last few decades, the discourse on IPR and ethnopharmacology has grown voluminous and has even over-shadowed other aspects that are connected with local ecological knowledge. Thus these themes merit a separate treatment in future. **Chapter 3** focuses on a detailed examination of issues related to knowledge which are encoded within the literature on coastal and marine systems in India. A descriptive analysis of different coastal states is attempted in this chapter along with a quantitative summarisation of publication trajectories, thematic areas of exploration, sites of study, etc. The last chapter (**Chapter 4**) is an attempt at outlining potential pathways for democratising knowledge, referring to implications for coastal and marine systems. Here, an attempt is made to distill useful principles not only from TEK/ LEK focused literature but also from the wider literature on overlapping thematic areas such as common property management and governance. Rather than just suggest a conventional set of prescriptions, an attempt is made to identify critical proscriptions that are a cautionary complement to the former.

While being far from exhaustive, the literature and themes addressed in this study nevertheless are useful starting points for experiments at knowledge-based governance of natural resources in India. Knowledge, with its imbrications with power, if understood better can help guide approaches that aim to counter societal injustices that mark the history of resource management in India. For coastal and marine systems in particular, these avenues could be explored along several lines that improve legibility, encourage plurality, and facilitate the democratisation of local knowledge.

1

A Place for Knowledge

*Tracing Governance from
the Late Colonial to Contemporary India*

Meera Anna Oommen and Aarthi Sridhar

Introduction

Natural resource governance can be viewed from the perspective of 'day-to-day management as well as broader decision-making regarding resource ownership, access and use, and associated legal, administrative and fiscal arrangements' (Lele 2004). It takes on various forms ranging from top-down centralised systems to decentralised, traditional, local and participatory ways of governing resources, mixing asymmetrically in discourse and practice (Andersson et al. 2004). In the developing tropics, governance is a particularly complex process as it often involves the reconciliation of diverse livelihoods-focused motivations and polarised stakeholder perspectives. In the effort to deal with rapidly transforming social ecological systems, strategies for equitable governance could incorporate a diversity of available knowledges supplemented by continuous learning and collaboration among different stakeholder groups. However, this is easier said than done given the hegemonic nature of knowledge production, circulation and acceptance which has created a power laden disjunct between local/ traditional forms of knowledge and modern science. This has led to a strong perception that local knowledges the world over have lost out to a dominant, globalising Western system of knowledge (Shiva 1993). In the tropics, this 'politics of disappearance' (Shiva 1993) can be attributed to colonial imperialistic and post-colonial development-centric encounters that have complicated resource management via a nexus of science, power and domination. This biocultural legacy is well exemplified in the case of India with its long history of diverse traditional governances overtaken by a centralised governance system that was inherited from its colonial past (Nandy 1989a; Kothari 2009). At the same time, these engagements have also brought to the forefront a complex, seemingly intractable set of hybrid interactions and composite knowledges that both

challenge and benefit contemporary natural resource governance throughout the developing world.

This review traces the trajectory of knowledge politics surrounding natural resource governance in India. We begin by touching upon the general scholarship that critiques differences between modern science and traditional/ local forms of knowledge (different ways of knowing), followed by an examination of key discourses pertaining to the politics of knowledge and its interlinkages with power in society (the knowledge-power nexus). Using this background, we explore the articulations of knowledge and its intersections with power and politics along a broad historical sequence for different natural resource governance themes in India. These include forestry, fisheries and maritime systems, common property resources, agriculture, water resources governance and conservation. For each theme, the sequence begins with colonial agendas of the Raj and follows through to the introduction of the 'development' ideologies of post-World War II and post-Independence India, and then to the governance agendas of contemporary India. Relevant pre-colonial knowledge dynamics are touched upon briefly in specific instances. Following this, we summarise knowledge politics in the Indian context and examine the key prospects and critiques pertaining to the treatment of traditional/ local knowledge. The themes explored in this review converge on an appeal for greater dialogue between proponents who identify themselves as practitioners or proponents of modern science and traditional knowledge and the reconciliation of knowledge-based agendas in natural resource governance in India. This would result in a wider appreciation of local as well as hybrid knowledge systems and their incorporation within decision-making and governance frameworks. This review also highlights the work of Indian scholars who have contributed

Different ways of knowing

significantly to the debates on science and knowledge.

In the scholarship on environmental governance, the convention has been to treat scientific and traditional knowledge as separate entities, notwithstanding the lack of consensus on an acceptable set of distinctions between the two. Scientific knowledge (also referred to as modern science, Western science, etc.) is labelled as objective, reductionist, experimental, and abstract, favouring the development of general laws and principles, whereas traditional knowledge is typically defined more in terms of its situatedness and context dependency, community wisdom, oral transmission, lack of generalisation, and so on. Both categories of knowledge have their defenders and detractors, vehemently supporting, patronising, valorising and dissenting in their respective opinions. Moving away from popular perceptions about knowledge systems, it has also been argued that Western knowledge is in fact simply a form of local knowledge that has advanced through intellectual colonialism as opposed to widespread acceptance of its universality (Nandy 1989a; Shiva 1993). This view claims that the dominance of Western science is not due to its superiority in terms of universal validity, but a result of historical and political advantages conferred on it by the geopolitics of power, and best illustrated by the spread of colonial science and post-colonial development ideologies (Escobar 1995).

Added to this is the problematic definition of local knowledge. As Mazzocchi (2006) elaborates, the difficulty in terminologies and definitions of these different forms of knowledges is reflected in the different ways in which we name and describe them. Usually, the TEK/IK literature is characterised by a series of coterminous phrases (traditional knowledge, traditional ecological knowledge, local knowledge, indigenous knowledge, folk knowledge, farmers' knowledge, fishers' knowledge, tacit knowledge, etc.), each with a different emphasis. For example, the word 'traditional' implies knowledge transmission along a

cultural continuum and at the same time conveys the impression that it is rooted in the past; the word 'local' signifies a scale of operation that omits to convey the specificity of place; 'indigenous' places emphasis on the autochthonous nature of a form of knowledge that ignores the complexities of classification of indigenous groups, the intertwined nature of knowledge transmission among groups (Mazzocchi 2006), or the multiple hybrid forms of knowledges formed by a fusing of indigenous and scientific knowledges (Goldman 2007).

These issues are also reflected in Agrawal's (1995) critique of traditional knowledge, which explores the problems associated with dichotomising traditional and scientific knowledge. While welcoming the resurgence of a form of knowledge that was once considered inferior, he draws attention to the challenges associated with labelling one form of knowledge as 'traditional' and the other as 'scientific'. For example, the conventional categorisation of traditional knowledge as largely qualitative, intuitive, holistic, diachronic, moral, and spiritual (for e.g. see the definition of Berkes 1993) alludes to a more superior definition for scientific knowledge which is commonly portrayed as quantitative, rational, reductionist, value-free, etc. In other words, phrases such as testable explanations, prediction, reliability, rationality, etc. which are extensively used to describe modern science is missing in the portrayals of traditional knowledge which take on socially-mediated characterisations such as wisdom, stories, legends, folklore, etc. In reality, these differences remain difficult to pinpoint, rather, they point to shared histories and intertwined natures of different forms of knowledge. Whether one agrees with the dichotomy between 'traditional' and 'scientific', Agrawal's critique that this demarcation could reinforce the current tendency to place modern science on a pedestal, reinforcing hierarchies and enabling further compartmentalisation holds true. Others encourage viewing different forms of knowledges as overlapping 'multiple webs of situated knowledges'

(Haraway 1991), 'knowledge spaces' (Turnbull 2000) or 'partial knowledges' (Goldman 2007) that are not inherently different from each other but have their own sets of transparent elements, ontological assumptions and knowledge claims (Turnbull 2000; Goldman 2007). Goldman (2007) calls for a recognition of 'different knowledge claims as *partial* knowledge spaces, embedded within particular social, cultural and political spaces' as the first steps towards dialogue between knowledge systems.

The question of cross validation of scientific and local knowledge is also relevant in this context. Davis and Ruddle (2010) call for TK systems to validate themselves in accordance with the prevailing Western paradigm:

'Like it or not, until replaced at some future time, Western science is the dominant paradigm that sets the prevailing standard. So the fight for the co-equal treatment for indigenous and other nonmainstream cultures and their knowledges need to be practical, and to demonstrate the validity of IEK/ LEK/ TEK in terms understandable

The knowledge-power nexus

cultural context (i.e they make sense only within their cultural contexts)'.

Knowledge not only relates to explanatory potential, i.e how an issue or problem is understood or solved, but also about how it is employed politically by different interest groups, as its creation and use is contingent on the political forces at work in a given context (Forsyth 2003). Over the years, political ecologists and STS scholars have used Foucauldian theory to show how knowledge has been used as a political tool of control and domination (Latour 1987; Nandy 1989a; Escobar 1995). As Weiler (2006) points out, 'knowledge and power are connected by a relationship of reciprocal legitimation' or complicity (Briggs and Sharp 2004). Saberwal (Saberwal 1997) captures this concept when he points out that,

to the dominant culture ...',

Nandy (1989b) objects to the contention that 'the victim must learn the oppressor's language and worldview before qualifying as a proper dissenter' (For a similar viewpoint to Nandy, see also Spivak 1988). Seth (2009) reflects on a similar example when he points out the case of Tibetan healers and their healing traditions. Even when successfully validated by Western science, the application of this knowledge may still be regulated in transnational situations by scientific norms and politics (e.g. the same healers may not be allowed to practice in the US without a valid license, whereas doctors in the US could adopt this knowledge into their practice with less difficulty). Mazzocchi (2006) clarifies this further by stating that, 'Western science and traditional systems follow radically different ways of knowledge creation and validation, therefore, trying to analyse or validate one using the criteria prescribed by another is difficult. Moreover, when validating local knowledges it needs to be kept in mind that their genesis and evolution, and therefore their validation is often specific to their

'Over time, a particular discourse may be shaped by the bureaucratic terrain it traverses, but because of the expertise associated with the bureaucracy, the discourse may come to acquire a legitimate scientific standing independent of the bureaucratic context within which it matures.'

The notion of a uniform concept of science or knowledge is therefore not only an epistemological problem that exists in a vacuum, rather it's symbiotic relationship with power has engendered a complex system of mechanisms that have transformed the Western scientific knowledge tradition into a superior, dominant force. This Western tradition that has spread through intellectual colonisation (aided by the territorial expansion of European colonisation and capitalism) delegitimised or ignored local knowledges the world

over, and resulted in a multitude of naïve, 'subjugated knowledges' (Foucault 1980) that are considered inadequate as universal explanations (Weiler 2006). Visvanathan (1989) and Shiva (1989) go a step further in stating that modern (reductionist) science encodes within itself a structure of pervasive domination and violence. In their call for a 'new, plural, political ecology of knowledge' (Nandy 1989b), they highlight that voices have over time questioned the hegemony of modern science and call instead for 'an insurrection of subjugated/ little knowledges' (Foucault 1980/ Visvanathan 1989; see also the idea of 'cognitive justice' that advocates an active recognition of the need for diversity of knowledges and the right of these different forms of knowledge to coexist; Visvanathan 1997, 2011a).

Perhaps the most significant lessons in relation to the knowledge-power nexus lie in the analysis of colonial and post-colonial situations. Adas (1989) points out to the unusually wide support (from both proponents and critics) accorded to the view that imperial science and technology served as a civilising and humanitarian mission in the colonised tropics (e.g. famine alleviation, public works, education). These 'positive and transformative powers' (Seth 2009) speaking a 'language of modernity' (Chakrabarty 2002) were used as justifications for colonialism while at the same time ignoring the oppressive and self-interest driven practices that characterised this period (e.g. see,

Fanon 1959; McGinn 2009). An understanding of the knowledge-power nexus is also critical to contemporary resource governance as it intersects most crucially with the politics of development in post colonial arenas. Escobar (1995) traces the politics of development in the post-World War II scenario whereby the industrialised North became the model to emulate for 'underdeveloped', 'Third World' countries. In a manner similar to Said's conceptualisation of Orientalism as a justification for colonial imperialism, Escobar argues for the historical contextualisation of development as a hegemonic space whereby the development policies that act as mechanisms of control are imposed not only by Western nations on the developing world, but also facilitated by state institutions (e.g. scientific institutions and universities) in the First and Third Worlds and also by international agencies such as the World Bank. Shiva (1989 in Nandy 1989a; see also hooks 1990) comments on the science links between this form of 'governmentality' (Foucault 1978-79, 1979) and its politically imposed top down system of reductionist science in the following manner:

'The rationality of reductionist science is declared apriori superior, even though it can be argued that if reductionist science has displaced non-reductionist modes of knowledge, it has done so not through cognitive competition, but through political support from the state and the state's development policies and development programmes which provide both financial subsidies and

Tracing sites and processes within the knowledge discourse

ideological support for the appropriation of nature for profits.'

In this section, we explore the discourses and articulations relating to knowledge in various natural resource governance themes in India. For most natural resource sectors, the Indian experience is characterised by a diversity of traditional/ local knowledges in the

pre-colonial period and their eventual domination by colonial policies and technologies during the period of European domination. Although colonial science came to acquire a dominant position by virtue of political control, a closer look shows that the interactions between different knowledges were hardly one-sided. The same applies to post-Independence era knowledge dynamics where state-sponsored development

Forestry

ideologies are constantly being mediated by local level interactions. The discourses pertaining to knowledge dynamics are explored in the following sub-sections.

Although biased towards analyses of colonial scientific forestry, both colonial as well as post-colonial forest policies have received a great deal of attention in environmental discourses related to knowledge in India. And it was in forestry perhaps, more than in any other natural resource governance sector, that the colonial administration's interactions with local communities were the most protracted and contentious, and its impacts the most far reaching. Colonial forestry had to contend with a subcontinental scale of local usage and governance arrangements resulting in the intersection of many layers of knowledge and politics. Unlike other sectors such as irrigation, where the colonial takeover was relatively rapid, scientific forestry witnessed slower growth. Stebbing (1922-1927) speculates that this slow growth of scientific forestry was due to the confinement of 'scientific knowledge' to a small set of European officials, particularly those belonging to the medical profession. Ribbentrop (1900) on the other hand attributes this to a 'mental bloc' amongst early administrators to consider forests as anything but an obstruction to agriculture and a 'bar to the prosperity of the empire'. However, by the late eighteenth century,

these views had been overturned and forests were already being viewed as resources for the empire, as sources of raw material for ship-building, railways and other expansionist activities, and as resources that merited protection (Poffenberger and Singh 1996). In 1864, the British India Government established the Imperial Forest Department to operationalise this new perspective on forestry which curbed 'destructive' traditional practices and encouraged scientific exploitation and silvicultural improvement. Saberwal (1997) states that along with this focus on production forestry was articulated a highly alarmist 'dessicationist discourse' (both European and American) informed by early experiences in Europe (Rajan 1994) as well as the colonial plantation-induced scarcities in fragile tropical island systems (Grove 1995). Rajan (1994) points to early influences (from the seventeenth century onwards) of the dessicationist discourse within Europe itself and its long-lasting influences in India till the 1960s. Saberwal (1997) also stresses on the key American influences beginning with Marsh (1864; the theory of environmental degradation) who theorised links between environmental catastrophes (such as floods, droughts and famines) and changing human-nature relationships.

The change in perception of forests (as sources of

extractive value as opposed to traditional livelihoods-related repositories) was reflected in the Forest Act of 1865, the first major legislation that empowered the state to assume monopolistic and absolute control of forested areas which were till that point, under a variety of governance structures. Here again, there were debates about local knowledge-based practices (i.e the ability of local communities to govern forests) with local and regional administrators more in favour of greater autonomy and local use whereas the centre pushed for more control on account of its imperial agenda. For instance, the Madras Presidency opposed the Forest Act, forcefully emphasising the adverse consequences it would have on communal rights and privileges (Bandopadhyay 2010). However, even staunch sympathisers of community forestry such as Dietrich Brandis (Guha 2001) were of the opinion that community rights should be limited to usage rights but not include property rights. In the context of communal forests, Brandis was of the opinion that 'their administration would have to be in the hands of the (forest) department, for village communities in India cannot at present be expected to be sufficiently alive to their own interests' (Brandis and Smythies 1875). Such views put the emerging discipline of scientific forestry right on top when the English Crown took over administration of the Dominion of India in 1857.

In the greater scheme of things, the prescribed formats (e.g. blueprints, rules relating to bans on traditional manipulation practices such as fire, extraction, access to forests, etc.) that scientific forestry set in motion were followed with apparent uniformity across various provinces in the country. These included working plans (even now considered by some forest departments as the 'Bible of forest management'; see Uttar Pradesh Forest Department website, <http://forest.up.nic.in/workingplan.htm>) that prescribed a bundle of management activities for a Forest Division, rules relating to bans on traditional manipulation practices such as fire, extraction, access to forests, etc. However, analysts, who have looked at regional comparative histories point to an interface of 'local autonomy' with 'central direction' (Sivaramakrishnan 2000), i.e the variation across regional situations where local knowledge

and specificities were incorporated into successive revisions of plans and practices (Bandopadhyay 2010; Sivaramakrishnan 2000). Although Ludden (1989, 1992) alludes to a general, centralised state power which is different from pre-colonial systems and even those of the Mughals (whose centralisation he describes as more ideological than operative), Bandopadhyay (2010) describes the history of forest policy in India as one of 'shifting emphasis, changed directions, and continued experimentation', and Mukarji (1989) states that 'the system inherited from colonial times was in many ways more decentralised than centralised'. In fact regional histories such as those of Bengal seem to parallel the governance system introduced in agrarian governance (as described by Bayly 1990) whereby traditional societies were encouraged to change along some axes and at the same time allowed to remain entrenched in certain aspects of hierarchical systems which would facilitate governance by the centre (Sivaramakrishnan 2000).

A close examination of regional histories such as that of Bengal by Sivaramakrishnan (1996, 2000) allows us to understand some of the intricacies of forest governance. Here, as in many parts of India, forest conservancy was justified not only as an environmental necessity (see the commentary on the desiccationist discourse by Saberwal 1997) and as a measure safeguarding wildlife exploitation, but also as a requirement of capitalist expansion and empire building. These differing agendas were however uniform in their disempowerment of local communities and their practices. At the same time the extractive nature of colonial forestry necessitated the development of knowledge related to silvicultural plans and practices and the takeover of this knowledge by experts. Silvicultural knowledge related to inventory methods, the development of working plans, and measurements of growing stock and harvestable timber, etc. signified the transformation of forest management to a predominantly scientific exercise informed significantly by European-trained experience (especially the German school of forestry). However, Sivaramakrishnan (2000) explains that this centralised knowledge was supplemented significantly by local administrators who called for the incorporation of local

knowledge at times in defiance of standing instructions from the centre. Local administrators who were dependent on the practical knowledge of staff lower in the hierarchy (e.g. forest guards, rangers) often used elements of this specialised ground-based expertise in the revision and re-adaptation of generalised blueprints such as working plans. In such contexts, we see also the interplay between centralised state knowledge and local knowledge and their role in leveraging between regional autonomy and central control. In most cases, changes in forestry practices necessitated concomitant changes in policy and rules of access for local communities (e.g. the shift to regeneration blocks entailed closure of forests for longer periods).

It is also interesting to note that numerous traditional practices were withdrawn from and incorporated into mainstream forestry at different points of time indicating the interactions between scientific theory and practical considerations. These reflected responses to different large-scale drivers of change to improve production forestry, and was rarely aimed at improving local livelihoods. For example, escalated requirements of wood in the First World War necessitated a shift in Bengal's sal silvicultural practices from the selection method and improvement felling to that of regeneration forestry based on the practice of taungya. This practice incorporated elements from two previously designated traditional 'vices' that colonial forestry was at pains to suppress: shifting cultivation and fire. Local communities in most forested parts of the subcontinent actively used both shifting cultivation (variously known as jhum in Northeast India, podu and kumri in southern India) and fire management to manipulate forest productivity more or less effectively for food surplus and social well-being. However, colonial foresters with their new emphasis on timber despaired at the wasteful nature of these practices, as well as the difficulty in collecting taxes and 'controlling' transient people, ownerships and property rights (Pouchepadass 1995). In northeast India and Burma where jhum was commonplace, these practices were associated with the loss of valuable trees such as teak and sal especially in the period when colonial forestry was unaware of

the positive role of fire in regeneration. However, in colonial Burma, to counter the resistance of the Karen community, this condemned practice was re-introduced in its related form 'taungya' whereby, the cultivators were encouraged to plant teak saplings along with food crops on cleared land. Regardless of the underlying resistance and coercion, colonial forestry turned around what was once considered to be an 'ecological vice' into a 'silvicultural virtue' which was replicated in many parts of the empire (Bryant 1994; 1997).

The manipulation of forests through fire, has a long history in India. Fire knowledge has been associated with a variety of pastoral and forestry related practices particularly shifting cultivation (e.g. podu, kumri, jhum, taungya, etc.). Local communities routinely conducted burning in order to clear forests, improve soil fertility, facilitate the collection of non-timber forest products, and to improve regeneration and fodder production. Fire has also been culturally significant in religion and ritual (e.g. in the hunting rituals of the Kondh and Didayi tribes of Odisha, the litter-fires of the Soliga in Karnataka). However, from the mid nineteenth century onwards, the advent of colonial forestry with its focus on harvestable timber led to stringent fire suppression in most forests on account of it being a 'primitive' and wasteful practice. Baden-Powell, who was a staunch advocate for fire suppression echoed a heightened form of this sentiment when he proclaimed that '... it is possible that the progress of knowledge has driven out this idea to a great extent in India, but there are here and there a few who still argue for forest fires, just as in England some eccentric individuals occasionally question the fact that the earth is round' (Baden-Powell 1876-1877). The Indian Forest Act of 1927, pronounced the setting of fires a punishable offence and a great deal of colonial forestry machinery was targeted at fire suppression. Moreover, in what Pyne (1994) describes as an example of the 'symbolism of science' the far flung European experience of fire suppression as a better practice was used out of context to justify the same in India. Again, the examination of a regional context is extremely important as it provides insights into the inner workings of knowledge and power. Sivaramakrishnan

(1996), exploring knowledge dynamics in fire and forestry in yet another study on Bengal attests to the centrality of fire in forest-management and its understanding by local foresters in inserting context-specific elements into the region's forestry. While most central forestry experts pushed for complete bans on fire, some foresters (especially Dietrich Brandis and his experience with taungya in Burma) and local administrators who learnt about the beneficial role of fire in assisting regeneration of valuable timber species such as teak and sal recommended the incorporation of local burning-related knowledge into their silvicultural practices. The use of burning to facilitate fodder, small game hunting and NTFP collection and other local uses also found favour with some departmental officers who devised hybrid schemes that combined intense local knowledge-based community schemes with forestry. Moreover, in some parts of the country, local forest guards (it is interesting to note that the first imperial forest guards were primarily appointed for fire protection) who could be counted as among the earliest sceptics in the protection force burned forests surreptitiously (Minchin 1921). According to Sivaramakrishnan (1996), regardless of the nature of the contention (political or scientific), the arguments of fire protection was carried out between forestry expert and field officer in the 'language of scientific certitude'. In the early twentieth century, the experiences of Bengal and other provinces led to the official incorporation of controlled burning in silviculture. The use of fire was also integral to the practice of taungya which was introduced later. This paradoxical treatment of burning whereby the practice was banned for political reasons for one group of stakeholders and encouraged for another embodies the double standards of science in the politics of knowledge. Areas where complete fire bans were operational were hotspots of resistance where local communities incensed by fire protection and loss of livelihoods set clandestine fires. The post-Independence forest management system in India inherited the stringent fire suppression ideologies of colonial forestry and enacted numerous legislations to maintain status quo. The resentment towards these discriminatory practices is reflected in the parallel history of long-term

retaliatory measures adopted by local people.

In the immediate post-Independent phase, priorities relating to agriculture and industry contradicted those of the newly formed Forest Department, with the National Forest Policy of 1952 being guided by issues of paramount national need (Bandopadhyay 2010). However, in the following decades, a new set of forestry related issues assumed centre-stage. Concerns over forest depletion by local over-exploitation as understood within the narrowly-held views of the time prompted the initiation of numerous social forestry schemes. The tendency of these mainstream perspectives of deforestation was to blame factors such as population growth and livestock impacts as the primary drivers of deforestation without taking into account broader viewpoints that incorporate factors such as agricultural-expansion, power generation, industrialisation, etc. or the large-scale socio-economic, political and historical influences. The underlying theory behind this sensibility not only incorporates aspects of the colonial 'dessicationist discourse' of the late 19th and early 20th centuries (see Saberwal 1997 for a commentary on this), but also the 'theory of environmental degradation' as propounded by George Perkins Marsh (1864), and others and finally culminating in the ideas of 'development' (see Escobar 1995) and 'sustainable development' (IUCN 1980; WCED 1987). In the 1970s in Africa and other tropical regions closer to home in Nepal, the 'theory of Himalayan degradation' (Eckholm 1976) placed the blame for degradation in the region squarely on the shoulders of impoverished peasants and their demands for agricultural lands and forest products, primarily fuelwood. Although these and other simplistic theories have been highly contested or refuted successfully in academic circles as root causes (see Ives and Messerli 1989 for a critique of Himalayan degradation), they were (and still are) invoked as justifications. These were in turn coincident with post-World War II development ideologies, paradigmatic shifts and associated aid interventions in India and much of the developing world (for the evolution of this environmental discourse for Nepal, see Guthman 2002). As in the case of Guthman's argument

for Nepal, it can be said to be true of Indian forestry as well, that, not only was academic knowledge related to environmental problems insufficiently conceptualised and analysed, compelling cases were made in favour of certain arguments and interventions that were politically motivated and intimately tied to power relations.

In the forestry sector of post-Independence India, it was 'fuelwood orthodoxy' which garnered heightened attention within the degradation debate of the 1970s. Acting on alarmist theorisations from international situations, particularly Nepal, international donors, particularly the World Bank encouraged massive biomass enhancement projects for mitigating fuelwood and fodder crises (Sekar and Jorgensen 2003). National governments such as India who were interested in securing these funds fashioned such discourses based on the prevailing paradigm, and pushed national policy and corrective measures in this direction (Agrawal 1998). In 1996, the National Commission on Agriculture encouraged the creation of 'social forests' on common lands and state forests in aid of this widespread problem. However, although biomass management has a long history of being embedded in local knowledge systems, in operational terms there was poor incorporation of local knowledge or technologies, reflecting a limited understanding of people-nature dependencies, social and community structures (Sekar and Jorgensen 2003). Strict protection running counter to the sentiment of community-centric objectives of the projects was attempted in some sites. Moreover in an effort to achieve the economic viability of projects (on the basis of which they were funded), the large-scale cultivation of fast growing, locally inappropriate exotics such as Eucalyptus was attempted with devastating ecological consequences in some places. Eventually these species were more of value to the paper and pulp industry than as options for biomass enhancement for the local community. The reluctance of the Forest Department was amply illustrated not only in its reluctance to give local communities power to plant their own vital resources based on local experience but also in its inflexibility towards decentralisation (Sekar and Jorgensen 2003). This rejection of local requirements and preferred practices

is another example of a situation where economic and political conditions took precedence over knowledge related to ecological or social well being. Towards the 1990s, however, widespread opposition to centralised social forestry found its way through to environmental discourses. The need for people-oriented approaches (both as a solution to the continuing conflicts between the FD and local communities, and as a response to calls for participatory processes) finally resulted in the first Joint Forest Management (JFM) initiative in Bengal in the 1990s.

Sundar (2005) points out that although forest management in India has always depended on the local knowledge of communities informally, JFM remains the first substantive initiative where the knowledge and practice of local communities was explicitly incorporated into forest policy. JFM's underlying mission incorporated a view to accede to peoples needs and practices. Sundar (2005) specifically links these developments to the recent rhetoric of NGOs, donors and academics in what Chambers (1992) coined as 'an ideology of the reversals of the normal', i.e., 'putting people before things and poor people first; development through learning process rather than blueprint; decentralization, democracy and diversity (to value local knowledge, participation and small group and community action): open and effective communications and access' (Chambers 1992). This formed the basis of 'participatory rural appraisal' (PRA), which was the set of methods adopted to incorporate local knowledge, concerns and practice. JFM exercises were facilitated in many cases by NGOs whose knowhow relating to mediation simplified interactions between the FD and local communities. While on the face of it, JFM was an attempt at a more inclusive forestry, Sundar (2005) points out that within the JFM framework, the rhetoric of indigenous knowledge has been used by various proponents in ways that suited them best. Since the final control in each JFM experiment rested with an outside agency (the FD), which mandated activities under pre-determined frameworks devised by them or the development agencies that funded them, local knowledge could only be incorporated within certain approved spheres. For example, most of the focus of

knowledge-related incorporations were on NTFP tree planting, collection and processing (it was easier for the FD to share control over a relatively less significant segment as opposed to say large-scale silvicultural practices) (Sivaramakrishnan 1996). However, there was a lack of conformation with expectations even in some of these instances. Local communities sometimes expressed their preference for commercially valuable exotics instead of native species; in some cases, wage earnings were favoured; differences within caste, class and gender groups also resulted in community choices that were not uniform (Sundar 2005). This shows that despite a wealth of local tradition, local communities too are at times motivated by economic and social factors.

Both the colonial and post-colonial phases saw the domination of the desiccationist discourses, albeit with different emphases during each phase. In the colonial period, academics linked forest preservation to climate-related variables such as rainfall, in the post-colonial period, the connections have typically been with wider issues related to environment and sustainability (Grove 1995; Bandopadhyay 2010). Tracing these linkages, Saberwal (1997) shows that the desiccationist discourses which could be initially considered as a set of diverse ideas coalesced into a consolidated argument during the 1920s with far reaching consequences. During this period, although significant empirical refutations of mainstream forester arguments (about the protective functions of forests) were made, the Indian Forest Department still clung to simplified notions of the earlier theory. Saberwal (1997) attributes this selective simplification (aided by a selective use of international/ particularly American forestry literature) and the reinforcement of the alarmist discourse to a strategy of control by the establishment to thwart the intentions of the Revenue Department with which it was in protracted conflict. It is interesting to note especially that the early American desiccationist literature which influenced Indian foresters were in fact influenced by European forestry (Saberwal 1997). Marsh (1864), Hough (1878, 1889, 1882), Pinchot (Quoted in Schiff 1962), and numerous other American proponents extolled the virtues of the protective nature of forests.

These views were in turn challenged successfully by American climatologists, meteorologists, geologists, engineers and soil conservationists (e.g see Moore 1910; Lowdermilk 1935) who point to the complexity of the system in general and the inadequacy of forestry science in disentangling complexity. Eventually, large-scale control experiments, such as the Wagon Wheel Gap experiment by the US Forest Service itself proved little support to the desiccationist argument (Saberwal 1997). But as Dodds (1969) argues about forestry advocates. '... their commitment was to a cause, not to scientific evidence if the evidence contravened the cause ... in the field of forest influences, where scientists even today are drawing only tentative conclusions from their experimental work, the conservationists were extremely slow to attempt controlled experiments and did so only in the crudest manner. Yet they argued for their cause as though its truth were irrefutable.' The period between the early 1900s and the 1940s saw various formats of these debates being played out. Extensive criticism of forestry science and its lack of empirical rigour finally forced a shift towards quantitative US forestry. Although this complex American literature, as well as European forestry discourses were being actively accessed by Indian foresters (as evidenced by publications in the *Indian Forester*), the majority opinion (there were notable exceptions, e.g. H.F. Blanford) including those of stalwarts such as Baden-Powell (1877), E.P. Stebbing (1922-1927) and FW Champion (1928) remained unchanged over a long period of time, regardless of the shift in course of American forestry.

Combined with the discourses that highlighted historical injustices to marginalised tribal communities all across India, the post-JFM phase of forestry opened up policy spaces for governance instruments of a more participatory nature. These include major acts such as the Panchayat Raj Act (Extension to the Scheduled Areas) (PESA) 1996, and the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act (FRA) (2006), Kapoor (2012) contends that although these forward looking legislations acknowledge ownership and use rights of indigenous communities, they are often undermined by the 'whimsical' manner in which forest

officials define damage to forests. Tribal communities often question the rationale behind the labelling of the relatively low levels of extraction that they practice in the forests as ecological damage, when at the same time, the Forest Department along with industry and private interests are often involved in large-scale extraction of bamboo, timber, etc. which are far more damaging in terms of ecological dynamics. In fact, it is not uncommon to hear tribal sentiments are expressed to the tune of having to protect the forests from the Forest Department itself (see interviews in Kapoor 2011). The question of who defines or decides what constitutes ecological damage reflects the play of the knowledge-power nexus whereby the government sees large-scale extraction and diversion of forest land as necessary to development, while paradoxically adopting the stand that tribal use is detrimental and therefore mandates evictions from forests. This is also reflected in contrary cross-sectoral influences where the government itself fails to recognise adivasi ways of life or political choice, instead, tribal communities with rights over forest land are discouraged from indigenous agriculture or other forms of extraction but encouraged under paternalistic policies to plant monocultures such as rubber, coffee, oil palm, etc. under government sponsored tribal development schemes

(Kapoor 2010).

A historiography of the discourses on forest resource governance in India reflects the signatures of knowledge systems linked to large-scale processes such as colonialism and post-War development, and also the recurrent influences of local and regional experiences in the refashioning of generalised blueprints (e.g. working plans, regeneration strategies) (Sivaramakrishnan 1996). In the context of colonial forestry, Sivaramakrishnan (Sivaramakrishnan 1996) refers to this as an 'interactive and contextualised production of knowledge' reflecting contributions of imperial and local knowledges as opposed to colonial forestry as a 'received doctrine, either emerging from the intellectual history of western science, or from the imperial, exploitative project of colonialism'. Additionally, when looking at large-scale influences, while international scholarship such as that of Escobar (1995) encourages comparison between the two periods (colonial and development phases), they place the major production and hegemonic spread of the development knowledge system as a defining feature of the post-War period. Sivaramakrishnan (2000) calls for a much longer history of the development enterprise when he points out that colonial forestry did actually incorporate many features of contemporary development agendas

Fisheries and other maritime knowledges

(e.g. productionist agendas, notions of progress, etc.) revealing a 'conflicted and contested production of development discourse'.

As knowledge systems are embedded in the social, economic and political lives of people, an understanding of knowledges relating to maritime communities therefore leads us to examine the region's histories of commerce, technologies, politics and nature. The term 'maritime communities' is used to denote the multiplicity of professions that coastal communities in India have been engaged with in relation to the sea. The identities of fishers in many regions were shaped by their close association with the sea, not restricted

to single professions (such as fishing), but also with other maritime skills such as boat building, navigation, shipping, salt making and so on (Reeves et al. 1996a). Tracing the engagement of the colonial and post-colonial state over these key professions can help illustrate the complexity of knowledge-making, sharing, and transmission in these communities and spaces.

Historical work on maritime communities of India is sparse in comparison to the range and depth of hinterland histories. The existing scholarship on the colonial period pertains largely to events in the Bengal, Bombay and Madras Presidencies with only minimal analyses of fisheries in other coastal stretches.

¹ For a selection of these studies see Bharathi 1999; Roche 1984; Reeves et al. 1996b

The literature¹ on fishers suggests that while coastal communities across India were largely homogenous units of specialists (i.e. engaged predominantly in one occupation or the other), many communities appear to have followed other maritime and non-maritime occupations. This occupational divergence was the result of political patronage, facilitation or coercion and caste politics occurring at varying scales across geographies. For instance, some historical accounts of the Paravar community of South India, suggest that this group which identifies itself as fisher people (meenavar makkal) was a large and diffuse group spread across the Tamil Nadu coast and engaged in a range of maritime activities, including pearl diving, fishing, shipping and boat building (Roche 1984; Deckla 2004). Some historians suggest that the origin of particular fishing castes is on account of their prominence as specialists, at one point, in particular activities such as near shore fisheries e.g. the sub-caste of the Pallar (Dalit) who engaged in fishing were called Kadaiyar, those undertaking pearl fisheries in the southern stretches of Kanyakumari were called Muthurayar and so on, even if they are all engaged in more homogenous sets of practices today. Similarly, the Koli fishers of Bombay Presidency were divided into a range of sub-castes based on occupation, but each of these groups experienced different treatment of taxation and control by their colonial masters depending on the economic significance of their occupations. Reeves (2002) suggests that there were nearly 30 fishing castes and some of these groups shifted occupations to agriculture (in particular the Namasudras) aimed at obtaining social mobility. Each of these sub-castes, or groups forged distinct political relations with the state and among each other. It is therefore likely that there may be variations in knowledges between multiple social groups based on their beliefs, pedagogical traditions, practical experience and political situation over a longer period of time. There is also likely to be variation regarding modes of transmission or knowledge and differences regarding knowledge-sharing and associated entitlements (or benefits) between social groups even as they practice a single activity. These aspects of TEK/LEK generation and application are important in understanding contemporary intellectual property

regimes in biodiversity conservation.

Chaudhuri's (1986) studies of the Indian Ocean reveal that maritime trade relations flourished well before the arrival of the Portuguese in these waters towards the late 15th century and actually accounted for a great deal of environmental change and knowledge-exchange about the seas and its natural resources. Arunachalam dates the trade in pearls along the Gulf of Mannar to the Sangam Era establishing it as a globally important trade, carried out on a large scale in which a large number of communities were involved, including Arab pearl divers. Similar historical scholarship establishes the existence of communities and maritime practices in antiquity, but at the same time this also illustrates the difficulties involved in establishing indigeneity in marine cultures. These studies that establish the antiquity of certain maritime trades and occupations contain valuable clues on the continuities of knowledge-making, transmission and ruptures in these processes. For instance, it appears that there may have been slight variations in skin diving techniques and skills among the pearl and chank divers belonging to various communities such as the Moors of Ceylon, the Paravar of the Tuticorin coast and other local fisher groups in the Malabar and Kanyakumari region. However each group followed distinct beliefs and understanding of the harvesting time, ecological habits of animals and their worldviews differed in relation to the marine space. The trade relations between these groups occupying a common space must have allowed for knowledge-exchange between maritime communities practicing particular trades, making it difficult to ascribe its indigeneity to a particular group.

While the scale of certain fishery operations (such as pearl harvests) were formidable prior to the arrival of European colonialists, it is suggested that there were shifts in the manner in which such harvesting operations were carried out under the reign of local kings, under the Portuguese, British and finally the Indian State. It is possible that these changes in harvesting practices brought about changes in people's observations and associations with the sea, although there are few documents to help us understand how this

transpired. The source of historical interpretation lies in a range of colonial administrative documents, survey and exploration reports and financial, scientific and administrative reports of the colonial period, and many of these await detailed exploration.

The prevalence of particular types of maritime technologies (particularly navigation and shipping) owed their emergence to the coexistence, competition and conflict that marked the periods of European colonization in India. As a matter of fact, Indian Ocean maritime technologies offer a good example of the difficulty of applying the label 'indigenous' to the range of maritime craft in this region. Although these were termed 'native' by the British, to distinguish them from European sailing craft, they themselves were possibly products of several centuries of pre-colonial regional trade, technological diffusion and innovation between several sea-faring communities (Pope 1995). In *Crossing the Bay of Bengal: The Furies of Nature and the Fortunes of Migrants*, Amrith (2013) proposes a point of departure for the scholarship on maritime communities, suggesting that we 'look beyond nationalist histories, to see the marine spaces such as the Bay of Bengal as a region where ideas, people and things were in a state of constant motion'. Such an understanding helps locate the complexity inherent in contemporary concerns with resource entitlements, privileging particular knowledges and rule-making over natural systems.

Popular historical narratives work around the assumption that new practices and technologies in particular sectors introduced by the colonial state brought about dramatic ruptures in local ways of knowing. But this tells us little about the subaltern response, the knowledge-power nexus or the political economy surrounding these technologies and knowledges. Although colonial powers introduced and favoured non-indigenous navigation technologies, European style sailing vessels plied alongside 'native' sailing vessels across both the east and west coast of India for conducting significant volumes of domestic and foreign trade in British India. James Hornell, then

Director of Fisheries remarked that the indigenous Arab baggalas or the Indian pattamars economically outperformed the European style sailing vessels (Hornell 1920). Native coastal shipping and navigation activity (and consequently the knowledges associated with it) declined along the east coast with the coming of the railways and the introduction of steamships in Burma (Pope 1995) pointing to the dynamic relation between broad sectoral development (in this case transport) and the maintenance of knowledge systems and practices in related realms.

Little historical attention has been devoted to the shifts in knowledge that such the simultaneous operation of maritime technologies engendered (between European and native sailing ships) or the disappearance of certain knowledges and practices with the introduction of others (such as steam shipping around the end of the 19th century (Pope 1995). Boat design and technology were also shaped by the prevalent ecological and social conditions. For instance, Hornell notes that the boats in Kathiawar were designed to function as both coastal trade vessels as well as fishing vessels due to the seasonal non-availability of fish in the region (Pope 1995). Pope's study of the British steamshipping industry reveals that in the Indian Ocean region, there were a layered set of navigation technologies each occupying a specific niche and powered by varying technological and scientific systems. However, the modest scale of steamshipping operations at this time ensured that there was still space for the operation of a range of native as well as traditional European sail vessel designs in use. The early 20th century still witnessed a plurality of technologies and practices of maritime navigation operations, of which only remnants are visible in trade centres such as Thoothukudi (Tamil Nadu) or Mandvi (Gujarat). Pope (1995) states that Hornell's study of boat designs shows that Tuticorin cotton traders developed a boat – the 'dhoni', a local rigged schooner design borrowing ideas from the Arab baggala and the British liner. Arasaratnam (1967) states that the dhonis of south India were able to do brisk business at large ports as well as in the smaller inlets and creeks because of their unique design. This enabled these traders to carry on larger links and

economies of shipping and gain a distinct advantage over other shipping companies from places such as Bengal. Roche (1984) argues that the introduction of the dhoni in response to lighterage needs of the intense European shipping activity at the time, introduced marked social reorganisation among the communities of Tuticorin, creating an elite class faction among the Paravar, thereby dislodging the conventional elite groups in this region. Thus, it appears that the colonial period saw the introduction of new technologies which had differential impacts not only on social and economic systems but also on local maritime knowledges, techniques and technologies. The above-cited studies remind us to be attentive to the impacts of selective state subsidies to chosen companies with the potential to gradually wipe out entire local industries (and thus knowledge systems), albeit with varying spatio-temporal effects.

Despite scholarship on maritime economies being sparse, some important historical work on marine fisheries in South Asia offers valuable insights into the colonial and post-colonial situation. Scholars of India's aquatic histories have focused largely on the influence of developmental policies in the post-Independence phase. Clues to the knowledge practices and beliefs of fisher peoples are to be discerned from historical texts that discuss fisheries practices, fisheries-based economies and fisher communities. However, historical sources on fisheries in the pre-colonial period do not indicate in great detail how fisheries were managed, unlike agrarian communities and practices. Peter Reeves suggests that although fishing as an activity existed in pre-Aryan times, it was represented as a lowly profession and perhaps this impression accounts for the poor literary attention to such activities, despite its significant nutritive and economic value. Citing Tarak Chandra Das' reading of the Rig Veda, Reeves (1995) points to evidence which suggests that fishing was not practiced by the Aryas but by 'people belonging to a different racial stock'. A variety of fishing techniques are mentioned in a single Sukta of the Rig Veda, the knowledge and practice of which is credited to non-Arya peoples.

Reeves' work on inland and marine fisheries focuses

on the significance of policy changes on local resource governance and practices. With the introduction of the Permanent Settlement Act in 1793, significant changes took place to the ways in which fisheries were taxed, governed and practiced by local communities. In pre-colonial times, almost all waterways across the country were governed by the mirasi system with its unique arrangements of rights and entitlements and levies. Reeves' work reveals that pre-colonial inland fisheries in Bengal were governed as a particular hierarchical arrangement of commons whereby select elite groups did not own rivers and streams but had rights to extract fees from other users – the muhtarifa (mohturfa) system of a tax imposed on trades and professions. This system was initially continued for a short period but soon replaced with the introduction of the Permanent Settlement Act in 1793 first in the Bengal Presidency. This marked a radical shift towards privatizing fisheries by vesting local zamindars with these aquatic estates (mahals). Thus by introducing the jalkar system, colonial tax revenues were augmented through the hitherto alien idea that the produce of water (fish) could be owned privately (Reeves 1995), but new classes of middlemen, wholesalers and retailers emerged who cornered the benefits from privatised fisheries (Reeves 2002).

Reeves et al. (1996b) also note that in places such as the Bombay Presidency, prior to Portuguese colonisation, there appeared to be well-formed governance and social mechanisms among the Koli fishers who occupied the stretches of present-day Maharashtra and Gujarat, and who were the original inhabitants of Bombay. By introducing the taxation system through the brokerage of the Parsi Patels, the elaborate stake fisheries managed by the Kolis came to experience vast changes, such as the taxation of individual fishers as well as their enslavement by company officials (Reeves et al. 1996b). Koli fishers were coerced into fishing for no wages and also were regularly used as salves by the company officials. The relations between the Koli and the Portuguese and later British colonial administration was mediated by the Patels who ensured the smooth operation of taxation. However, in keeping with changes in the Bengal Presidency, there

was a strong move towards abolishing the *mohturfa* system and introducing the privatised system of taxation through intermediaries (*muccadams*) even in the Bombay presidency. Reeves states that an elaborate 'farming' system of tax collections ensued through the 19th century, which effectively reduced the relations between the colonial state and fishers to one of unequal pecuniary obligation.

The colonial land revenue arrangements and the growth of colonial settlements such as Calcutta produced new classes of middlemen and wholesalers and the various fisheries production ownership patterns established over tanks, rivers and other freshwater systems resulted in the relegation of the role of fishers to that of mere producers while other social classes engaged in allied marketing activities prospered across the various presidencies (Reeves 2002). Gradually, fishers themselves were seen as being incapable of engaging in sophisticated marketing or processing measures, requiring further government or private investment in these areas. The history of the marginalisation of fisher communities from their practices of preservation, processing and marketing needs to be explored further in light of the colonial revenue arrangements. This also gives us insights into the perceptions of their technologies, scope and support for building knowledge systems in these aspects.

India's post-colonial interest in large scale fisheries development and 'improvement' projects is indicated in the surveys it undertook under the Exploratory Fisheries Project (later christened as the Fishery Survey of India) and scientific fisheries stock estimation studies undertaken by the Central Marine Fisheries Research Institute. These fisheries survey explorations have their origins in the late 19th century and early 20th century, when fisheries officers made efforts to interest private players in undertaking deep sea fishing using steam trawlers (Reeves et al. 1996a). It was at this time that marine exploratory surveys began to be conducted across the other British colonies. However, the colonial governments were unable to finance and support these initiatives undertaken by their own staff

despite their proven profitability (Reeves, 1996). It is seen that the colonial administration demonstrated a degree of flexibility in its local operations and a diversity of approaches towards nature and people across the Raj (*ibid*). It was also at this stage when the debate on technological capabilities of the indigenous population, their knowledge and the debate on the states of fisheries development rose to prominence. The colonial administration by no means was united in its views of fisheries development. Some of the fisheries officers clearly believed that fisheries development was necessary since Indian fishers were primitive and backward. Other officers such as Hornell believed that India was more suited to a smaller and diffuse approach to development, even recognising some indigenous practices, craft and knowledge as superior (Hornell 1920).

The subject of fisheries appears in various colonial records under various branches of the Departments of Commerce & Industry, and Revenue & Agriculture. The Fisheries Branch was established as a separate branch under the Ministry of Agriculture only in the year 1945. The post-War years saw a growing concern with food security and increasing supplies of food which became the mandate of the Ministry of Agriculture (Rajeswari 1992). This concern was mirrored in other countries as well and fisheries development saw particularly important shifts as a result (Smith 1994). This concern is translated into the intensification of pond-based pisciculture and stocking a variety of fisheries as seen in the many administrative reports and in the research activities of the Central Marine Fisheries Research Institute (CMFRI), established in the year 1947 which later came under the Imperial Council of Agricultural Research (ICAR) set up in 1929. Fisheries as a subject of governance was thus subsumed under scientific institutions tasked with the agenda of maximising the new nation's capabilities under the rubric of agricultural productivity (see Silas 2003 for a brief account of fisheries science activities in India).

A seamless transition from the colonial administration to the post colonial Indian state took place as far as the management of these institutions is concerned. The

concern was with putting in place indigenous officials who were scientifically trained and capable of handling the colonial governance apparatus. As with the agricultural sciences, fisheries too was considered a national primary production industry to be managed scientifically. The late 19th century and early 20th century saw the emergence of the concepts of Maximum Sustainable Yield (MSY; the point up to which fish catches increase in response to fishing effort) and Maximum Economic Yield (MEY; where economic returns from fishing would be maximised relative to cost). The Food and Agriculture Organisation conducted extensive training programmes across the developing world to equip fisheries scientific officers with such knowledge-production capability. Contemporary fisheries inventorying practices of estimating fish stocks and maintaining catch statistics by state scientific organisations find their roots in this influential 'bioeconomic' view (St. Martin 2001). Early attempts of fisheries monitoring revealed conflicts with fishers along the coast, where they were stated to be ignorant, uncooperative or just aggressive. Over half a century since the first fisheries data protocols appeared, these efforts have come for sharp criticism from various quarters, including scientists, administrators and civil society groups (Sridhar and Namboothri 2012). The state-led fisheries data collection exercises and the responsibility of managing fisheries appeared to run at some distance from each other since the institutional structure of knowledge production and regulation found few meeting points (ibid).

Fisheries in India underwent tremendous technological transformation beginning in the post-Independence period. The origins of such a transition have been well-documented particularly in states such as Kerala and Tamil Nadu. Subramanian's anthropological study (2009) is an important contribution to understanding fishers' modernity through negotiations over fisheries development programmes of the state. Artisanal fishers transitioned into a new sector – the motorised or an intermediary sector, while a separate mechanised sector thoroughly flourished till the end of the 70s – a phenomenon termed as the 'pink revolution' to describe the growth in export oriented prawn fisheries on account

of the introduction of bottom trawlers. Kurien (2002) states that fisheries 'modernisation' programmes and the economic policy changes brought about by globalisation led to the introduction of new fishing technologies such as the trawler and purse seiner boats. These modern technologies removed the barriers to a range of people who did not any longer have to 'learn by doing' within a closed community. Artisanal fishing with indigenous technologies and knowledge, he reminds us were stigmatised as non-modern or primitive (Kurien 2002). Thus it was easy to introduce modern technologies to fishers who began seeing it as a means to secure social mobility and enhance self-identity.

Where the colonial concern with conservation of fish stocks was closely tied to maintaining the integrity of the taxation system and maintaining steady supplies of fish for the market, it was also in equal measure about maintaining law and order among various social groups¹. Post-Independence fisheries legislations only extend this perspective further. The legislation was introduced in Kerala to prevent the outbreak of clashes between the mechanised and traditional fishing sectors by demarcating fishing zones for each sector. Falling under the State List of the Indian Constitution, each state government introduced a Marine Fisheries Regulation Act at various points, with Kerala enacting its first in 1980 and Gujarat only in 2003. These regulations follow the same schema of physically separating the classes of fishers with few modifications made to these. The laws do not envisage a role for local communities in the management of fisheries and makes no reference to the processes of determining regulations. Thus they rely only on the state machinery for regulation and offer little by means of recognising local knowledge systems and practices.

The subject of much of South Asian environmental history has been to assign a primary role to the state as a leading actor shaping environmental change, acknowledging the late 19th century as a period of 'high imperialism' (Arnold and Guha 1995) marked by a deep faith in science and technology to control nature. Few studies have explored what transformations took

¹ The Bengal Private Fisheries (Protection) Act of 1889, the Nilgiris Game and Fish Preservation Act, 1879, The Punjab Fisheries Act, 1914 and the Indian Fisheries Act 1927 are the prominent colonial laws betraying this disposition.

place in fishermen's knowledges when confronted with new technologies, and with 'extraneous, ontologically incommensurable knowledges' (Hoeppe, 2009). Even Barathi's acclaimed meticulous ethnographic description (1999) of Pattinavar fishers only indirectly acknowledges their struggles with modernity and its material elements. Critical scholarship that explores this contemporary crisis between modernity and tradition in the governance of fisheries is sorely lacking. Hoeppe makes a beginning arguing that fishers' activities related to fishing are central to 'active knowledge making' (Hoppe 2009) and to

their conceptualisation of environmental change and encounters with modernity. The encounter between new and older forms of knowledge has however resulted in making extraneous global knowledge of environments appear literal, while transforming local knowledge-statements (earlier understood as literal truths) appear figurative and hence non-modern. Future scholarship needs to engage further with the histories of encounters between knowledge-power systems in shaping the discourse on fisher's rights and identity.

Agriculture and water resources governance

The intersection of agriculture, water resources governance and environmental factors with that of the socio-politics of the colonial milieu was a fertile, yet controversial ground for engagement of local and western principles and their underlying principles and systems of knowledge. Colonial governance in the latter half of the nineteenth-century (following the end of East India Company rule in 1857 and the assumption of direct control by the British Crown) focused significantly on a series of public works projects that included railways, and perennial irrigation projects, primarily canals. The latter were especially projected as morally motivated and superior knowledge-driven humanitarian efforts to rid the dominion of widespread poverty and famine (McGinn 2009). In 1881, the Viceroy Ripon reiterated this moral stand when he called for the adoption of western technology in India as Britain's moral responsibility and an underlying basis of its imperialist civilising mission (*'If with all our power and all our knowledge, and all our science we cannot preserve them from dying of starvation by hundreds of thousands every few years, how can we justify our domination over them?'*: Ripon 1881). However, historians argue, that behind the moral rhetoric of development via canal irrigation, the drive was to legitimate an economically advantageous 'long-term capital investment' (Cain and Hopkins 1993; McGinn 2009) for Britain (primarily the City of London and the elite connected to it) in India. As

Worster (1985) points out, colonial science during this period was drawing liberally from the global ethos of the commodification of water which saw large-scale irrigation projects and related hydraulic engineering based on predictable mathematical models that transformed 'wastelands' into productive agricultural spaces. Reflecting these sentiments, an article published in 1858 titled, 'Why is not British capital more largely invested in India?' (Economist, 9 October 1858, p. 1121), the Economist draws attention to the advantageous investment opportunities in mines, railways, canals, etc. This prompted an era of British funded grand irrigation projects that ranged from barrages (anicut), weirs, channels, and canals.

However, it has been pointed out that irrigation, especially those of canals was not always attempted in areas of maximum exigency or viability in terms of famine relief, nor was there a clearcut input of scientific rationale. Analysts such as Whitcombe (1971), Stokes (1980), Stone (1984) and McGinn (2009) all point to instances where canal irrigation was imposed on areas where it was ecologically unsuitable, agriculturally unnecessary, bypassed arid zones, and often water demanding, profitable crops such as sugarcane, indigo and rice were planted displacing traditional food crops suited to the region. Controversial schemes included the Triple Canal project in western Punjab interlinking

canals from the Jhelum, Chenab and Ravi rivers, and Sir Arthur Cotton's ambitious river interlinking plans in two regions (from Madras to Mangalore and from Cuttack to Calcutta) through a network of canals. The Australian politician Alfred Deakin touring India in the 1890s, questioned the need for constructing canals in areas where the soil was unsuitable, where crop production was not dependent on irrigation and where the benefits from navigation were negligible. Although it may be pointed out that some of these schemes were the efforts of well-meaning humanitarians (Sir Arthur Cotton was a widely respected figure in some areas and controversial in others, e.g. Deakin 1893; Desiraju 2003), the rationale or the technology behind them were often not the justifications for securing funds (1893). Whitcombe's (1971) studies of irrigation works in the Ganges-Jumna Doab points to the increase in famine conditions, the displacement of food staples in the region, increase in salinity and water logging, and malarial infestation, reflecting the questionable role of colonial scientific knowledge in some of these endeavours. As McGinn (2009) points out, *'Canals and railways were not built to modernise India's economy. Development was merely rhetoric to legitimise actions taken purely in the interests of capital'*. As far as the colonial government was concerned, revenue expansion trumped actual concern for development. Repatriation was carried out as Home Charges, i.e. as returns on capital investment and administrative costs of projects that were funded by these investments (McGinn 2009). The selection of development projects reflected Britain's own discomfort with the effects of industrialisation in terms of socio-political changes that could undo the hierarchical nature of governance within Britain. Therefore investments were designed in a way that provided the best returns for investment (Britain had already invested successfully in canal and railway construction in the United States; Jenks 1927) and entailed minimal social and political upheaval. The decades of extensive canal irrigation in India were also marked by a series of devastating famines which according to some analysts were exacerbated by canal irrigation, especially in terms of its impact on poor communities who depended on dryland staples such as jowar, bajra and grams which were displaced in favour

of commercial crops. During this time, the commercial cultivation of wheat was promoted on account of its value for export. Although famine relief was the major stated objective (the Famine Commission, established in 1880 had canal irrigation as its primary objective), industries that were promoted were firmly grounded in the agricultural sector with little to do with food production. In sum, as McGinn (2009, citing Cain and Hopkins 1993), argues, 'hand-in-hand with the needs of capital went a developmental programme underscored by political and moral principle'. And as he clarifies further, when canal irrigation could no longer be justified, the expansion of railways was the next major project which had its own long reaching consequences for forests and famines.

The causes of famine and food shortage have also been controversially argued. While colonial administrators (e.g. Elgin, Lyton, Temple) favoured crop failures due climatic factors as the main causes, analysts point to the crucial role of colonial practices in exacerbating the impacts (Guha 1999; Davis 2001; Satya nd). The commercialisation of agriculture, decline in the cultivation of locally adapted food staples, the export of commercial food grains (wheat was being exported during some of the major famine periods), the destruction of common lands (which provided critical livelihood security to the poor) and their designation as 'wastelands' (facilitating conversion), the decline of pastoral activities and the insertion of global market forces into local economies, all created situations which transformed minor calamities into major humanitarian disasters (Bhatia 1963; Satya nd). While the canal irrigation and famine relief projects themselves were problematic in practice on the ground, the role of the colonial apparatus in the politics and economics of famine was even more revealing in terms of exchanges of ideas and ideologies between England and its colonial administration. Nineteenth century British imperialist thought was to a great extent shaped by influential scholars such as Adam Smith (free market), Jeremy Bentham (utilitarianism), John Stuart Mill (utilitarianism and liberty) and Thomas Malthus (theory of population growth). The nexus between

colonial knowledge, capitalist expansion and power resulted in a situation in which Britain as a country that was so deeply embedded in Adam Smith's liberal free market ideologies (*laissez faire*), treated its the Indian dominion in a manner more reminiscent of twentieth century socialism or fascism (McGinn 2009). Free market capitalism imposed as part of the European imperialist project focused on revenue generation great economic, social and ecological costs and made sure that even in some instance of acute famine, the government machinery failed to step in (Satya nd). Added to this was the idea that famines provided natural checks on population growth, which absolved the government of its moral responsibility to intervene during famine crises (Satya n.d.). The British intelligentsia during this period prescribed to the views of the hugely influential cleric and scholar Thomas Malthus whose criticism of Britain's Poor Laws had shifted opinion away from humanitarian assistance to the destitute. As an academic at the East India Company College in Herefordshire, Malthus influenced colonial administrators who viewed famine relief as a poor long-term strategy, and favoured non-intervention during such calamities. In their view, population growth rates were already higher because of a lack of positive checks on growth (such as reduced deaths from warfare, disease, etc.) (Caldwell 1988) and following Benthamite principles, claimed that it would create further dependency if government support was offered (Satya nd). Ambirajan (1976) quotes the Governor General, Lord Lytton in 1877 echoing the Malthusian maxim by saying that the Indian population 'has a tendency to increase more rapidly than the food it raises from the soil'. And, as Davis (2001) argues in his proposal about Late Victorian Holocausts,

'Millions died, not outside the 'modern world system', but in the very process of being forcibly incorporated into its economic and political structures. They died in the golden age of Liberal Capitalism; indeed, many were murdered ... by the theological application of the sacred principles of Smith, Bentham and Mill.'

Drèze (1991) attributes large-scale intermittent famines to four main reasons: the failure to identify and declare

famines, the extremely punitive nature of famine works, the policy of non-interference with private trade and the natural severity of some of the events. Others including Davis (2001) point to the contradictory role played by the other great British public works marvel, the Indian Railways in famine relief as well as exacerbation (Attwood 2005; McGinn 2009). In some cases, the railways transported grains from food-surplus regions to those of scarcity, in other cases, this role appears to have been reversed as grain was transported to centralised depots for hoarding.

As historians such as Irfan Habib (1963) affirm, the Indian region was no stranger to food shortages before the colonial period. These were managed somewhat effectively by numerous traditional knowledge-based water management systems until colonial interventions exacerbated the scale and frequency of these calamities to such an extent that small-scale interventions were powerless or had declined. Hardiman (1995) argues that the over-centralisation of management during the colonial period was detrimental to the decline of small dams and other irrigation systems that were scattered across the countryside. Traditional systems included the small dam systems in piedmonts of low rainfall areas, check dams, channels, inundation channels, canals, reservoirs, stepwells, wells, and rainwater harvesting and storage tanks scattered across the country (e.g. *tanka*, *khadin dora* (Rajasthan), *vav* (Gujarat), *aharpynes* (Bihar), *dungs*, *jampoos* (Bengal), *cheruvu* (Andhra Pradesh), *kohli tanks*, *bhandhara*, *phad* (Maharashtra), *kere* (Karnataka), *zing* (Ladakh), *kuhl* (Himachal Pradesh). Opinions regarding their management have been divided. Some scholarship points to decentralised systems where communities managed their own resources voluntarily, whereas in other areas there was partial, yet significant control by the state (e.g. Travancore – Pandian 1990; South Bihar – Gyan Prakash 1990; southern Tamil Nadu – Hardiman 1995). Others such as Wittfogel (1957) have argued that irrigation projects were perhaps the model systems for despotic control even in pre-colonial times. While past feats of agricultural engineering are edifices to local knowledge that is frequently on display, unique systems of cooperative management have been

preserved successfully through to contemporary times. The *phad* system in the Khandesh region of the northern Sahyadri range and the *kuhl* system in the Kangra region of the Himalaya are examples of traditional organised cooperative systems that have persisted to recent times (Hardiman 1993; Baker 2005). Cooperation between community members, castes as well as cooperation between the state and different communities have all been recorded for traditional water governance systems.

However, most traditional forms of irrigation were better attuned to local food staples in most places and when the colonial push for increased revenues began in the nineteenth century, local irrigation systems were neglected and perhaps even overwhelmed by the size of the projects as these were no longer at the scale of typical community projects. British governance though largely uniform in its imperial purpose followed a variety of governance strategies in canal construction and other forms of famine relief. In some instances such as that of the Sarda Canal (the largest among the colonial canal systems), construction was carried out in opposition to the sentiments of the local administrators: the talukdars of Oudh. While the latter were powerful groups who had a political state, their opposition was also on local knowledge-based grounds which reiterated the adequate availability of wells, the lack of evidence for famine, the potential deterioration of soil and susceptibility to disease if the canal was constructed (Whitcombe 1993). In other situations, such as the famines in the Mizo hills, the British and missionary organisations worked with the tribal communities in ameliorating famines caused by exploding rat populations that were a consequence of episodic bamboo flowering. These strategies relied a great deal on local knowledge about flowering cycles, trapping patterns, etc. (Nag 1999). In the case of other well known irrigation systems such as the *bandharas* of Baglan, Hardiman (1993) argues that although the British claimed to be interested in the preservation of traditional irrigation systems, they in fact did little in terms of repair (as they considered the peasants incapable of maintaining these systems), and instead, new works that were under complete governmental control were financed. Increased taxation

and increased indebtedness also contributed to the problem rendering agriculture unviable. In the initial days of canal development, local influences were significant, but eventually the public administration took over control from groups such as zamindars to streamline financial revenue (e.g. Whitcombe 1993). In areas such as the Indus Basin, the first series of projects were the repair of traditional structures and 'British technology ... tended to focus on a vision of Indian society as composed of indigenous societies whose local water use could be adapted to the requirements of larger hydraulic models' (Gilmartin 1993). Later on, with increased capitalist expansion and a coordinated irrigation policy (which was systemised following the accession of the Crown government in 1857-58), state-controlled integrated hydraulic technology was preferred over local knowledge-based solutions and local irrigators though part of the system were expected to follow rules and strict guidelines (Whitcombe 1971; Stone 1982; Gilmartin 1993). Gilmartin (1993) clarifies the relationship in the following manner, 'British canal administration was therefore marked by a strong tendency to view the canal outlet as the great theoretical divider of the irrigation system, with a system of rational environmental control operating on one side, and a world of indigenous, customary, kin-based community organisation operating on the other. Even as indigenous communities were rigidly excluded from influence over the main, scientific irrigating system, their domination over the disposal of water 'beyond the outlet' was largely accepted as an inevitable fact of colonial irrigation. Indeed such communities came to be viewed as part of the 'natural' environment, to be 'controlled and guided, led and regulated' like Punjab's rivers, by 'scientific' administration, rather than as allies of government in a common project of rational environmental domination.' Beyond the outlet, distribution systems such as the *warabandi* system (registers of timings for water turns for each irrigator) were perhaps the among the few hybrid systems developed by the British in conjunction with local irrigators, but these too were rarely problem free.

Analysing the role of nineteenth century famine discourses (colonial, nationalist and local narratives) and

their role in creating perceptions about the causes and consequences of frequent Indian famines, Zook (2000) points to the creation of the new image of India as a 'land of famine' and later on as a 'poverty ridden nation'.

In the early 1940s, which was the final phase of colonial rule and signified an ebb in British (and European) dominance, the focus in irrigation shifted from canal irrigation to that of multi-purpose river valley development (MVRVD). The knowledge inputs for these came from the United States which emerged at this point as the new and dynamic centre of capitalism (D'Souza 2002). The primary influence was the export of the pioneering dam technologies of the Tennessee Valley Authority (TVA) whose successful deployment of a series of dams across the Tennessee river and its tributaries resulted in the development of pre-packed module that could be exported widely and replicated (Scott 1998). These dams built on the basis of an American technological blueprint became the signature activities of a multitude of countries, especially recently independent post colonialist states such as India which zealously embraced their construction in their efforts to modernise (Klingensmith 2007). Starting with the 1940s multipurpose projects in the Damodar and Mahanadi basins, that aimed at power generation, flood control and irrigation were attempted at several sites. Undertaken in the backdrop of a politically volatile situation that signified the end of colonial rule and post-war welfare measures, most projects were undertaken without adequate attention to social, economic or environmental consequences. The sourcing of American technical expertise by the Government of India signified a break old ties with British capital as well as a rejection of centuries of British racial exclusivity (D'Souza 2002). This deeply alarmed British sentiments as they helplessly watched the far reaching impacts of American imperialism. As D'Souza (2002) explains, this period is also noted for its changes in representation of British India as underdeveloped and the rhetorics of population growth and natural scarcity re-emerged. Large dams guided by centralised knowledge soon became symbols of nationalism for the new government of India.

Despite the centralised nature of powerful technological and development initiatives such as dams, it has been shown that local knowledges and livelihood related issues have ways of circulating and impacting scientific knowledges, and engendering what is commonly referred to as hybrid knowledges (Phadke 2011; Goldman 2011). Even during the colonial period, it has been suggested that while the irrigation system in northern India was thoroughly revamped (e.g. building of new canals, the switch from wells to canals resulting in increased salinity), in areas like the Madras Presidency in the south, a more hybrid approach was followed with the focus on repairs and revival of existing pre-colonial systems (Whitcombe 1972). In the case of post-Independence water governance in India, this is well illustrated by Phadke's study of people's science movements (PSMs) in the state of Maharashtra. PSMs originated in the mid-1960s as a response to the domination of experts and state control in science and technology, and have tackled a number of sectors such as environment, forestry, healthcare, etc. In the case of drought prone rural Maharashtra where access to water is a contentious issue, PSMs have combined oppositional politics with reconstructive development approaches that have given rise to hybrid systems with 'more acceptable designs, better knowledge, more political buy-in—and eventually and hopefully more water for the most vulnerable members of society who suffer from chronic water insecurity.' Phadke (2011) further reports that,

'By melding hydrological expertise with local socioecological knowledge about water, PSM leaders in Maharashtra have aimed to reclaim the very technological artifacts, such as large dams, that have become naturalised embodiments of hegemonic knowledge and power. The engineers and environmental activists are materially and cognitively producing new kinds of dams, ones that are productive and restorative, organic and synthetic. Their goals are to make these infrastructure systems stand in for a different set of moral, political, and ecological virtues.'

Pastoral landscapes and common property resources

The pre-colonial landscape of the Indian subcontinent encompassed the traditional livelihoods of a diversity of pastoral and nomadic communities. Among pastoralists, these ranged from the annual long-distance and large-scale migrations of the *Powindha* nomads in the north west frontier regions, to the semi-arid pastoralism of the *Bhattis*, *Joiyas*, *Wattus*, *Bodlas*, etc. of the Punjab, the *Bhotiya* and *Chang-pa* of the trans-Himalaya, the alpine pastoralism of the *Gujjars*, *Gaddis*, etc. in various parts of the Himalaya, the *Raika/ Rabari*, *Charans*, *Ahirs*, *Bharwards*, *Gujars*, etc. of Gujarat and Rajasthan, the *Todas* of the Nilgiris, the *Dhangar Gowlis* of Karnataka, etc. Livestock included a number of animals ranging from sheep and goats, buffalo, yaks and *dzo*, camels, and played an important role not only in subsistence and trading activities related to meat, wool, hides and bone, and draught animals, but also as significant elements in religious and cultural activities. Moreover, local breeds and pastoral practices evolved over long periods of time adapting to specialised ecological systems were important in the context of disease resistance, low input management systems, supplementary agricultural benefits, etc.

Colonial policies dramatically transformed affected a variety of pastoral practices in different parts of the subcontinent. While some of these were directly related to the colonial mistrust of nomadic peoples and their sedentarisation for gaining control, others included colonial policies ranging from forestry and agricultural expansion that manifested in indirect impacts on pastoral peoples. For instance, in the North West Frontier regions, colonial policies aimed at displacing the Russian presence in Central Asia disrupted the traditional annual migrations of nomadic Pathan populations from Central Asia to Pakistan and India. In the Punjab, the complementary coexistence between agriculture and pastoralism was disrupted with the push to increase cropped area. In the Himalaya, the traditional grazing practices of groups such as the *Gaddis* and the *Van-Gujars* were jeopardised when the government enclosed forests and charged grazing

fees. In all these cases, through various policies, the state appropriated collective properties and controlled access, increased taxation, disrupted temporal rhythms and redefined social relations. Here, the civilising ideologies of colonial science (rooted in Western thought) such as the reclamation of 'wastelands', the redefinition of grazing lands and common property in favour of agriculture, and the curbing of mobility as a legitimate way of life were considered synonymous with progress and resulted in a clash between local knowledges and practices which also took away a series of complex, traditional livelihood strategies that aided the survival of pastoral peoples (Bhattacharya 1995; Satya 2004).

Moreover, dominant cultural and economic views favoured the hardworking peasant. On the other hand, pastoralists and non-pastoralist nomads, with mobility as their dominant survival strategy and cultural hallmark, were the target of the state's disciplining and sedentarising ideologies which were eventually legitimated by The Criminal Tribes Act of 1871. Over 200 or so wandering communities labelled as 'habitual' and 'hereditary' criminal tribes were eradicated (e.g. the Thugs, thuggee) enumerated, their mobility curtailed, disciplined and made the target of reform by imperial civilising missions such as the Salvation Army (Nigam 1990; Tolen 1991; Bhattacharya 1995; Radhakrishna 2001). In (Nigam 1990) words,

"Through an elaborate corpus of revenue, juridical and police records the British Raj produced for itself a colonial archive: a ready-at-hand knowledge which in turn provided manuals for modifying and when necessary thwarting the challenge of traditional, unchanging-and to that extent anticipated-behaviour of the subject population. Inherent in the production of this colonialist knowledge was the conception of the essential types without history."

Drawing from Said's (1978) Orientalism, and Inden's (1986) analysis of the same, Nigam points to the

stereotyping of the temperament, mentality and other characteristics of a caste or group as a the generalising tendency of Western science in colonial practice. Although sympathetic voices were raised (e.g that of A.O. Hume), these were mostly with reference to converting them into moral subjects by reforming them and reinventing them as peasants. These had little to do with continuing the significant natural history knowledge base or the specialised, context specific, peripatetic production strategies possessed by most of these groups (Rangarajan 1996b; Sharma 2011).

It needs to be noted that even during the pre-colonial period, although there were efforts to sedentarise some mobile groups, all interactions were not antagonistic, and there was a great deal of room for dispersed forms of production outside that of settled agricultural systems (see Rangarajan 1996b). Tribal expertise and knowledge about terrain and local resources was used extensively by the state in some instances. For example, the Mughals used the *Banjaras* and their pack bullocks as supports for the military campaigns, similarly, the *Bedas*, who were expert archers were often recruited in to Tipu's Mysore army. Reflecting this dependency, rulers and state administrations had a more flexible policy towards tribal groups, which also enabled the latter to lead their traditional practices that included slash and burn cultivation, stock keeping, nomadic trade, hunting and trapping. However, the British with their lack of dependency on mobile groups, their fixed ideas about settled agriculture and property rights which they imposed, deprived many of these communities of their indigenous practices and interrupted local production processes, thereby bringing about a transition to a more 'intrusive political order and a harsher fiscal regime' (see Rangarajan 1996b).

In the post colonial era too, most of the restrictive policies initiated during the previous era were reinforced (e.g. Gooch 2009 commenting on the Van Gujjars). However, the attention accorded to research, policy and practice relating to itinerant and mobile communities has not been commensurate with the population size or to the extent of areas accessed

(Blench 2000; Sharma 2011). Despite the fact that South Asia has the largest population of mobile peoples (Rao and Casimir 2003), post-Independence governance has (through privatisation, encroachment and government appropriation) facilitated the decline in common property resources which have been the mainstay of mobile peoples as well as the rural poor (Arnold 1990). This decline underlies an associated decline in traditional management use and access rights of many marginalised indigenous groups. Concomitant with this dispossession is the drain in knowledge components relating to a range of tenure arrangements and usage rules, production and harvesting strategies related to marginal lands and drought relief, nutritional knowledge, and social and cultural values that were operational in what used to be approximately two-thirds of India (Singh 1986 estimated approximately two thirds of India was under community control in the 19th century). Robbins (1994) analyses the changing livestock demographics (shift from large stock such as cattle and camels to small stock such as sheep and goats) in arid Western Rajasthan in terms of changes in the regional ecology, alterations of local land-use institutions, and the increasing demand for meat, and terms these as the adaptations of the poor in order to use 'ecological and institutional interstices'. The coexistence between pastoralism and settled agriculture has also been disrupted in most parts of the country. For example, the traditional exchange systems of the *Rabaris* of Rajasthan with local agriculturalists (that included provision of dairy products and soil enhancement by livestock in exchange for permission for cattle camps and resting places) has turned into monetary and in some cases hostile relationships in recent times (Dyer and Choksi 2006).

In contemporary governance too, mainstream ideologies have questioned the fit between nomadism and development (Gooch 2009). Although a feature of colonial policy as well post-Independence conservation policies such as the Wildlife (Protection) Act, 1972 have been instrumental in widening this disconnect as they effectively curbed traditional occupations such as hunting, grazing and felling

(Rangarajan 1996a). It is also important to note that protectionist conservation policies as well as numerous conservation NGOs with their ideological opposition to practices such as hunting and trapping (critical livelihood strategies employed by many marginal communities and nomadic groups) have supported the curbing of traditional ways of life and knowledges and reformation of these groups. Nomadic traditional occupations involving wild species such as those of the *Kalandars*, *Saperas*, *Nari Kuravas*, *Bawarias*, *Pardhis* and numerous others have been targeted by animal rights groups, NGOs and government departments and over the years a number of rehabilitation and gentrification projects have been attempted resulting in the loss of cultural continuity and knowledge (Berland 2003; Dutt 2004; Berland and Rao 2006). Despite the extensive expertise in tracking, trapping, snaring and hunting a variety of species including problem carnivores (e.g. the *Bagh Maree* from Chota Nagpur and the *Baiga* from the Central Provinces) or the use of medicinal and toxic plant material (e.g. poisons from the genus *Aconitum*, *Datura*), most tribal groups have found their knowledge to be redundant and hardly relevant in the face of protectionist conservation. These shifts occur along a continuum. The *Nari Koravas* of southern India, another hunting community has been forced to make a living in urban areas Chennai often coming into conflict with urban communities and animal rights groups (see for example views against the Nari Korava at <https://www.facebook.com/CattitudeTrust/posts/498943253459024>). In Rajasthan, Dutt (2004) reports the shift in occupation of the *Bawaria* from famed hunters of the past to paid *chowkidars* (guards) of crop fields against species such as wild boar and *nilgai*. In a unique example from southern India, we also have instances of a more careful integration of traditional knowledge. The best example is that of the *Irula*, a hunting community who were involved in the extensive snake skin trade of the past century who are now employed as snake catchers for the snake venom industry and as custodians of a cooperative that manages it. However, it has to be noted that in most cases, the changes not only signify a change in ethos that is brought about by outside influences, but also

associated changes in skills and expertise, nutritional, cultural and social aspects.

Rigid perceptions of post Independence development in India has meant that governmental support has largely been contingent on the willingness of mobile people to sedentarise and the relinquishment of their specialised occupations making it increasingly difficult for nomadic groups to retain or use their traditional skills or knowledges in current and future scenarios (Sharma 2011). The contemporary development agenda influenced by Hardin's (1968) 'tragedy of the commons' ideology and related debates have fuelled the disappearance of the commons resulting in a similar situation for the rural poor whose access to land has been curbed along with their practices. Arnold (1990) explains that the decline in local, customary CPR management arrangements in the face of increased governmental control and developmental inputs has catalysed a shift to detrimental open access regimes. In response to some of these issues, hybrid management systems using varying components of local and governmental knowledge and institutional control have been attempted in some parts of the country. Most of these have been initiated and have been established in the hill and forest areas of the country where area under CPRs is significant. The Forest Department has been the main governmental actor in this regard. These include the joint management arrangements with the Van Panchayats in Uttaranchal, the Hill Resource Management Societies in Haryana, the Village Development Committees of Himachal Pradesh and the Village Protection Committees of West Bengal. The most successful among these initiatives have been in areas where the technical knowledge was already available, with the missing ingredient being an effective management agreement between the government and the local body (Arnold 1990). At the same time, a number of these cases are characterised by instances where local knowledge was not given relevance. A prime example is the numerous social forestry arrangements where large scale plantations of exotics such as *Eucalyptus* instead were planted despite local preferences for native species.

The focus of a variety of development initiatives including that of gentrification projects and modern education (which is rarely contextual) for mobile groups, generational gaps in knowledge transference for rural communities, etc. are likely to erode traditional knowledge base of common lands further. However, it is hoped that the establishment of the Nomadic Commission (jointly

set up for denotified, nomadic and semi-nomadic tribes) as well as contextual education might help development concerns and revive livelihoods and practices. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 if implemented properly is also a chance at redressal as far as the nomadic and marginalised are concerned.

Conservation arenas

As is the case with most themes explored in this manuscript, the colonial experience was central to the origin of the contemporary conservation movement in India. However, the focus on colonial conservation as a starting point for the current exercise does not efface the significance of numerous pre-colonial conservation practices that incorporated long-term, utilitarian, rational use of resources (e.g. Kautilya's concept of *artha*), or non-utilitarian, transcendent ethical orders for the protection of species (e.g. elephant forests of Ashoka) (Rich 2010). The Indian subcontinent's long tradition of indigenous use is reflected in a diversity of use including nutrition, medicine, religion and spirituality that is still operational. At the same time, the contemporary discourse on Indian conservation can be split along broad axis of colonialism which redefined the once fluid boundaries between village and forests and the dynamics of people-nature relationships (Rangarajan 1998).

Colonial knowledge in combination with imperialist expansion was instrumental in the establishment of protected areas in Africa and India. Across the tropics, initial conservation agendas were rarely overt in their economic and political intent; game and forest laws were articulated as being necessary to overcome the inefficiency of native people (projected variously as rootless, ignorant, recalcitrant and savage) to manage their own resources (MacKenzie 1988; Wolfe 2006). In India, when colonial forestry's focus turned to timber extraction, traditional knowledge-based practices such as shifting cultivation, burning, girdling of trees, came

to be viewed as primitive and wasteful (Poucheпадass 1995; Sivaramakrishnan 1996). Saberwal (1997) points out that early conservation too was informed by the alarmist desiccationist discourse (which in turn was a cumulative impact of European experiences of the previous century as well as the colonial experiences in islands; see Grove 1993; Rajan 1994 for explanations). Later on, Indian foresters and conservationists were also influenced by American forestry and its increasing focus on forest conservation. The underlying theme of twentieth century conservation agendas include the influence of American romanticist conservationists (Muir, Thoreau, Leopold, etc.) as has been a persistent adherence to the development era tenets of neo-Malthusian paradigms that implicate population growth and poverty in developing countries as the primary driver of environmental degradation and biodiversity loss. In this context, influenced by American scholars such as Garret Hardin (the tragedy of the commons, 1968), Paul Ehrlich (the population bomb; 1968), etc. conservation biologists have spawned a simplistic, yet vast literature on the need for exclusive protectionism, and this has found resonance in India as well.

Rangarajan (1996b, 1998) argues that unlike the case of colonial Africa which saw a rapid evolution of wildlife preservation and game laws, the preservation of wildlife was not a key focus of the early colonial experience. Although human-animal relationships were multifaceted, during the colonial period, 'scientific expertise, aesthetic concerns, and sporting interests, broadly concurred' on the subject of extermination of

a hit list of unwanted species that brought about loss of lives, crop depredation or loss of sporting opportunities (Rangarajan 1998). These species were countered using local knowledge and lessons learnt from an early European antecedent, and the selective removal of vermin, especially carnivores was a significant feature of this period. Colonial administrations routinely used the expertise of 'subaltern *shikaris*' (Rashkow 2014) (poor tribal and rural hunters thrust into subordinate roles of hunting for the British) not only for assistance in their own hunting exploits, but also in the removal of dangerous carnivores and other species of vermin (Rangarajan 1998; Rashkow 2014). Although this policy had its dissidents (colonial officers such as G. P Sanderson felt that large predators such as tigers as allies against widespread ungulate crop depredations, others opposed due to religious or cultural reasons), tigers, wolves, leopards, bears and a number of other species were targeted under this approach where local hunters were provided incentives for their eradication. Many communities such as the *Gonds*, *Pardhis*, *Baigas*, etc. secured significant employment opportunities in these vermin eradication campaigns. In this sense, these 'hunting tribes' were a colonial creation (provision of bounties were systematised by after 1857) which resulted in hybrid hunting practices and technologies for the colonists (e.g. beats) and tribal communities (e.g. rifles). However, as species declines started being noticed from the beginning of the twentieth century onwards, the time had come to dismantle this tribal identity and replace it with a new one. Local skills were deprecated and game as a scarce resource became the object of sporting interests of various elite groups. The administrators were quick to label the hunting tribes whose services they once extensively relied upon as poachers and law breakers; other groups such as native hunters were also disallowed from hunting. The radical shift in perceptions about wildlife exalted sport hunting as a noble cause, whereas traditional hunting for subsistence or ritual was relegated to a subaltern activity that was punishable by law. However, despite the primacy accorded to elite hunting, local communities routinely resisted sportsmen in the attempts at game. These attempts at resistance can be broadly classified under the

general term of 'cultural conservation' (Rashkow 2015) which included religious, resource-based, local politics and nationalist opposition to hunting or combinations of these (e.g., religious environmentalisms, ecological nationalisms). Rashkow (Rashkow 2015) also alludes to the possibility of these acts of resistance as manifestations of challenges to imperialism (the hunt was a ritualised, symbolic activity of white colonialism; MacKenzie 1988). These incidents nevertheless were instrumental in the framing of emerging conservation laws in the subcontinent the exclusion of at least some sites, periods, and species from colonial hunting. These developments also catalysed a shift in the re-envisioning of many reserve forests and other use-oriented areas into protected spaces for wildlife conservation; from a mere handful of protected areas before 1947, the number of protected areas has risen to over 400 in number.

The first few decades of the post-colonial period, especially the Nehru-Gandhi era (especially the period between the 1950s and the 1970s), paradoxically acted as the development phase where forestry bowed down to industrialisation as well as the pioneering phase of Indian environmentalism (see Guha 1983; Rangarajan 2006; Rashkow_2014). This period also ushered in an era of species-based conservation, where large charismatic vertebrates selected as flagships and umbrella species were to form the basis of conservation on a large-scale. Although tigers had topped the list of problem species during the agricultural expansion period, as their numbers dwindled, the voices of dissent against large-scale killing and bounty systems grew louder. The support of elite public figures and hunter conservationists such as Jim Corbett in the 1920s and 1930s were vital in this regard. This resulted in the establishment of the protected area system (from the 1930s) and the initiation of Project Tiger (in 1973), a landmark conservation initiative which aimed to protect the tiger and its habitat. Although it took the better part of a century to reach this stage, the radical overturning of enmities with the tiger was unimaginable during the earlier colonial period. The Indian government's rhetoric at the time stressed on the nationalistic policy of inculcating in-house scientific

development as a check against dependence on any country. While this apprehension about a return to colonial times where outsiders imposed scientific ideas was justifiable, this also closely paralleled a deterioration of relations with the US over the latter's position in the 1971 Indo-Pakistan war. The requirement to develop internal expertise and knowledge related to wildlife management was used to counter not only the involvement of US scientists and institutions (organisations such as the WWF, Smithsonian, etc. were involved in India since the 1960s), but also that of Indian biologists primarily affiliated with non-governmental institutions who collaborated with them. The Indian Wildlife (Protection) Act, 1972 and the launching of Project Tiger cemented the state-controlled model of conservation for approximately 25% of India's land area. This signified a shift from scientist-driven conservation of the 1960s to government-dominated conservation in the 1970s. Underlying these developments was a pervasive reactive sentiment among bureaucrats against the influence of an emerging US science (in some cases funded by the US army), and the arrogance of scientist-dominated knowledge, both international and indigenous. Lewis (Lewis 2005) refers to role of the imperialist 'BCI mentality' of US scientists (referring to the Barro Colorado Island US field station in Panama where US scientists established a tropical field station, carried independent projects without building adequate local collaboration or relationships with scientists, local people or government officials) as well as the constant criticisms (of the FD) voiced by their Indian counterparts in furthering the divide. It has to be remembered that this period, particularly the prime ministership of Indira Gandhi was characterised by a somewhat authoritarian leadership which was sympathetic to conservation in general and to and ideas proposed by elite scientists and conservationists in particular. Indian scientists used international experts as mouthpieces to raise issues, who according to Lewis (2005), in the belief that science transcended national boundaries, and trusted foreign biologists to further their cause more than their non-biologist counterparts in India. US as well as Indian science's cultural imperialism put them in direct opposition with high level bureaucrats (who

were often passionate conservationists themselves), who thwarted their scientific intentions by devising obstacles to both foreign and Indian research. Both groups however, had highly influential individuals with high profile connections who used science and politics to good measure to curry favour with their respective governments and conservation organisations. This legacy has left an indelible mark on the politics of conservation in India if one were to go by the numerous turf wars and ideological differences between foresters and scientists over the decades, and in Lewis's (Lewis 2005) words, this shows that conservation biology as a science 'is practiced and applied not in laboratories but in a world laden with power differentials between governments, between institutions, and between people'.

The divide between biological scientists and non-biologists (be they managers or local communities) is a widening one in which knowledge continues to play a very important role. Guha (1997) points out that alarmist statements by biologists (e.g. apocalyptic warnings about the 'sixth extinction') are often a strategy towards the privileging of their own knowledge and expertise over that of others, especially local communities. According to Guha (1997), this 'authoritarianism' is evident in biologist discourses of the post-colonial period which are often deeply antagonistic to local people ('anti-humanism'), and which allude to the latter's inability to manage his own resources (an updated version of the White Man's Burden). Local traditions and practices, especially those related to hunting and harvesting of species to which Indian biologists are often ideologically opposed to, are often opposed using the pretext of privileged scientific expertise. Much of the rhetoric is aimed at keeping parks free of human interference. In this context, one can detect the inroads made by the strong influences of radical American environmentalism (Guha 1989) and deep ecology within the conservation biology community. It is particularly ironic for a country such as India which spent the better part of its history trying to tackle human-wildlife conflicts, that the myth of pristine wilderness has been used to displace and relocate people.

Equally important is the implicit support accorded by Indian conservationists to Western portrayals of cherry-picked Eastern spiritual traditions as inherently more environmentally friendly and benign. This stereotypical projection of India as the land of vegetarianism and *ahimsa* reflects a lack of understanding about the diverse martial and hunting traditions of the country (Rashkow 2015). While it is important to note that in the current scenario a switch to sole traditional management is impractical, it is the pre-eminent position accorded to the protectionist paradigm in forest management and the lack of hybrid knowledge-based approaches that is problematic in contemporary conservation.

Rashkow (Rashkow 2015) refers to two starkly opposing standpoints on *adivasi* relationships with wildlife conservation. The predominant protectionist paradigm which has proponents among both biologists and forest administration labels them as 'ecological sinners', whereas contemporary conservation discourses in India outside of conservation biology is replete with people-oriented viewpoints which upholds them as 'ecological saints'. While the biologist standpoint has been elaborated in the previous section, Sinha et al. (1997) refers to 'new traditionalist' discourses which portray pre-colonial, tribal and indigenous use in spiritualised and romanticised terms or that of the 'noble savage'. This ideology which has found support from various proponents such as Vandana Shiva, J. Krishnamurti, etc. also reflects urban conservationists' constructs of tribal/ traditional spirituality in their own ways (which may in fact be far removed from the reality experienced by tribal communities themselves). For example, while ecofeminism as propounded by Shiva has brought to the fore important points for debate about gender and the environment, there are equally problematic alliances with dominant Brahminical traditions and morals. Moderate viewpoints in relation to traditional knowledge systems such as those of Gadgil and Kothari are also still deemed problematic by some (see Sinha et al. 1997).

In the face of these developments, numerous local and tribal communities have used identity politics and

traditional relationships as strategies to gain a foothold in their struggles against dominant forms of power and science. In the conservation scenario, this necessitates a stand against not only the Forest Department, but also conservation's most vocal stakeholder, the urban middle class environmentalist with his western view of nature (Agrawal 1985). In an increasingly polarised 'tiger vs. tribal' scenario (Sekhsaria 2007), communities deliberately project embodied relationships by labelling themselves as 'children of the forest', 'forest people', etc. For example, the *Van Gujjars* in the Himalaya adopted the prefix 'Van' (*van* = forest) to give voice to what was till recent times a tacit label of collective identity (see Gooch 1998). Tribal activist C.K. Janu, titled her autobiography as '*Mother Forest:*' (Janu 2004). In fact, the usage of the appellation 'adivasi' (literally translated as 'original/ first inhabitant' and used to denote a heterogenous group of ethnic and tribal groups in India) itself has become more commonplace in recent times (Baviskar 2005a). In many cases, indigenous groups are compelled to use strategies that advertise explicitly, their links to forests and landscapes and their knowledges that were hitherto unstated to overcome the alarmist rhetoric of environmentalists as well as to retain access to ancestral lands and rights of use in exploitative political struggles that marginalised them. Claims to (indigenous) knowledge have now become vital political symbols of strategic value for use against various forms of control.

Critical discourses and practical dilemmas challenging exclusionary reserves and protectionism as well as a global shift in sustainable development related thinking favouring decentralisation laid the foundations of Integrated Conservation Development Projects in the 1980s. Although these were top-down, large institution driven projects (WWF played a major role), at the time of their initiation they were radically divergent in their conservation approach and hence could be considered the first real alternatives to exclusionary protection (Hughes and Flintan 2001). In a manner similar to the introduction of JFM practices into forestry, a series of Eco-development projects were initiated in the peripheral areas of certain protected

areas in India. These projects brought together the twin goals of biodiversity conservation in protected areas with socio-economic development of peripheral localities of selected PAs. Local knowledge and local practices were considered significant, however, there is a view that wildlife conservation as an objective preceded all others and many activities were focused on weaning people away from their traditional (natural resource-based) practices (see Baviskar 2005b). Case studies also point out the problems associated with the across-the-board introduction of exercises such as PRA and the inclusion of outside experts, and therefore the removal of context specificity (for Indian case studies, see Sanjayan et al. 1997; Baviskar 2005b; Gubbi et al 2009; Varma 2009, etc.). And as Baviskar (2005b) points out, participation is seen as something that promotes the implementation of the programme, rather than a right that the villagers have to be involved in making choices about their future. Similarly, inclusion of local knowledge is often limited to gathering information on uses of medicinal plants, rituals, etc. which are then incorporated into a more superior 'scientific' research. The results of such exercises are then used to devise strategies for the new management objective of conservation which are opposed to the interests or traditional practices and livelihoods of

local communities (Baviskar 2005b). Although the results of these projects have been mixed as far as conservation is concerned, ICDPs were instrumental in further such experiments relating to community-based conservation and alternative conservation strategies involving the non governmental sector. In many parts of the developing world, this period also saw the increasing involvement and influence of non-governmental actors in conservation. This period of ascendancy of NGOs and their embracing of the new wave of capitalist free market ideologies has resulted in a spread of neoliberal conservation strategies such as ecotourism, payments for ecosystem services and avoided deforestation, etc. The critics of neoliberal conservation (Igoe and Brockington 2007; Castree 2010) argue that neoliberal strategies - which entails a re-regulation of nature through commodification and considers a partnership between conservation and capitalism a desirable exercise - facilitates territorialisation, privatisation and elite appropriation and with it exclusion of local communities (Fletcher 2010). In the context of circulating ideas and knowledge, however, it is important to note that contrary to many developing countries, in the post-liberalisation era in India, neoliberal conservation strategies have been slow to take off (but see Munster and Munster 2012).

The role of knowledge: Summary and critiques

In the preceding sections, we summarised along a broad historical sequence, the role of knowledge in natural governance sectors in India. From this complex and vast collection of academic scholarship, it is imperative to extract coherent summaries and critiques that could inform both theory and practice related to natural resource governance. The main points emerging from the review is the complexity as well as the interactive nature of historical and contemporary interfaces between colonising and local knowledge systems as they

relate to different governance contexts. While large-scale foreign influences in the form of colonial science and development discourses impacted Indian resource dynamics, a more diffused, yet, pervasive incorporation of local and traditional practices yielding hybrid context-specific knowledges are observed as local and regional experiences are analysed in detail. In the following paragraphs, we explain some of these themes further by distilling and reiterating a set of key insights arising from an analysis the role of knowledge in the Indian context.

Colonising knowledges and ecological watersheds

Two key periods of large-scale outside knowledge influences and their respective ecological ramifications can be identified for India. The first was that of colonial scientific knowledge which coincided with the rise of capitalism and British imperialism; the second was the post-colonial era which included the lasting impacts of colonisation accompanied by the emergence of capitalism in United States and the ushering in of the development era. Both 'colonial' knowledge (e.g. scientific forestry) and 'development' can be labelled as colonising forms of knowledge (see Sivaramakrishnan 1996). In the context of ecological watersheds, Rangarajan (Rangarajan 1996b) designates colonialism as the crucial divide. He identifies the triad of government forestry, canal irrigation and carnivore control as the critical drivers of landscape change in colonial (and even post-colonial) policy and its ensuing ecological transformations. Colonial knowledge during this period can be explained in terms of the increasing influence of capitalist thinking that included the domination of nature as an important legitimiser of power and colonialism (Gilmartin 1993). According to Adas (1989), Europeans considered their understanding of nature superior to that of other cultures and their resourcefulness in commodifying nature and putting it to productive use was used

as justification for colonial takeovers. Science and technology (e.g. flow models developed by colonial irrigation engineers, scientific forestry that measured biomass, stand volume and wood outputs) as the newly designed instruments of capitalist conquest were therefore given a high status (Adas 1989; Gilmartin 1993). Colonial technical improvements solved some problems while creating others. For example, the development of the railways ameliorated the impacts of famine in some places, exacerbated the same in others (Attwood 2005; see McGinn paper; Sweeney 2008).

The second phase of the application of international knowledge has been the post-Independence era with its combined politics of carried over colonial bureaucratic and administrative systems as well as that of the US-inspired development era agendas and the creation of the Third World (see Escobar 1995 for a general reading; Philip 2004 for the Indian context). As Guthman (2002) points out, the 'historical conjectures' that triggered paradigm shifts in post-World War II development witnessed parallel shifts in environmental discourses and environmental degradation. The construction of large dams or large-scale plantation forestry with limited benefits but ensuing environmental degradation is symbolic of

scientific and bureaucratic thought during this period. Nandy (Nandy 1989a) also comments on a somewhat unique stance taken by the Indian leadership when Jawaharlal Nehru '*decided to keep the practice of science outside politics but ensured that the scientific estate had a direct, privileged access to the state. It was as a part of this 'double vision' that Nehru, the modern élites which gathered around him, and the Indian state began to build science as a major source of justification for the Indian state as well as for their political dominance. That the formula did not keep science out of politics but only introduced another kind of politics into science is one of those paradoxes which lie at the heart of the distinctive relationship between science and society in contemporary India*'. This relationship is not only confined to key developmental themes (e.g.

nuclear power) but in diverse fields in contemporary India. For example, in the conservation arena, while lobbying by the conservation elite (both prominent conservationists as well as biologists) use their superior scientific knowledge and ideologies to facilitate pro-protectionist policy decisions, local communities do not have the same ease of success and it is often only the reactive, violent responses that receive any attention. As in the case of Guthman's (2002) argument (for Nepal), it can be said to be true of India as well, that, not only were environmental problems insufficiently conceptualised and analysed, compelling cases were (and are still) made in favour of certain arguments and politically motivated interventions that are intimately tied to power relations of the development era.

Dismantling monoliths

While both colonial science and development ideologies have exerted large-scale influences in India, perhaps the most prominent drawback of a number of analyses on these forms of knowledge has been of their viewing as homogenised entities devoid of variation within them. Not only are the conventional opposing categories of 'modern' and 'traditional' knowledge difficult to separate along conceptual lines, in practice, there has been a constant amalgamation of centralised and local knowledges. Here, it would be important to reiterate the difficulty with simplistic dichotomous definitions which the researchers of one system of knowledge typically attribute to the other, e.g., the classification of colonial science by new traditionalists or the characterisation of traditional knowledge by colonial historians. According to Rangarajan (Rangarajan 1996b), in their enthusiasm to give legitimacy of traditional resource users and knowledge, proponents of traditionalist perspectives portray colonialism as a monolith that was an anti-nature and anti-people. At the same time, for characterising traditional knowledge, Seth (2009) points out the difficulty in prescribing to the idea of an 'authentic, systemic and autonomous indigenous knowledge as

opposed to a singular scientific knowledge'. This stems from the difficulty of considering local or indigenous knowledge generation as processes isolated from their historical and dynamic contexts. In many cases, the knowledges that we are looking at are themselves likely to be hybrid systems which are the products of circulation across local, regional and transcontinental spaces (Gupta 1998; Raj 2010); this hybridity could be regarded as an emergent property that reflects the failures of colonial dichotomies or could in fact arise from new colonial and post colonial binaries (Seth 2009).

Hence a number of researchers caution against the stereotyping tendencies, particularly of broad brush analyses and encourage the examination of local and region centred studies (Sivaramakrishnan 1996; Bandopadhyay 2010; Goldman 2007; Goldman et al. 2011) in what Sparke (1994) terms as the 'hardwork of specific analyses'. In the Indian context, while the colonial scientific project was large-scale and centralised, a closer look reveals tensions and interactions with local/ traditional systems in most sectors. The transfer of metropolitan science to that

of the province (i.e from core to periphery) was not a fool proof, uniform one. Instead, as Sivaramakrishnan (Sivaramakrishnan 1996) points out in the context of colonial forestry, 'there is an interactive and contextualised production of knowledge' that involved a range of actors (from imperial administrators to low level ground staff). 'Scientific forestry has frequently been treated as received doctrine, either emerging from the intellectual history of western science, or from the imperial, exploitative project of colonialism. Such consolidation of the identity of scientific forestry over time and space inadequately acknowledges, let alone explains, the misadventures and experiments through which it was crafted. We are then likely to miss as well the part played by particular colonial locations in these several historical modifications and reconstructions of scientific knowledge' (Sivaramakrishnan 1996). In this sense, the history of science is one of integration of imperial science and indigenous ideas (MacKenzie 1990 and Sivaramakrishnan 1996) and a meaningful separation of the two is likely to be problematic (Agrawal 1995). These examinations also show that by no means were the colonial science projects entirely consensual or homogenous. Forestry, irrigation projects, famine relief, all had detractors within the system itself (for forestry, see Brandis and others, for irrigation, see Gilmartin (1993, p.221), some driven by scientific curiosity, others by humanitarian motivations. While there was a general tendency of administrators further

removed from local situations to favour Benthamite utilitarianism, it is difficult to envisage that those at the local level were not moved by immense suffering such as those of the famine era.

Most historians of science also concede that although the colonial apparatus was primarily geared towards profit generation, there still existed a significant scientific component (Grove 1993; Rangarajan 1994; Sangwan 1994, 1997; Sivaramakrishnan 1996). In the field of forest governance and conservation, a very large body of scholarship was accumulated by naturalists, botanists and medical practitioners and other local administrators. Although many of them were amateurs, these individuals contributed extensively to the fields of forestry, taxonomy, surveying and climatology as well as to the emerging debates on environmental degradation and climatic phenomena such as the El Nino (Grove 1993; Rangarajan 1994; Sangwan 1994; Sivaramakrishnan 1996). In other words, looking from this perspective lends support to the view that 'Western knowledge has been co-constituted with colonialism' (Seth 2009); for similar viewpoints see Pratt 1992; Philip 2004). This applies not only to integrated knowledges in natural resource management fields like colonial forestry (Sivaramakrishnan 1996) but also to the role of unique tropical contexts in changing world views of science in general (e.g tropical medicine: Arnold 1993; ecology: Darwin 1859).

Valorisation of pre-colonial traditions

In the analysis of natural resource governance trajectories in India, it is important to note that while the focus is often extensively on the underlying colonial and post-colonial knowledge driven degradation (e.g. colonial forestry, large dam projects), this does not mean that these large-scale processes were solely responsible for environmental degradation, nor does it imply that all forms of pre-colonial or contemporary traditional use were/are sustainable or without ecological implications. However, the forcefulness of colonial and post-colonial

criticisms combined with the discourses on valorisation of traditional systems (e.g. Shiva 1988; Gadgil and Guha 1993) seem to have brought about what Rangarajan (1996b) terms an assumption of a stasis or a 'long equilibrium' in the pre-colonial period and an inadequate problematisation of pre-colonial practices. While he supports the designation of colonialism as a crucial divide in terms of extent and impact, Rangarajan (1996b) cautions against its exaggeration as a scapegoat for all degradation.

It has been emphatically pointed out by others as well that negative commentaries on the problematic aspects of colonial land management and post-colonial development strategies has resulted in an oppositional discourse that paints traditional knowledge-based systems as benign, sustainable and exclusively indigenous (Sinha et al 1997). These include arguments suggesting special gender relationships (e.g women as nurtures of nature; ecofeminist arguments as put forward by Shiva (1988), romanticised conservation ethics for traditional people (Pereira and Seabrook 1990; Pereira 1992), caste-based regulation of resource governance (Gadgil and Guha 1993), etc. Sinha et al. (1997) christen this the 'new traditionalist' discourse and remind us that many aspects of traditional knowledge and practice (pre-colonial

and otherwise) have embedded within them facets of social domination and subordination. According to these critics, this discourse is a key component of the anti-development rhetoric highlighting the poor track record of development-era strategies in bringing about social and environmental justice. As a highly politically engaged oppositional discourse, critics point out that new traditionalism not only offers a different version of environmental history, it has the potential to reshape resource use and governance based on the questionable credentials of traditionalism as a benign and socially just set of knowledges. In the same way that conventional development ideas are put to the test, they urge for the evaluation of the potential of new traditionalist knowledge claims as solutions towards current governance related impasses.

Criticisms from post-colonial theory

The limited success of formal, top-down projects of the development era have resulted in a renewed interest in developing alternative strategies for natural resource governance. In this scenario, the potential for deploying context-specific traditional knowledges and technologies within the Western development framework have received renewed attention from theorists and practitioners alike, but as post colonial theorists caution, are hardly devoid of problems. These include the representation of marginalised voices and outsider perceptions and portrayals of local knowledges, the limited way in which traditional knowledge is drawn into the development process (i.e as technical or artefactual incorporation as opposed to fundamental or conceptual overhauls that challenge the perceptions of modern science), and the expectation that indigenous knowledges and practice remain static and unchanging for them to be acceptable (Briggs and Sharp 2004). Others such as Seth (2009) also argue that while at one point garnering support for local/indigenous forms of knowledge and the groups affected by it was critically important, contemporary political scenarios on the other hand also demonstrate the way

in which traditional knowledge holders exercise power (e.g. identity politics).

Traditional knowledge systems on account of their subaltern nature are in particular prone to outsider interpretations. Accurately representing the experiences and expectations of marginalised communities is problematic when considering the question posed by Spivak (1988) as to whether the subaltern can ever speak (see also Zook, 2000, citing Wilhem Abel in the context of famine: '*How shall we describe the hunger which the poor experienced? What they felt was rarely transcribed by themselves, those who took up the pen described for the most part only what they saw and heard*'). A most striking example in the Indian context is the Chipko andolan, a conflict over forest resources (local resource users particularly women protested over contractual tree felling by the Forest Department) became the popular rallying point for environmentalists across India and has been instrumental in shaping global perceptions of Indian environmentalism. This popular movement has been variously interpreted in ways belying the ideologies of its proponents (for varying perspectives,

see Shiva 1986, 1988 Guha 1990) prompting Rangan (2000) to say that '*facts could be used to reveal Chipko as a women's movement, a non-violent movement, a peasant movement, an environmental movement*'. Critiquing the new traditionalist interpretations, Sinha et al (1997) take pains to point out Chipko as a complex political project instead of a civilisational response, and criticises the simplistic drawing of connections to concepts such as *ahimsa* (non-violence) and Vedic tree veneration (there were periods of violent encounters and destruction of trees by local communities within the Chipko movement), which might result in the production of discourses that are alien to the contextual approaches of local communities (Kalland 2000). Along this vein it is not only essential to critique Orientalist constructions of traditional knowledge and practice, but also examine the limited extent to which modern science is open to the inclusion of traditional knowledge as it relates to fundamentally different worldviews and ideologies of its practitioners. The experiences of local communities, particularly technical and artefactual elements, are 'incorporated' into the modern scientific system typically only if they fit within the modern scientific framework, but hardly so if they challenge the value systems of the dominant worldview (Briggs and Sharp 2004). Spivak (1998) considers this trivialisation and

relegation of traditional knowledge to the margins by Western experts as 'epistemic violence' (see also hooks 1990 for a similar viewpoint). Moreover the dynamism of traditional environmental knowledges is challenged as they are expected to remain static if they are to be included as valid for inclusion (Briggs and Sharp 2004).

In the context of India, Sundar (2005) urges that issues related to indigenous knowledge need to be viewed within the dual context of the lack of a distinguishable category of people who can be termed 'indigenous' ('*adivasi*' in the Indian context), while at the same time taking cognisance of the marginalised and exploited scheduled castes and tribes of the country. In Agrawal's (1995) opinion, the usage of these terms is further problematic, as 'to use the term "indigenous" in the Indian context is therefore to be complicit in a history of somebody else's making, to accept the category of Hindu and tribal as defined by a century and more of colonial knowledge creation, to deny the possibilities of common construction and common destruction by 'indigenous' and non-indigenous alike. If it is impossible to box indigenous people neatly, defining their knowledge in bounded terms is even more difficult, given the status of knowledge as a transferable, flowing entity' (Agrawal 1995:422).

Critical junctures

Natural resource governance discourses especially highlight the need for science or knowledge and practices need to be necessarily viewed within their socio-political and historical backdrops. Rangarajan (1996) points out that '*Ever so often, the idea implicit in environmental histories is that there were critical junctures in the past when specific interests or the bias of dominant groups led to a certain set of choices in preference to others*'. The political extent of these 'critical junctures' controlled the way in which science was deployed; the economic and imperialist agendas of British colonialism found their parallels in colonial science. For example, Rangarajan (1996b) reminds us that when compared

to India, British colonialism focused on a different set of imperatives in different colonies (e.g. stock control and watershed management in southern or eastern Africa). While high levels of wild animal pestilence and direct attacks by carnivores necessitated the extermination of wildlife during much of the pre-colonial and colonial times, their preservation mirrored a shift in international discourses over nature preservation and the lobbying of powerful elites (Rangarajan 1996b). Similarly, imperialist agendas justified the use of fire in many parts of the Indian subcontinent for commercial forestry while at the same time the local burning practices of forest-dwelling communities were banned

(Sivaramakrishnan 1996).

Contemporary India, by virtue of its bicultural experience spanning several centuries, epitomizes the global problem of knowledge and power in our times (Nandy 1989a). Therefore the hybrid knowledges in the country are an amalgamation of both local/traditional knowledges and Western science. Nandy (1989a) is of the opinion that this puts the country in the advantageous position of creatively incorporating

elements from the modern knowledge system into its traditional systems of knowledge. This would be a reversal of what he calls the conventional one-way format of enriching modern science with traditional knowledges. Although the practicality of this idea could be questioned on several grounds, discussions pertaining to the opportunities of embracing a range of philosophies and world-views would be a new starting point for devising strategies of knowledge-based governance in India.

2

LEK in India

A Biogeographic Analysis

Meera Anna Oommen, Seema Shenoy and Aarthi Sridhar

Introduction

As one of the mega-diverse countries of the world, India not only has high levels of biodiversity, but an equally diverse set of human communities that depend on natural resources. Research on traditional knowledge systems has been gaining a great deal of importance since the last two decades leading up to the millennium. Traditional and local knowledge related explorations have particularly been prominent after India became a signatory to the Convention on Biological Diversity (CBD) in 1992. The CBD stresses on the crucial importance of traditional knowledge to achieve its objectives and is especially mindful of the need to ensure equitable sharing of benefits with local and indigenous communities who possess this knowledge. Medicinal and healing practices, nutritional strategies, cosmetics, crop hybrids, agricultural and fisheries technologies, animal husbandry practices, religion, ritual, etc. are only a few of the multitude of contexts which commonly employ these forms of knowledge. Indigenous perspectives and locally developed resource management strategies that have accumulated over the years have resulted in an adaptive body of knowledge that continue to be of practical significance to local

communities. Research conducted in these systems has also shown that traditional knowledge systems have the potential to inform sustainable resource management and biodiversity conservation over a larger scale.

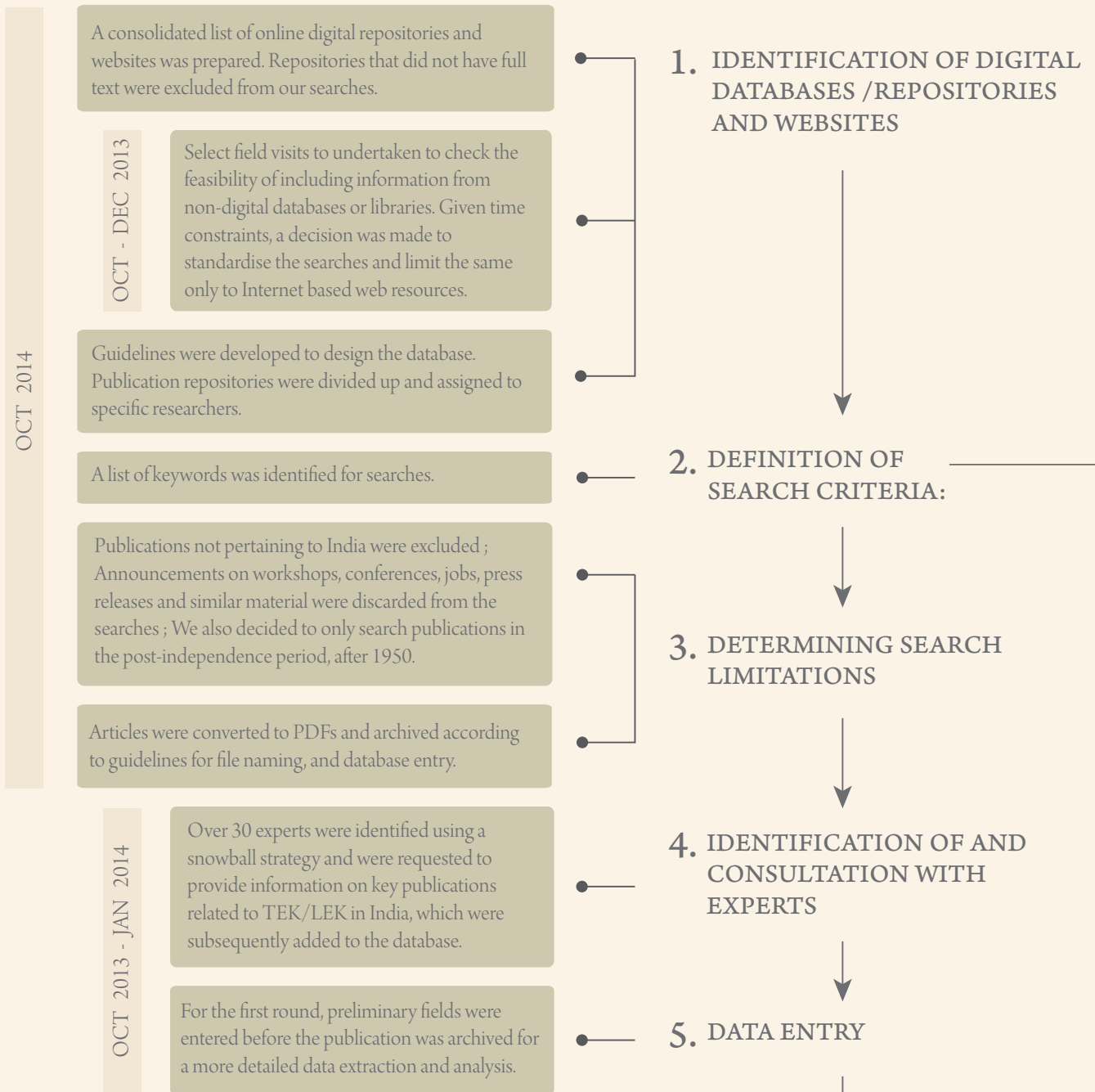
This chapter summarises contemporary scholarship on traditional and local ecological knowledge (henceforth TEK/LEK) in India. Studies on the subject published between 1980 and 2014 were compiled and summarised systematically to create a database of traditional knowledge literature for India. Types of publications, spatial units of study, time lines, patterns of distribution of studies in different states and biogeographic zones, etc. have been analysed in this chapter. The purpose of this exercise is to provide a descriptive summary of the extent and type of TEK/LEK literature not only at the national level, but also at the scale of significant ecological and geographical units and their attendant human communities. For this purpose, for the most part, a biogeographic zone approach is followed that takes into account, large-scale human-environment relationships and associated resource management strategies.

Methods and analysis

The compilation of the TK database for India was carried out using the framework outlined on pages 40-41. The database compilation involved a five step process that included identification of major internet search engines and institutional digital databases. We also identified a set of experts who we interviewed and held brief discussions with to identify key literature in the field. This strategy helped us add more databases, websites and publications to the database. The major steps involved in the data collection process included 1) identification of databases and repositories of studies involving TK in India, 2) definition and selection of search criteria, 3) determination of search limitations related to time periods selected, types of publications considered, geographical delimitations, etc., 4) renaming and archiving publications in an easily searchable spreadsheet database and easily accessible archiving format, and, 5) definition of data fields that are significant to the study.

Summarisation was carried out using simple statistical measures such as counts, percentages, and proportions. The representation of these figures has been facilitated by the design and development of dedicated infographics for each set of results. Additional methodological details and clarifications are also provided wherever necessary in the relevant sub-sections of this chapter.

For this study, we were interested in analysing the content of publications that had TEK/LEK as their focus, but only within the context of India. We made a decision not to source publications that dealt with countries such as Pakistan, Bangladesh or Burma even though these countries formed part of the Imperial crown and shared a post-colonial present. Although we identified over a 100 Indian digital online repositories, a majority of these did not provide access to the full text of documents and had to be discarded from our searches. Following the identification of databases, the research team undertook searches based on keywords that looked for a combination of keywords. Keywords included “Traditional knowledge”, “Local knowledge”, “Local ecological knowledge”, “Indigenous knowledge”, “People’s science”, “Indian Science”, “Local science”, “Traditional science”, “knowledge+nature+wildlife”, “hunting + knowledge”, “traditional + fishing”, “traditional + practice + marine”, “traditional + technique + fish”. Publications that did not pertain to India were left out of the searches. Also excluded were announcements on workshops, conferences, jobs, correction notes, book releases and corrigenda. Duplicates and documents that actually did not contain a TEK/LEK focus in any manner were filtered from the final database leaving us with a set of 1008 documents upon which the final analysis is based.



DATA FIELDS

Publication type	Page range
Title	Volume and issue no.
Year of publication	Journal name
Author(s)	Publisher name
Keyword(s)	URL
Organisation or affiliation	Whether marine/coastal or other

- Journal article (peer-reviewed)
- Article (non-peer-reviewed)
- Conference / Workshop proceedings
- Report
- Working paper / Position paper
- Book (or edited book)
- Thesis
- Manual / Handbook

ROUND 1

RESEARCH PLAN & DATA MANAGEMENT

KEYWORDS

- "Traditional knowledge"
- "Local knowledge"
- "Local ecological knowledge"
- "Indigenous knowledge"
- "People's science"
- "Indian Science"
- "Local science"
- "Traditional science"
- "knowledge+nature+wildlife"
- "hunting + knowledge"
- "traditional + fishing"
- "traditional + practice + marine"
- "traditional + technique + fish"

Subject to select criteria, a list of publications downloaded from a range of repositories were identified for in-depth data extraction in Round 2.

Prior to assigning publications to Round 2 of analysis, a thorough check was undertaken to identify duplicates and extraneous publications that might have erroneously entered our database.

data from each publication

The publications that formed the final database were assigned to different researchers to undertake a more detailed sorting through based on a number of fields.

In the second round of data extraction, we listed out the following fields to be entered in an excel sheet, by examining the content of the final set of publications.

FEB - JUN 2014

JUN - AUG 2014

DATA FIELDS

- Distribution across biogeographic zones
- Research themes across biogeographic zones
- Focus across states, spatial scales
- Communities in focus
- Distribution across publication type
- Author related details
- Conceptual ideas regarding TEK/LEK
- Methodological focus and research design
- Definition and contextual aspects of TEK
- Place of TEK/LEK in governance

If coastal / marine,

- Focus of study, species, habitat,
- Legal references,
- Management / governance related references

DATA ANALYSIS (MIXED METHODS)

ROUND 2

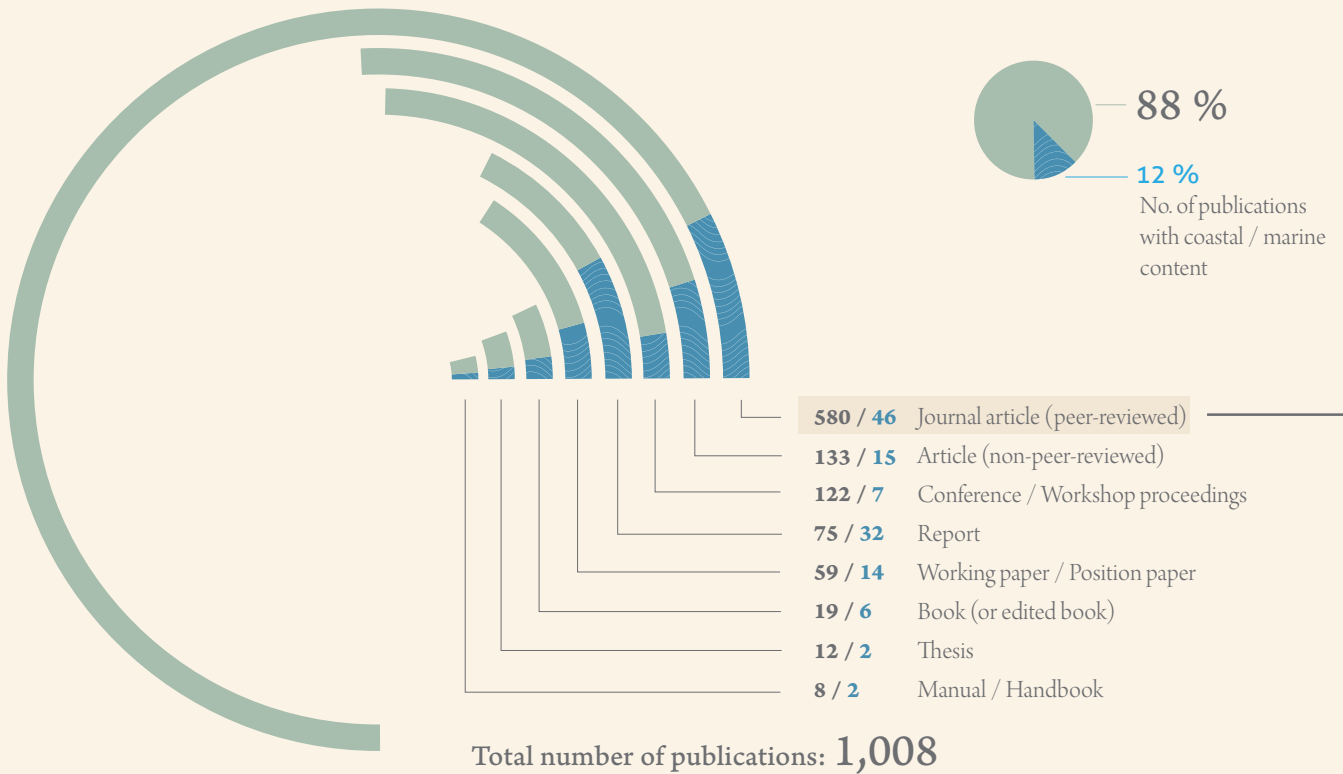
Types of publications

A total number of 1008 publications were included in the database. These included studies with a primary (60%) or secondary (16%) focus on TK, as well as those studies which had an indirect focus (15%) or some significant TK-related component (9%).

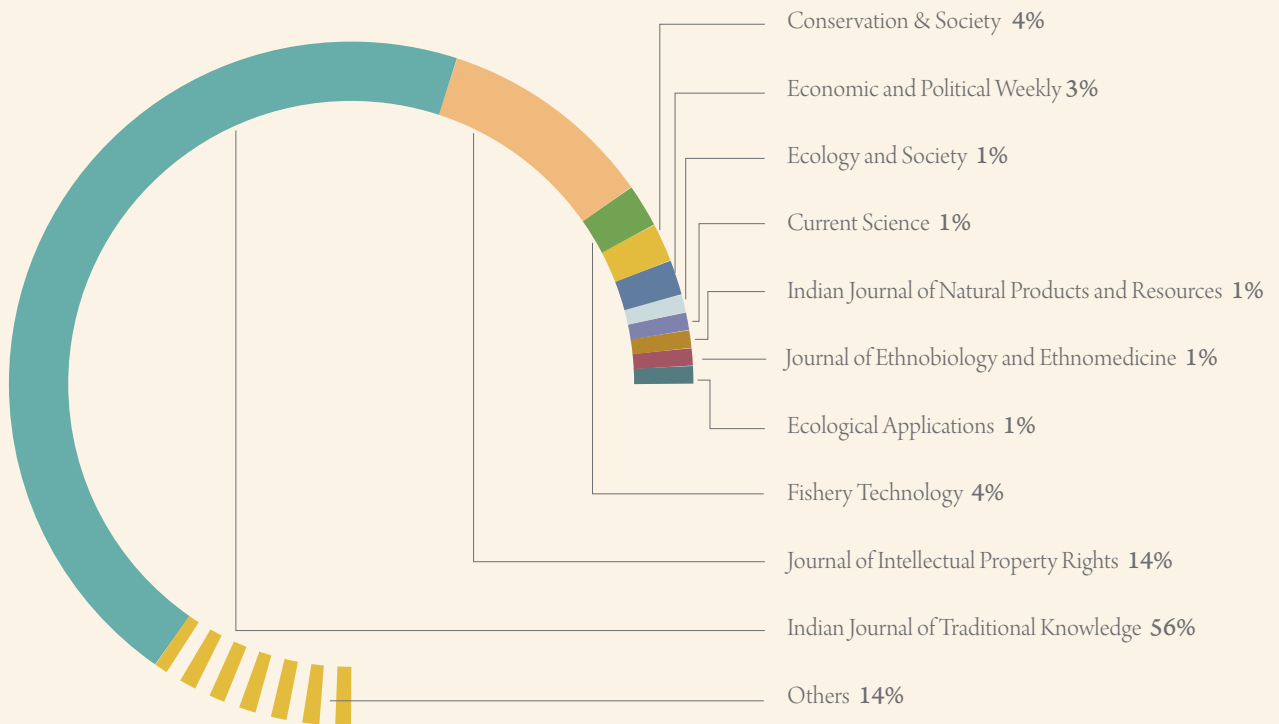
Of the overall total of 1008, more than 50% of studies (580) were peer-reviewed publications. These were followed by non-peer reviewed articles, conference and workshop proceedings, reports, working papers, etc. Within the category of peer-reviewed journal publications, the maximum number of studies were published in the *Indian Journal of Traditional Knowledge* (IJTK), and these accounted for 56% of peer-reviewed articles. A significant number of papers (14%) were also published in the *Journal of Intellectual Property Rights*. Other journals that were represented by multiple research papers include *Conservation and Society*, *Economic and Political Weekly*, *Current Science*, etc.

Publications within the database were also categorised based on the type of publisher. Nearly 47% of these publications are publications initiated by the Government of India. International NGOs contributed 11% of publications. The International Association for the Study of the Commons was a major independent contributor of research themes that touched upon traditional and local knowledge practices in India. Other key contributors included independent journal publishers, academic publishing houses, domestic as well as international universities, etc. Local scale studies, i.e those examining aspects of TK at the spatial scale of villages and similar sized spatial units accounted for 175 studies and accounted for 17% of the database. State level studies constituted the largest group with 42 % (421 studies) of publications. 279 studies accounting for 28% of the overall database were national level explorations. Larger regional and global level studies in which Indian case studies were recorded were only 8% and 5% respectively.

PUBLICATION CHARACTERISTICS

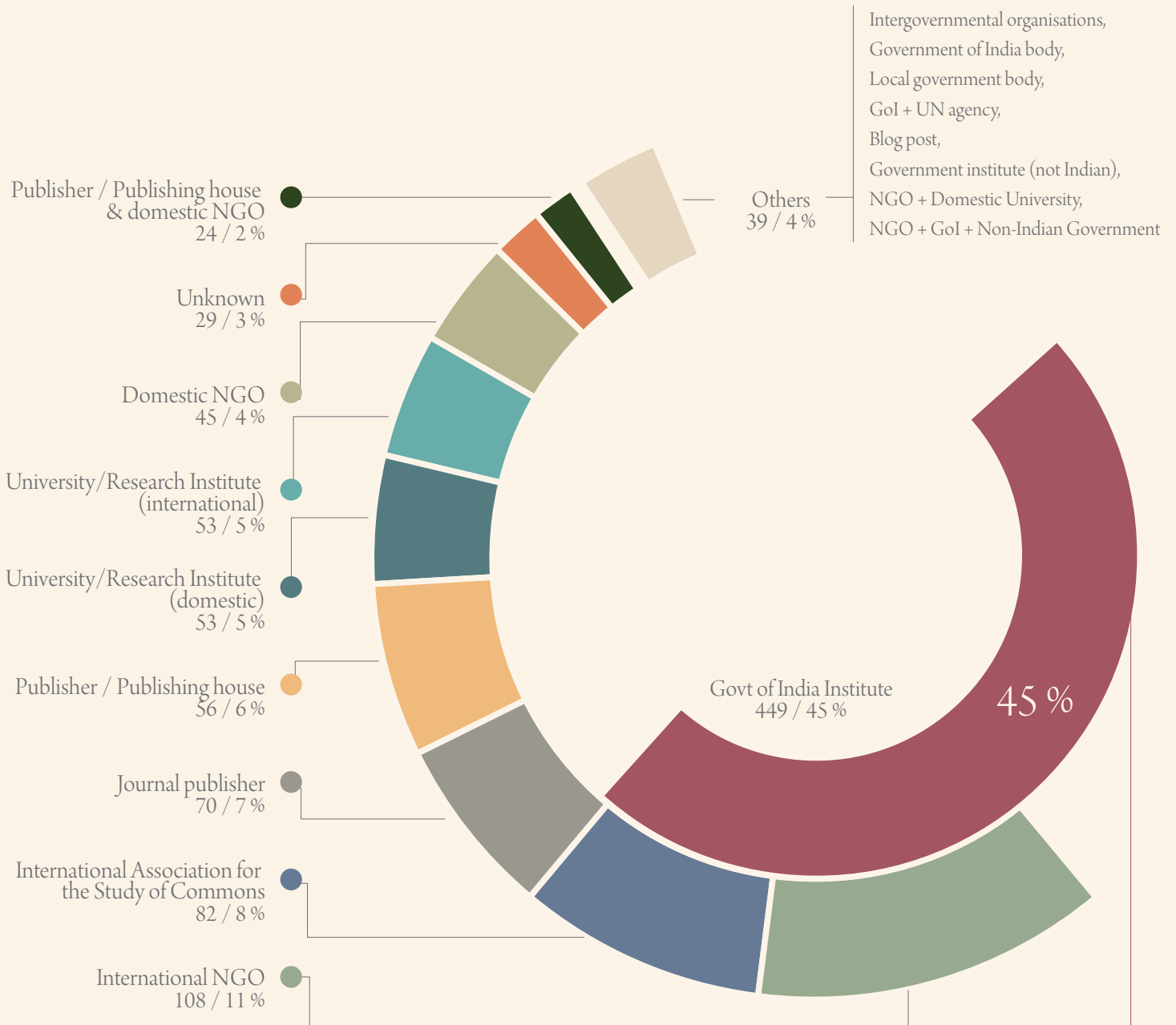


LEK studies in peer-reviewed journals



Total number of peer reviewed articles: 580

LEK STUDIES IN INDIA: PUBLISHER INTEREST

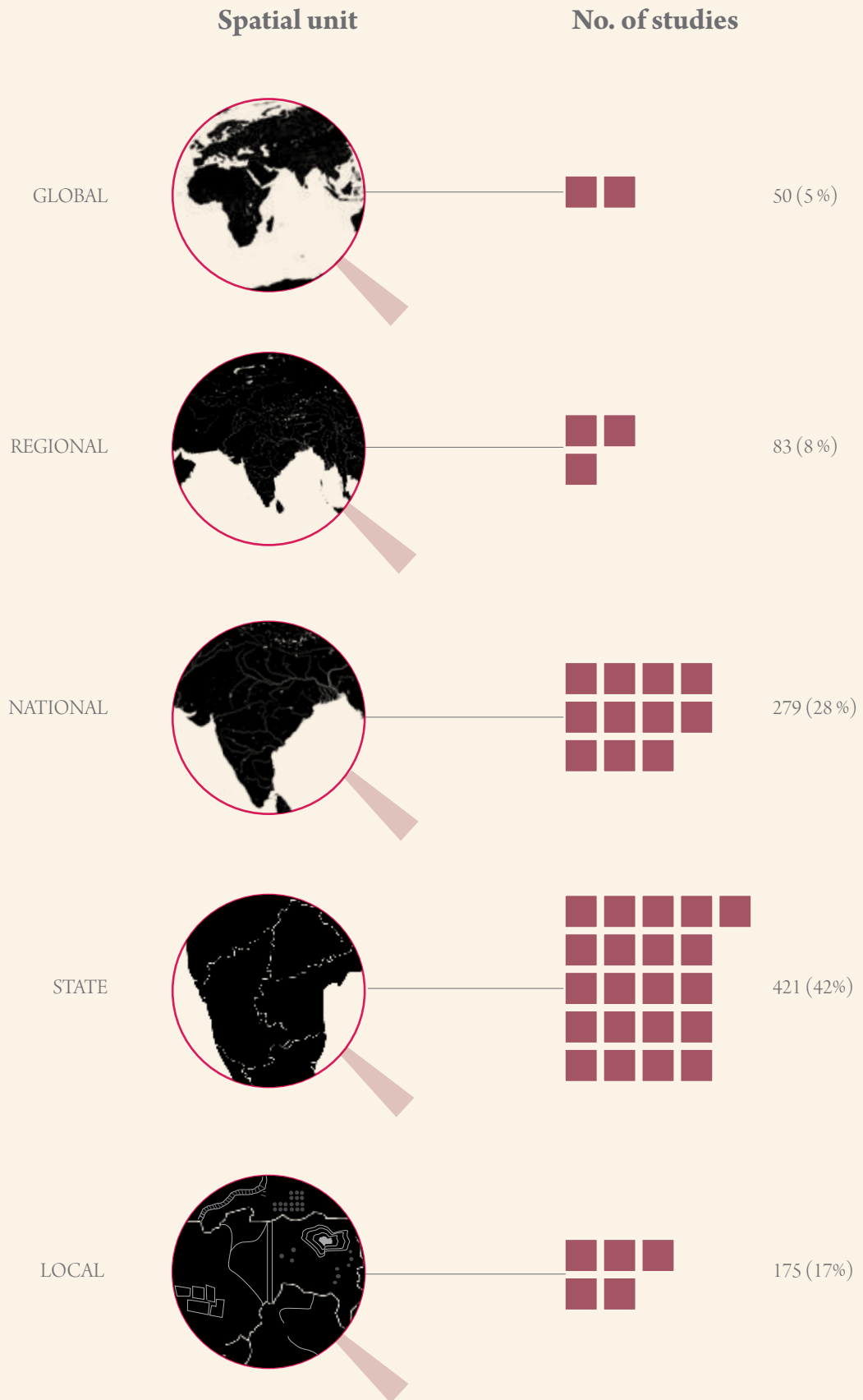


IJTK



Nearly 47 % of all publications are government publications. Of these, nearly 70 % were published by the Indian Journal of Traditional Knowledge.

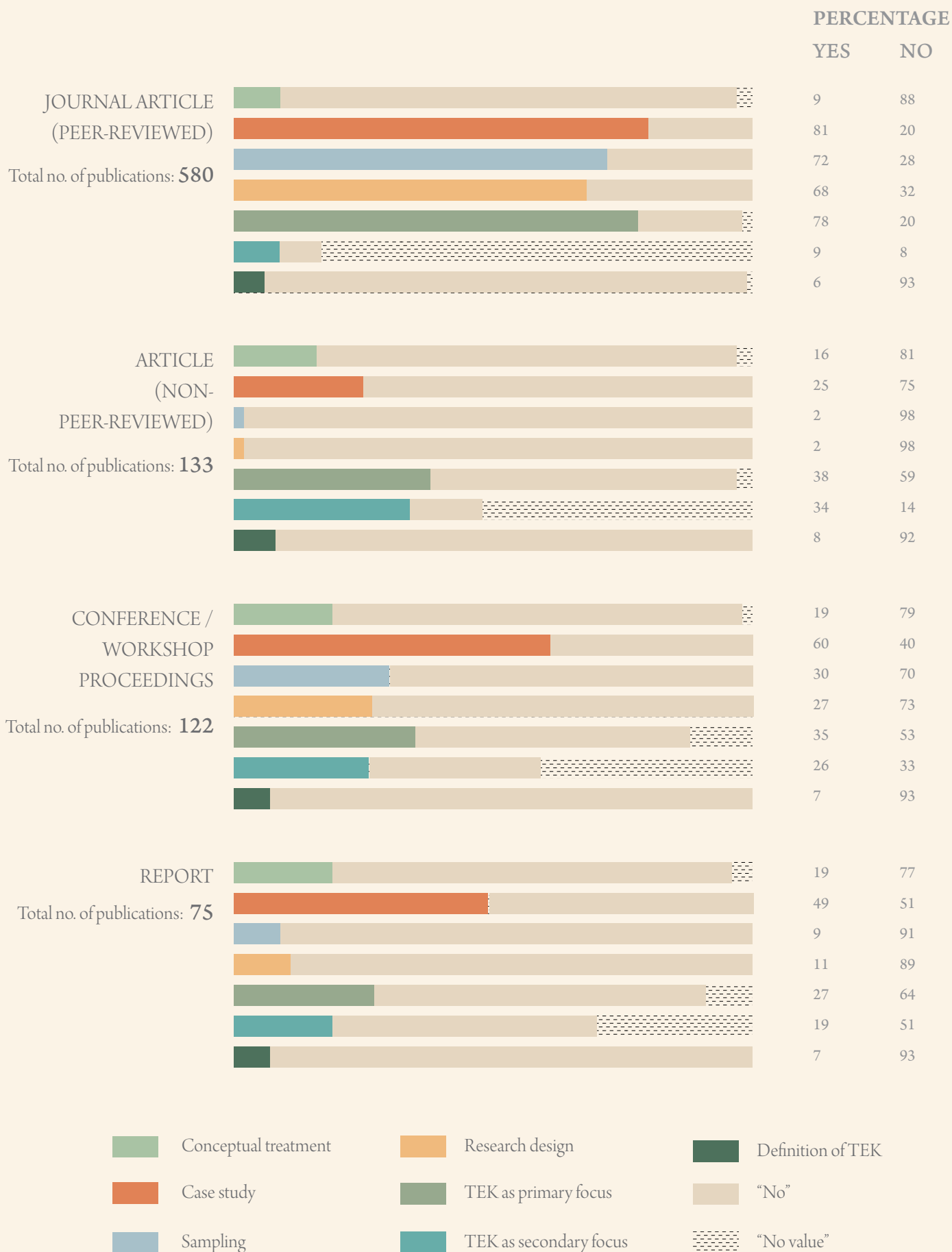
SPATIAL UNIT OF STUDY



Total number of studies: 1,008

■ ~ 25 studies

RESEARCH FOCUS IN LEK STUDIES IN INDIA

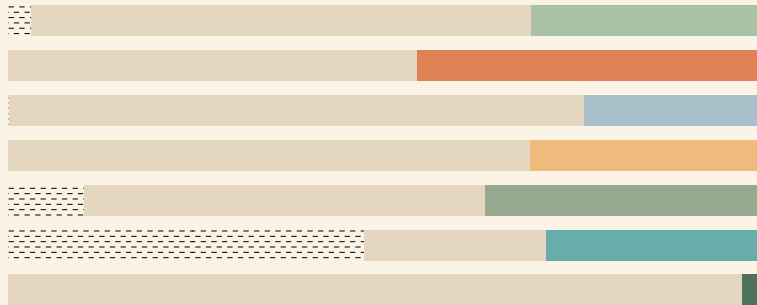


100 %

PERCENTAGE

YES NO

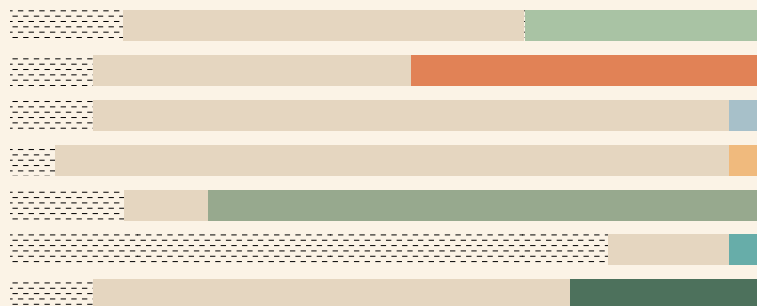
31 66
46 54
24 76
31 69
37 53
29 24
3 97



WORKING PAPER /
POSITION PAPER

Total no. of publications: **59**

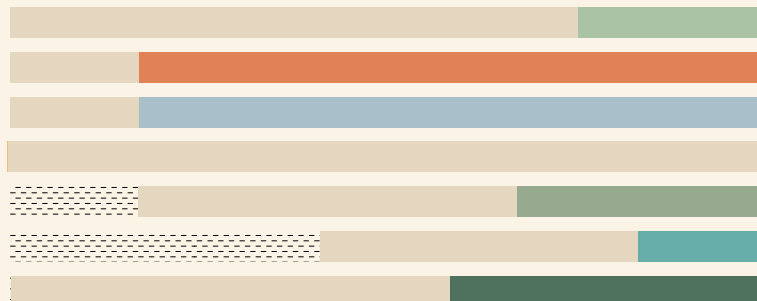
32 53
47 42
5 84
0 89
74 11
5 16
26 63



BOOK
(OR EDITED BOOK)

Total no. of publications: **19**

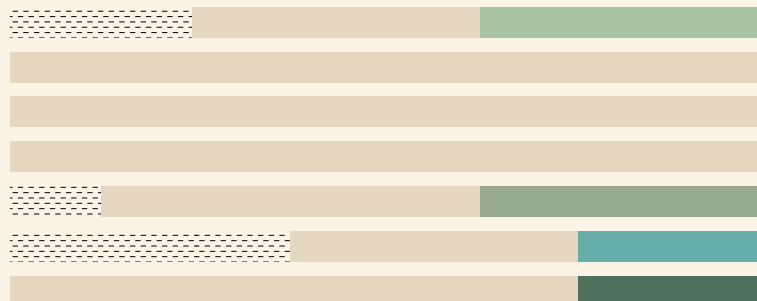
25 75
83 17
83 17
100 0
33 50
17 42
42 58



THESIS

Total no. of publications: **12**

38 63
0 100
0 100
0 100
38 50
25 38
25 75



MANUAL /
HANDBOOK

Total no. of publications: **8**

Tracing LEK research with respect to legislation

A total of 308 publications in the database dealt with legal aspects in relation to TEK/LEK in India (nearly 34%). An average of 1.8 publications dealt with law and policy for the years 1981 to 1991. The next decade recorded an average of nearly 8 publications. However, between the year 2000 till the present, an average of 59 publications have been produced each year which make a mention of some legal facet in relation to TEK/LEK. However, these have been distributed across a range of themes. Many of the publications however do not devote more than a cursory mention of legal issues with very few undertaking a rigorous analysis. The themes most discussed here were community rights, forest policies, CBD provisions, Access and Benefit Sharing mechanisms, intellectual property rights, patents, patent disputes, community protocols, biopiracy, bioprospecting, community biodiversity registers, REDD related policies, fishing regulations, common property issues, WIPO and the Inter-governmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore.

The laws and legal instruments discussed specifically were the Forest Rights Act, 2006¹, FRA, the Biological Diversity Act, 2002, Draft Conservation and Effective Management of Traditional Knowledge relating to

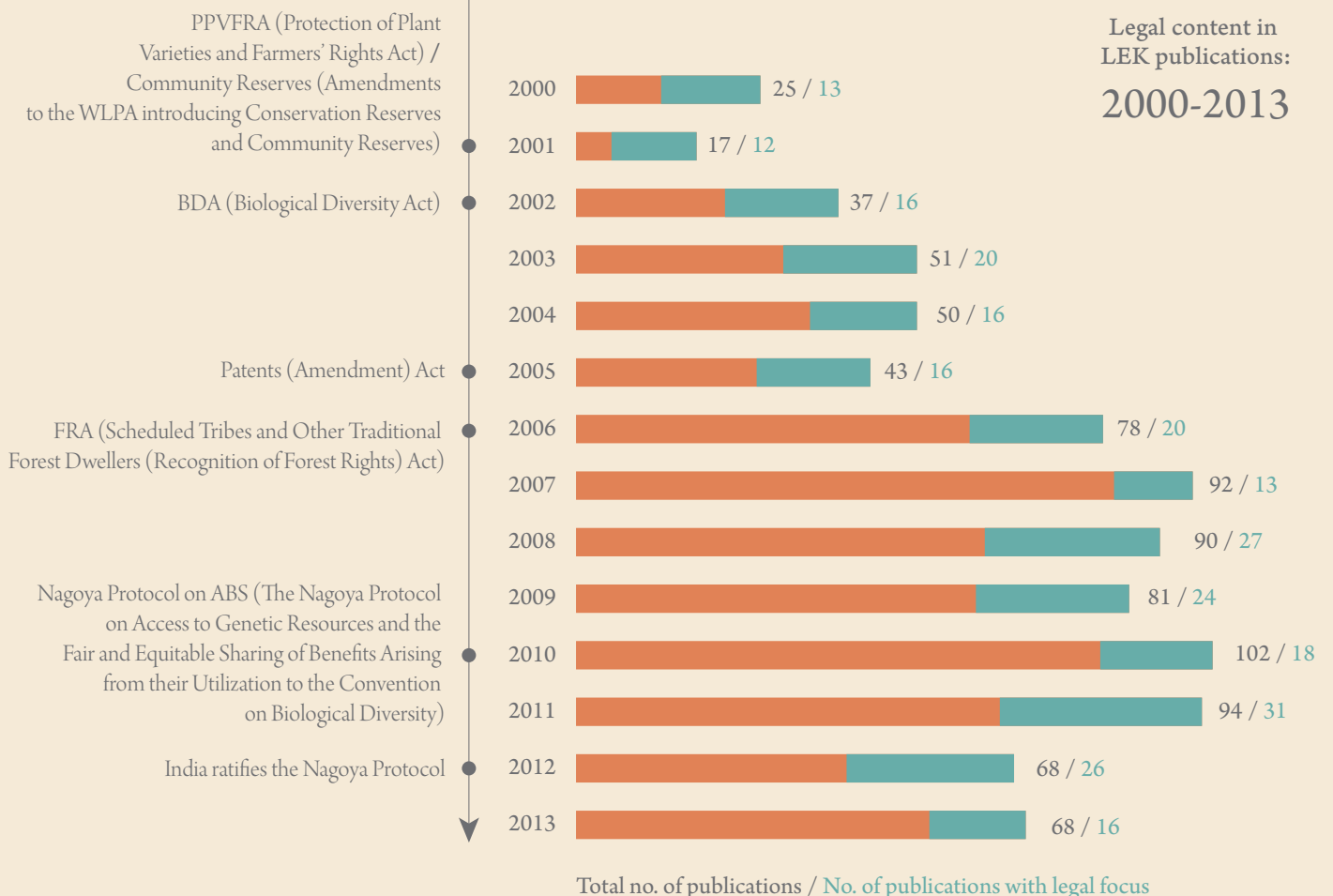
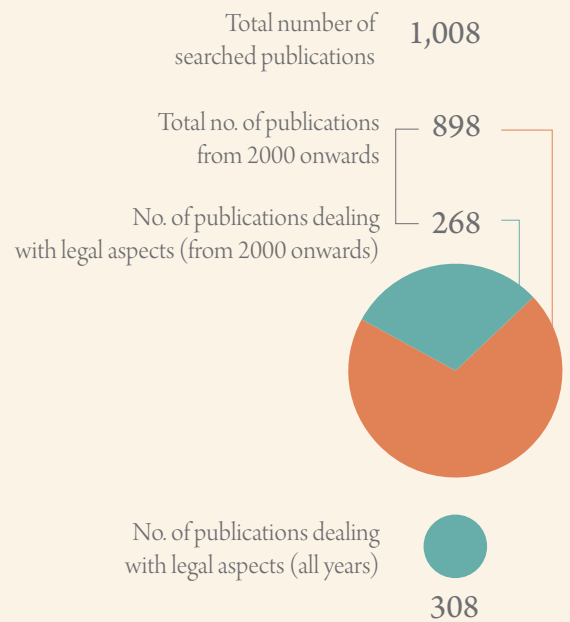
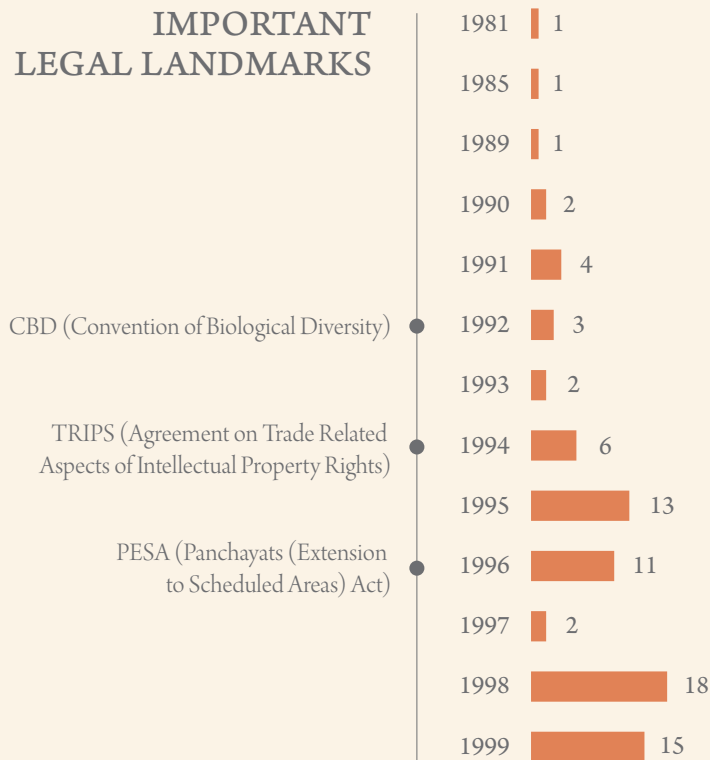
Biological Diversity Rules, 2009, the Wild Life Protection Act, 1972, Nisthar rights, Forest Conservation Act, Forest Policy, Joint Forest Management, State Marine Fisheries Regulation Acts, the Indian Patents Act, 2005, the Nagaland Village and Area Council Act (1978), Panchayats (Local Government) Extensions to Scheduled Areas Act, 1996 and the Protection of Plant Varieties and Farmers Rights Act.

The interest in legal issues pertaining to TEK/LEK however cannot be judged merely by the mention of legal aspects or laws in these publications. We found that most publications did not elaborate on the manner in which legal rights either inhibited or promoted TEK/LEK. Several platitudes were submitted in honour or TEK, asking for the promotion of community rights, but without a clear road map of what this might entail in terms of an implementation structure. Only specific publications by experts who had engaged in this subject for several years, such as the publications of Kalpavriksh, Natural Justice or the International Collective in Support of Fishworkers attempted a more rigorous analysis of the legal frameworks that influenced TEK/LEK. A more detailed analysis of the legal content in publications within this database has been undertaken for papers dealing with coastal and marine systems.

¹The full title of this law is Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Rights on Forest) Act, 2006

LEGAL THEMES IN LEK PUBLICATIONS

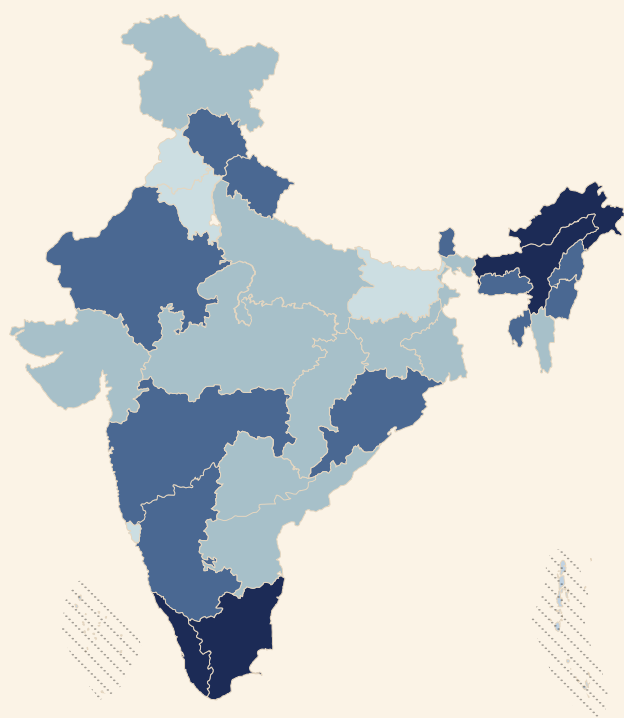
IMPORTANT LEGAL LANDMARKS



State-wise representation of studies

The number of studies that addressed various aspects of traditional/ local ecological knowledge in the different states and union territories of India were examined and summarised. Of the 1008 studies that were compiled as part of this dataset, 646 studies could be identified as located within or associated with specific states of India. There is a wide disparity in the number of studies that have been reported from each state. The maximum

number of studies were reported from the states of Arunachal Pradesh, Tamil Nadu, Assam and Kerala. These figures are likely to be under-representations as study locations could not be pinpointed for all cases, and partitioning of states into new political entities could have also been responsible for low values for some states. For cases where publication dates were available, new state level information has been incorporated.



Number of studies with state level information: **646**

10 - 15 %

Arunachal Pradesh: 84 / 13 %
Tamil Nadu: 73 / 11 %
Assam: 69 / 10.7 %
Kerala 65 / 10 %

5 - 10 %

Uttarakhand: 60 / 9.3 %
Sikkim: 54 / 8.4 %
Karnataka: 46 / 7.1 %
Manipur: 44 / 6.8 %
Rajasthan: 43 / 6.7 %
Himachal Pradesh: 42 / 6.5 %
Meghalaya: 42 / 6.5 %
Maharashtra: 38 / 5.9 %
Nagaland: 38 / 5.9 %
Tripura: 37 / 5.7 %
Odisha: 33 / 5.1 %

1 - 5 %

Mizoram: 30 / 4.6 %
West Bengal: 28 / 4.3 %
Madhya Pradesh: 25 / 3.9 %
Andhra Pradesh: 22 / 3.4 %
Gujarat: 21 / 3.3 %
Telangana: 18 / 2.8 %
Jammu and Kashmir: 17 / 2.6 %
Uttar Pradesh: 15 / 2.3 %
Chattisgarh: 11 / 1.7 %
Jharkhand: 7 / 1.2 %

Less than 1 %

Andaman and Nicobar: 5 / 0.8 %
Punjab: 5 / 0.8 %
Bihar: 4 / 0.6 %
Goa: 3 / 0.5 %
Haryana: 2 / 0.3 %
Lakshadweep: 2 / 0.3 %
Chandigarh: 1 / 0.2 %

States not listed:

Dadra and Nagar Haveli
Daman and Diu
National Capital Region
Pondicherry

Biogeographic zones of India

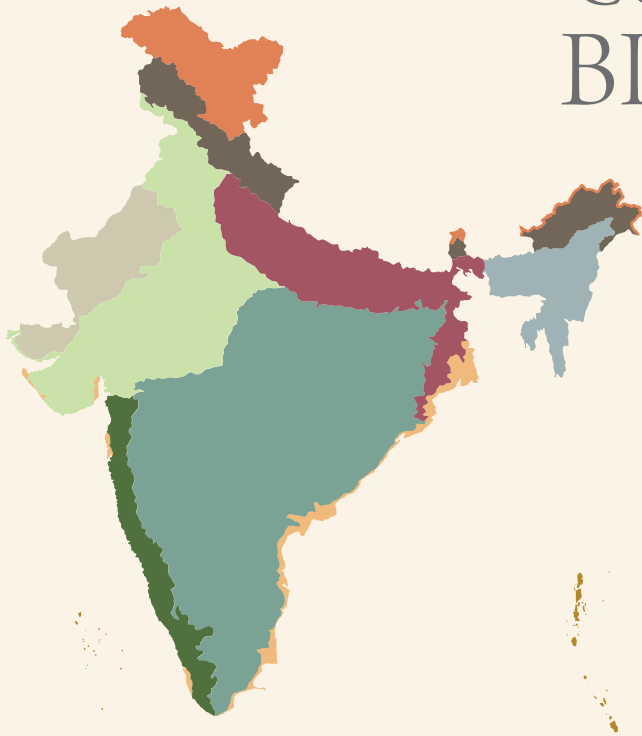
Formal biogeographical classifications in India (Mani 1974; Rodgers and Panwar 1988; Rodgers, Panwar and Mathur 2000), have attempted to identify 'biogeographic zones' or large distinctive spatial units of similar ecological processes, topography and climate that also have species with shared taxonomic and historical similarities. The currently accepted classification (Rodgers, Panwar and Mathur 2000) identifies ten biogeographic zones and 26 biogeographic provinces within them. These biogeographic classifications take into account the distribution of plant and animal species, ecosystems, climatic and topographical similarities, and has a particular focus on the taxonomic and historical affinities of species to different large-scale biogeographical realms (e.g. Palearctic, Oriental, etc.). They include: 1) Trans-Himalaya, 2) Himalaya, 3) Desert, 4) Semi-Arid, 5) Western Ghats, 6) Deccan Peninsula, 7) Gangetic Plain, 8) Coasts, 9) North East, and, 10) Islands. In terms of area, the largest biogeographical zone is the Deccan peninsula (1380380 km²), whereas the Islands (Lakshadweep and Andaman & Nicobar) are the smallest zone with just over 8000 km² of area. Local communities also take into account these similarities and differences, evolving specialised human-nature relationships within each of these systems. This knowledge is reflected in their day to day engagements with species and ecosystems and is integral to the development of locally adaptive livelihood strategies. Forestry and conservation agencies make use of the biogeographic classification for planning protected area networks, conservation interventions, etc.

For this analysis, the number of studies that addressed various aspects of traditional/ local ecological knowledge in India's biogeographic zones were examined and summarised. A total of 1008 studies addressing 10 biogeographic zones were compiled. Out of these, 300 studies addressed the Indian region

as a whole without a particular focus on specific biogeographic zones. In terms of overall numbers, the greatest number of studies addressed the Himalayan biogeographic zone, followed by the Deccan Peninsula, North East, coasts and the Western Ghats. Together, these zones accounted for over 80% of research attention. The other biogeographic zones received poor research attention with islands being the least studied. Coastal areas received considerably more attention than island ecosystems with 11% of studies being reported from the former and less than 2% of studies being reported from the latter. From a total of 1008 studies which were examined, 658 individual studies could be classified as case studies. Case studies also showed the similar distribution patterns as overall studies with the greatest research effort on local/ traditional knowledge systems being focused on three zones (Himalaya, Deccan Peninsula and North East) and the least effort in the islands and the trans-Himalaya).

The portioning of studies based on research attention accorded to the major biomes were also investigated. Approximately 87% of published studies evaluated traditional knowledge related components in terrestrial spaces. In contrast, less than 24% of studies evaluated the same for aquatic systems. These patterns were also similar when terrestrial and aquatic systems were evaluated within major biogeographic zones. Apart from Coastal areas where the focus was clearly in favour of aquatic systems, terrestrial TK-based components received greater research attention. Excluding the coast, the maximum number (29) of studies on freshwater systems was from North East India. A moderate number of studies were recorded from the Himalaya (15) and the Deccan Peninsula (10). Within the category of aquatic studies, we see that marine and estuarine systems received greater research attention (about 70%), whereas freshwater biomes figured only about 30% of studies.

COVERAGE OF BIOGEOGRAPHIC ZONES IN INDIA

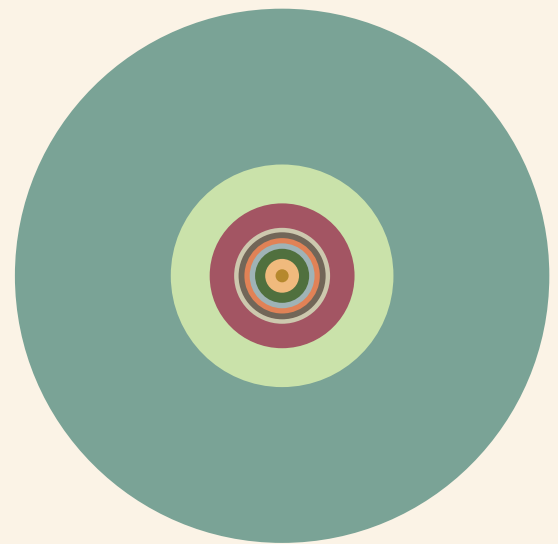


Map credit and disclaimer text

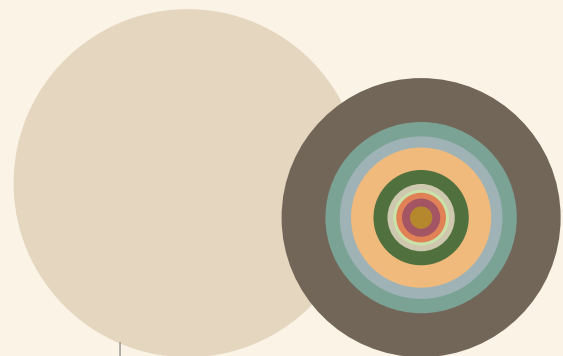
Biogeographic zone	Land area (sq. km) / % of India's land area	No. of studies / % of total no. of studies
Trans-Himalaya	1,84,823 / 5.62 %	39 / 3.8 %
Himalaya	2,10,662 / 6.41 %	206 / 20.7 %
Desert	2,15,757 / 6.56 %	50 / 4.9 %
Semi-arid	5,45,850 / 16.6 %	41 / 4.0 %
Western Ghats	1,32,606 / 4.03 %	70 / 6.9 %
Deccan Peninsula	13,80,380 / 41.99 %	141 / 13.9 %
Gangetic Plain	3,54,782 / 10.79 %	36 / 3.6 %
Coasts	82,813 / 2.52 %	111 / 11 %
Northeast	1,71,341 / 5.21 %	120 / 11.8 %
Islands	8,249 / 0.25 %	19 / 1.9 %

Studies addressing the Indian region as a whole without a particular focus on specific biogeographic zones : 300 / 29.6 %

Percentage area of India's land area

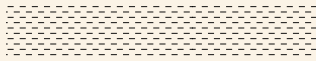


Percentage studies of total number of studies



Total number of studies:
1,008

Note: these percentages add up to more than 100% as several studies looked at multiple biomes



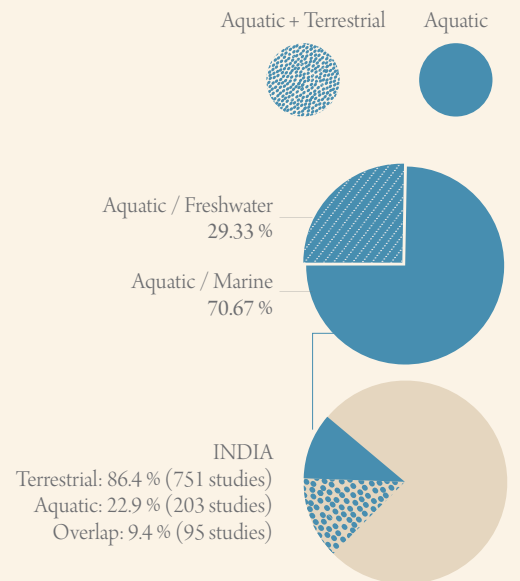
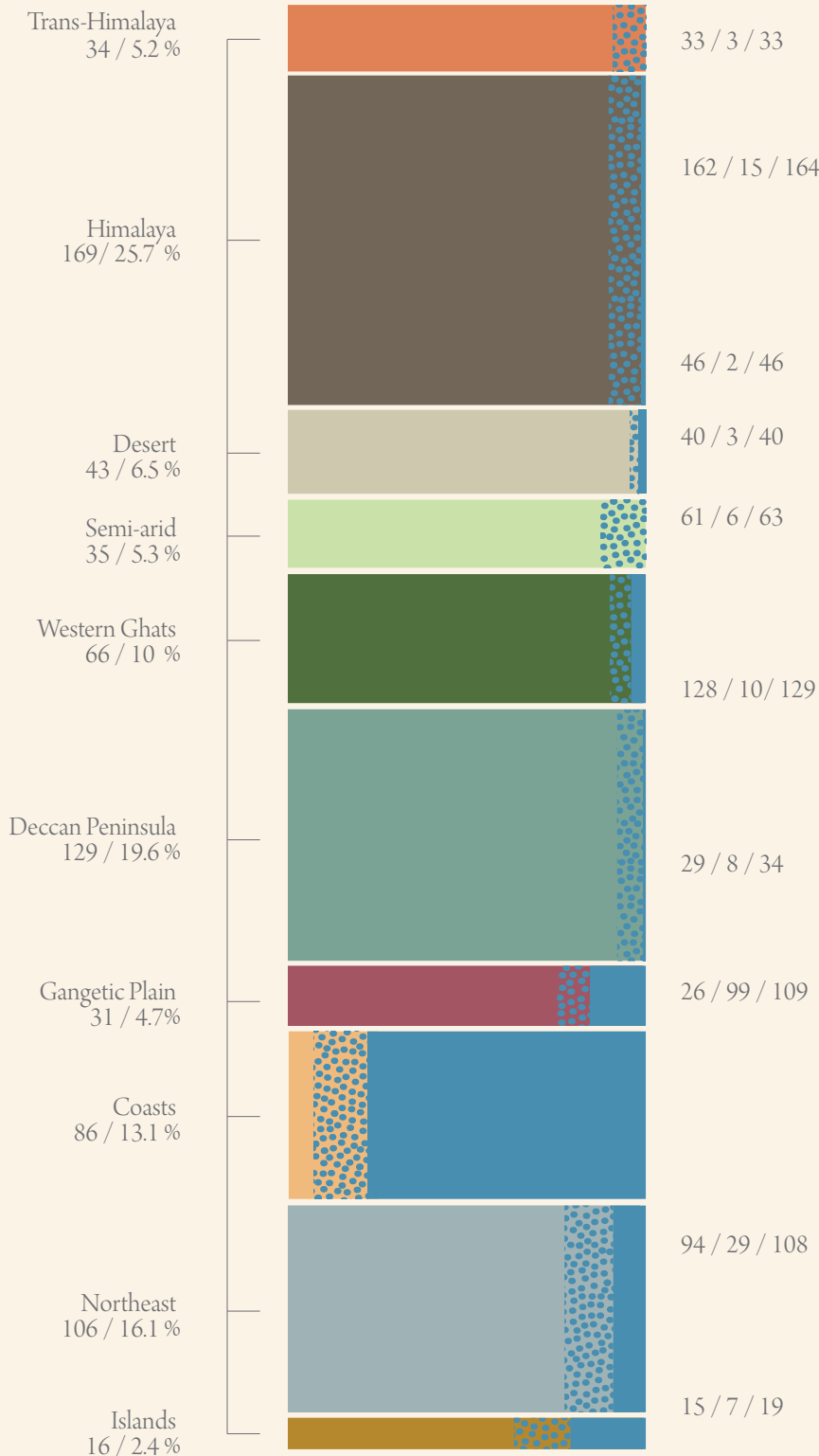
CASE STUDIES

658 (65.3 %) of the total number of 1,008 studies are case studies

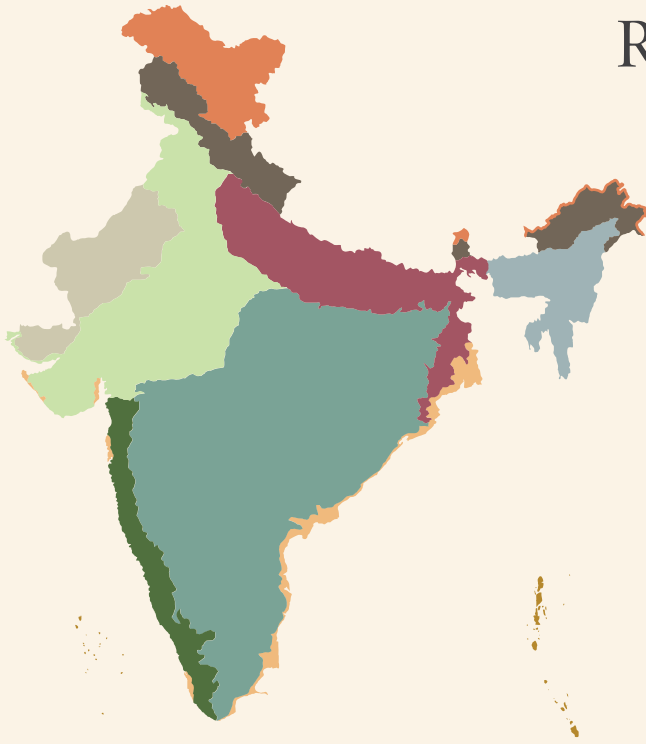
Biogeographic Zone

No. of studies

Terrestrial / Aquatic / Total

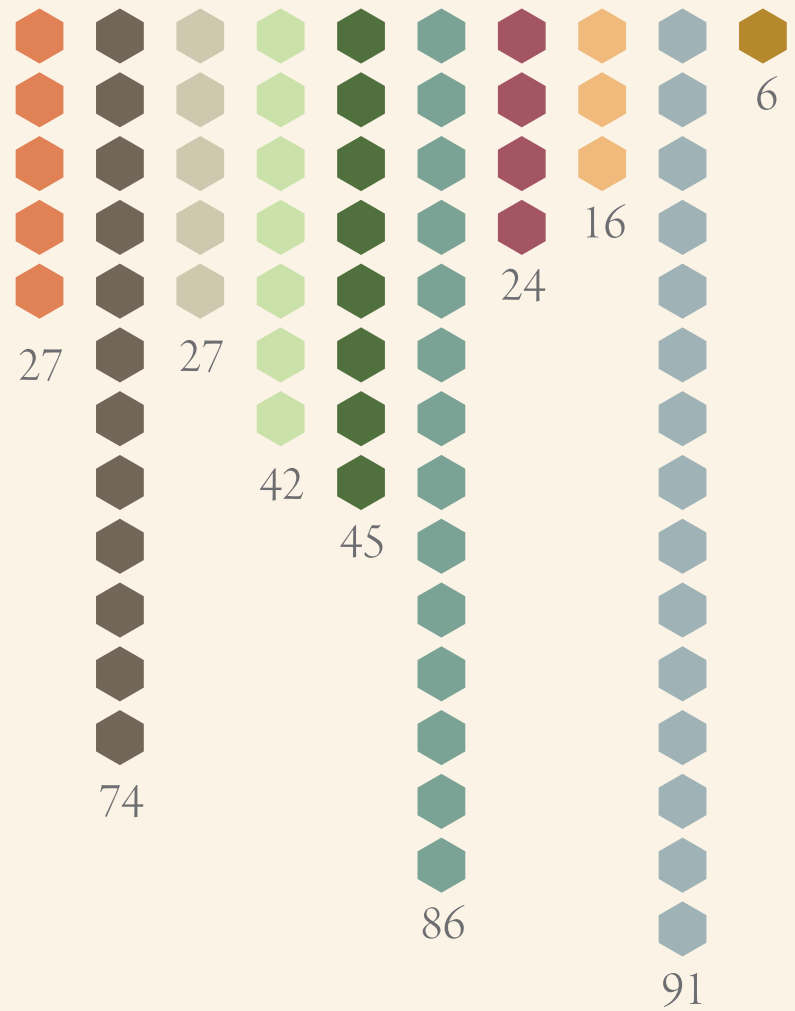


REPRESENTATION OF KNOWLEDGE AMONG LOCAL COMMUNITIES IN INDIA



Total number of communities: 334

Trans-Himalaya
Himalaya
Desert
Semi-arid
Western Ghats
Deccan Peninsula
Gangetic Plain
Coasts
Northeast
Islands



Communities in India

The compiled database included traditional knowledge components relating to 334 local communities within India. These included in-depth case studies as well as examinations of significant aspects of local knowledge which were nested within other types of publications. The communities under focus included scheduled tribes, scheduled castes and other significant castes whose nomenclature allowed geographical representation, and migrant communities from neighbouring countries as well as across states. A large number of these studies were compiled from the Indian Journal of Traditional Knowledge. Although most of the studies were on particular local communities, a large number of studies failed to identify these groups by name referring to them as 'local communities', 'indigenous communities' or 'tribals'. This is a significant drawback as ethnicity is an important factor not only in terms of communicating this knowledge to outsiders but also in terms of community identity and ownership of knowledge relating to different practices.

Information related to traditional practices was recorded along various levels for over 90 communities in North East India. The Deccan plateau and the Himalayan region with 86 communities and 74 communities respectively were also prominent in terms of community representation. The Western Ghats and semi-arid regions were represented by a moderate diversity of

ethnicities (45 and 42 respectively). Desert regions and the Gangetic Plain were represented only by 27 and 24 communities respectively. Coastal regions which have diffused communities that are difficult to separate along discrete lines and islands which have fewer numbers of ethnic groups were represented by only 16 and 6 groups respectively. While these studies do not address all local groups in these regions, it is clear that in general these numbers parallel the general pattern of ethnic diversity in India. It also has to be kept in mind that some communities with several subdivisions were typically treated by the majority of researchers as large widespread groups (e.g. the Gonds and Bhils in Central India), whereas others were treated as separate units of study even when they are part of larger group (e.g. the different Naga sub groups in North East India). In this analysis, these community identities were largely retained from literature, standardisation was carried out only in cases of phonetic similarity or if there were obvious indications that names were synonymous. These have been listed in the Appendix. In terms of research attention, the greatest focus was on communities such as the Bhil, Meena and Gond communities in the semi-arid and the Deccan Plateau region, followed by communities in North East such as the Lepcha, Khasi, Meitei, etc. In a pattern that is typical of most research on traditional practices, the degree of research interest in a community is rarely dependent on its size or spatial extent.

Research themes

The contributions to Indian traditional knowledge research was categorised according to the major themes of enquiry for each of the studies that were considered part of the TK/IK database for India. These included a variety of uses, practices and technologies that were adopted by local communities and largely signified their adaptations with the environment. Many studies focused on more than a single aspect of TK/IK resulting in overlapping categories. When considered as a whole, the largest number of studies in this database pertained to the ethnobotanical practices of different

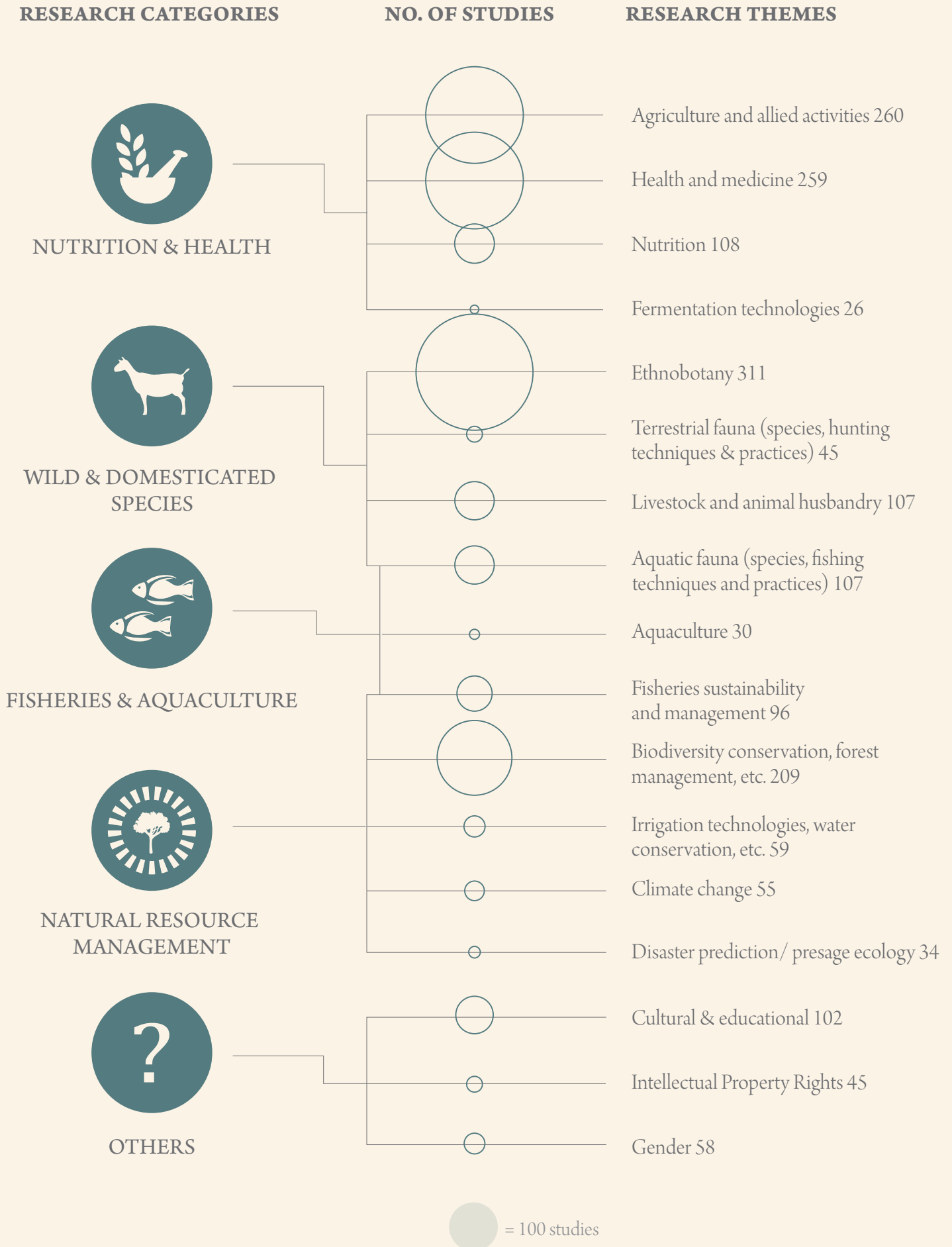
local communities. These examinations were uniformly important for almost all ecological zones in India. The next largest category of studies targeted the agricultural sector followed by health and medicine. Traditional knowledge systems incorporating management of forest or biodiversity resources were also a significant theme of enquiry. The patterns in research relating to top research themes were along similar lines for most of the ecological zones in the country. Some of the major lines of enquiry in contemporary TK/IK research in India are explained further in the following sections.

Nutrition and health

Agricultural and allied activities as well as those relating to health and medicine (along with ethnobotany) constituted the largest individual themes of enquiry. The maximum number of studies related to these themes was from the Himalaya and the Deccan Plateau. Agricultural and allied activities include a wide variety of sub-themes ranging from different forms of cultivation and management (e.g. terraced farming, shifting cultivation, dryland agriculture, traditional agroforestry and home garden systems), crop preservation and seed conservation technologies, food habits and allied agricultural activities such as beekeeping, pest control, soil conservation, water management, etc. TK related aspects of cereals, especially rice received focused attention from a number of researchers. Fermentation technologies, largely involving cereals were a key focus of enquiry for many studies especially from the northeastern part of the country. Indigenous knowledge relating to medicinal plants is perhaps the single largest focus of research in the database. These related to human as well as livestock health. Most studies of this

category are of a descriptive nature largely identifying wild species (predominantly plants) as cures for different ailments as obtained from local informants especially traditional healers. The knowledge of women from indigenous communities also received attention. Although a number of studies raise the subject of intellectual property rights related to agricultural and medicinal plant centred knowledge, compilation and publication of simplistic associations between species and cures without adequate safeguards may lend itself to appropriation by commercial bioprospecting interests and poor benefit sharing outcomes. Recent initiatives such as Globally Important Agricultural Heritage Systems (GIAHS facilitated by the Food and Agriculture Organisation) have resulted in delineation of potential sites (e.g. the paderu agricultural system of Andhra Pradesh, the demazong sacred agro-ecological system of the Kanchendzonga landscape of Sikkim, etc.) that address traditional knowledge aspects related to food security, sustainability and cultural diversity.

MAJOR FOCUS AREAS OF LEK RESEARCH IN INDIA



Wild and domesticated species

Species centred knowledge showed a predominant focus on plant species. These include medicinal plants, plants used as food and those associated with traded goods, especially non-timber forest products. In contrast, studies relating to terrestrial fauna, although covering a wide range of taxonomies (insects to mammals), was of a limited number.

The greatest contributions to terrestrial species focused knowledge is from the Himalaya, the North East, the Western Ghats and the Deccan Peninsula. Species that are hunted and harvested for food, zootherapeutic uses, pest control, herpetofaunal knowledge especially relating to snake venom, sacred species, etc. have been the key lines of enquiry. The maximum concentration of animal focused research was in the North East Indian zone and the Himalaya. Knowledge on aquatic fauna, especially relating to fish was expectedly concentrated in coastal areas. Research on traditional freshwater fisheries was concentrated in the North Eastern region. Although the Indo-Gangetic Plain and the Western Ghats have extensive freshwater fisheries and a range of associated traditional practices, this diversity is not evident from the research conducted on traditional systems.

Fisheries and aquaculture

Research on marine and brackish water fisheries has been reported from numerous sites along the mainland coast. Fewer studies have taken place with either the Lakshadweep archipelago or the Andaman Nicobar Islands as the focus of enquiry. A large number of publications relate to species that are utilised as food, indigenous fishing practices, local technologies related to craft and gear. Numerous studies have also explored the potential of traditional fishery to inform issues related to sustainable use, conservation and long-term fisheries management. Traditional fishery practices that evaluate marine systems as regulated common property (e.g Pulicat's *padu* system) and livelihood options among

As mentioned before, traditional agricultural practices incorporate knowledge relating to a wide variety of cultivated species throughout the country. This is showcased in the literature encompassed within the database and includes detailed information on cereal staples, locally cultivated herbs and vegetables, traditional fermented foods, etc., as well as trees used in agroforestry for timber, fuelwood, fodder, fencing and a variety of other purposes. In terms of overall numbers, livestock systems are widespread throughout the country, but mostly reported from the Himalaya and the Deccan. However, when scaled in terms of the number of studies reported, the trans-himalaya and the desert zone and semi-arid zone interfaces report greater research attention on these systems. A great deal of research on livestock relates to common lands in India. Livestock and animal husbandry systems are distinctive in terms of species and herding practices and will be discussed further in the context of individual biogeographic zones. Aquaculture in India includes marine, brackish water and aquatic species. Aquaculture systems are concentrated in coastal areas (marine and brackish water fisheries) and North East India (freshwater aquaculture systems) and are described further in the following section.

women fisherfolk have received focused attention in a handful of cases.

Although freshwater fishery is an important component of traditional livelihoods in most biomes other than the arid zone, much research on aquatic systems has been concentrated on local communities in North East India. Fishery practices targeting wild caught species as well as local systems combining aquaculture and agriculture (e.g. paddy-cum-fish farming along with shifting cultivation) have been reported from this zone. TK research in this zone also reports on a number of fish attractants, fish toxins and other traditional fishery methods.

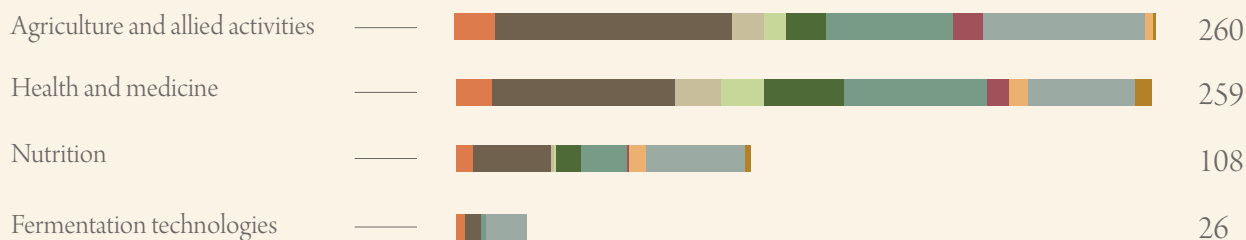
FOCUS AREAS OF RESEARCH WITHIN BIOGEOGRAPHIC UNITS IN INDIA



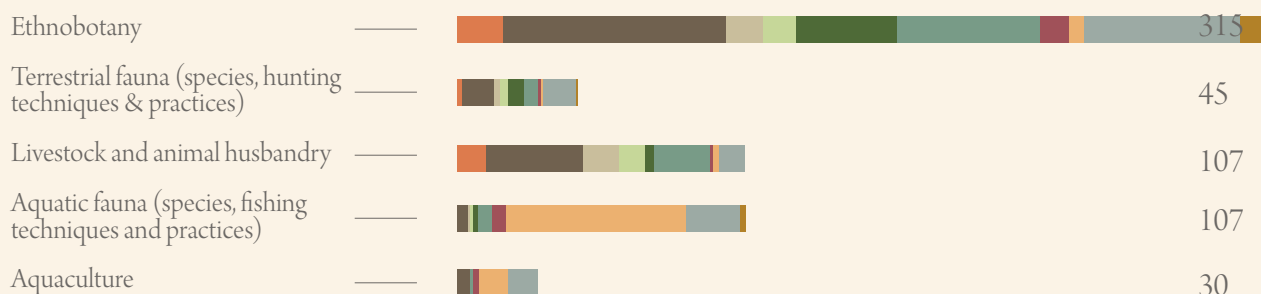
Total no. of studies



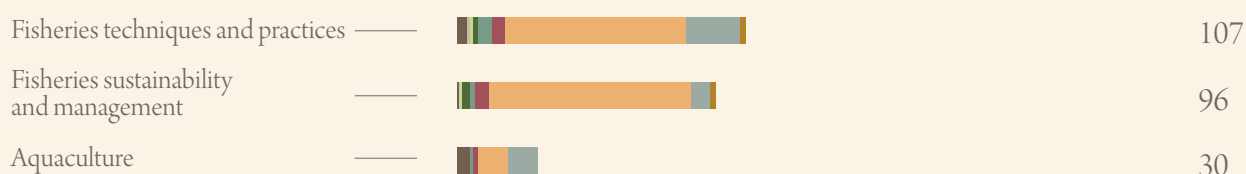
NUTRITION & HEALTH



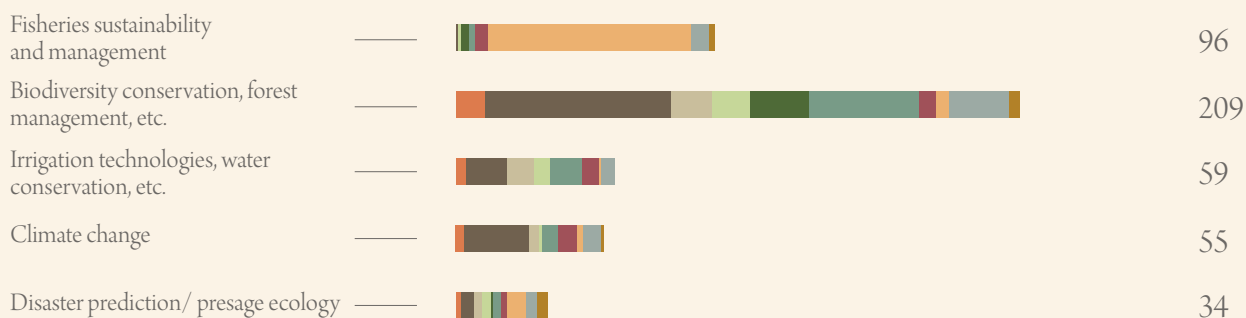
WILD & DOMESTICATED SPECIES



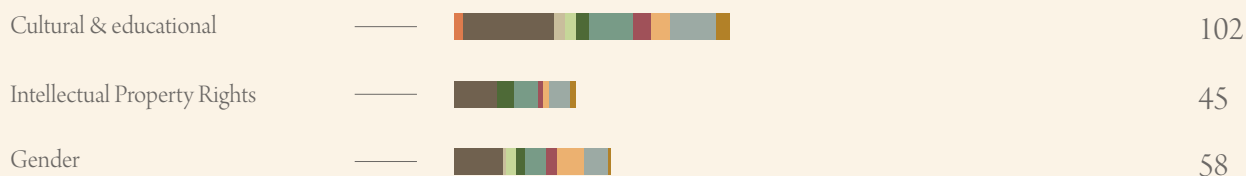
FISHERIES & AQUACULTURE



NATURAL RESOURCE MANAGEMENT



OTHERS



Natural resource management, prediction, etc.

TK research in India has touched upon a variety of subjects relevant to different sectors of natural resource management. A large number of descriptive studies report on forest and land use management, and biodiversity conservation. Traditional common property management, restoration technologies, management with cultural interfaces (e.g. sacred groves), traditional land tenure arrangements, etc. have been discussed. The largest number of studies has been reported from the Himalaya, followed by the Deccan, the Western Ghats and North East India. All these regions have a rich history of traditional land management practices. Traditional management and use are often tied to location-specific technological innovations such as those dealing with irrigation, water conservation, etc. These studies have expectedly been reported from Himalayan agricultural systems as well as India's arid and semi-arid regions where water regulation is central to livelihoods.

Paralleling global patterns of overexploitation and depletion of fish stocks, Indian fisheries are also facing challenges related to unsustainable harvesting practices, technologies, etc. In this context, a number of recent studies have looked towards identifying traditionally sustainable practices that may potentially inform better

management of the country's resources. Though largely confined to marine systems, this research has targeted numerous aspects of fisheries sustainability ranging from traditional tenure arrangements to technological innovations and empowerment of fisher communities. A large number of studies describe indigenous technical knowledge of fishing communities, both in terms of harvesting techniques, indigenous craft and gear, etc. Post-harvesting technologies, value addition for livelihoods, policy analysis, gender, etc. are only some of the associated themes that have been explored in relation to marine fisheries.

A large number of studies in this database touch upon the issue of climate change. While descriptive in nature, it is evident from this literature that climate change is an important challenge for which traditional solutions are being explored. An overwhelming majority of these studies have been reported from the Himalayan region. Some of these examinations go hand in hand with investigations on disaster management and the predictive potential of traditional knowledge. However, most of these studies are of a simplistic nature and do not adequately explore or analyse predictive capacities of communities.

Other important themes

A number of studies report on the cultural aspects of traditional knowledge in India. However, while the term traditional knowledge implies deep cultural engagements between people and nature, most studies analyse these aspects in a cursory manner (for an exception, see Arora's analysis of the *Tholung* sacred landscape in Sikkim; Arora, 2006). Many studies are descriptions of rituals or practices, but fail to go beyond these narratives in pointing out how human-environment relationships can be harnessed towards natural resource management. The potential for learning from these systems is immense as sacred landscapes (e.g.,

agro-cultural landscapes such as *demazong* and sacred forests such as *tholung* of Sikkim, *umanglai* of Manipur, *jatheran* of West Bengal, *dev vans* of Himachal Pradesh, *orans* of Rajasthan, *sarana* of Bihar, *deorai* of Maharashtra, *devarakadu* of Karnataka, *kovil kadu* of Tamil Nadu, *kavu* of Kerala, etc.) are widespread throughout the Indian region and wield considerable influence on the cultural dynamics of local communities. Cultural and educational themes have been dealt with cursorily in some of the literature relating to the Himalaya, the North East and the Deccan plateau, and even more poorly analysed for other regions.

A reasonable number of studies also deal with the issue of intellectual property rights in relation to traditional knowledge. These range from the issue of patents and benefit sharing especially for agricultural crops (e.g basmati rice, turmeric, neem) and medicinal products (e.g *jeevani*, *Trichopus zeylanicus*), privatisation of biotechnological research, compilation of TK, etc. In terms of overall research, the largest number of publications relating to IPR is from the Himalayan region. An increasing number of knowledge-centred analyses are being conducted on traditionally disadvantaged

groups such as women. The largest number of these studies has been reported from forest and agricultural systems in the Himalaya where women play a crucial role in managing local food and fodder resources. In coastal fisherfolk communities also, women play a critical role in maintaining livelihoods security. A handful of authors have analysed ethnobotanical and ethnomedicinal knowledge of women, especially that of elders belonging to tribal communities. The studies reported in this database point to an increasing scrutiny on the role of women.

Regional focus

Trans-Himalaya

The trans-Himalaya of India lies north of the Great Himalaya including the Zaskar, Ladakh and (parts of the) Karakorum ranges in the northern sector, and the Kangchenjunga region of Sikkim and northwestern Arunachal Pradesh in the northeastern sector. In both sectors, these cold desert landscapes form an extension of the Tibetan Plateau and are contiguous with the Tibetan Autonomous Region (TAR). These areas encompass parts of the present day states of Jammu and Kashmir (Ladakh district), Himachal Pradesh (Lahaul and Spiti district and parts of Kinnaur), and Uttaranchal (parts of Uttarkashi, Chamoli and Pithoragarh districts). In the north eastern part of India, the trans-Himalaya is restricted to parts of Sikkim and a small part of northwestern Arunachal Pradesh. Formally, the trans-Himalaya is divided into three main sections: Ladakh Mountains, Tibetan Plateau and Sikkim Himalaya.

The cold desert, as the name implies, is characterised by extremely low temperatures and high altitudes, making for harsh living conditions and an extremely adaptive set of lifestyles. The populations include nomadic as well as sedentary groups of people practicing a variety of traditional occupations related to agriculture and livestock rearing. They encompass numerous ethnicities largely belonging to the Tibetan-Himalayan group

of people, some of them migrant from neighbouring areas such as Nepal, TAR and Bhutan, and at the same time encompassing Hindu, Islamic, Buddhist and animistic religious affinities. In terms of research attention, traditional knowledge-related aspects of 27 communities were recorded as part of the database. The greatest focus was on the Bhotia communities in Uttaranchal, Ladakh, Spiti and Sikkim. The Bhotia are ethno-linguistically a Tibetan-Himalayan group that comprises closely related subgroups that are widespread across the trans-Himalayan, the Himalayan region and the Tibetan Plateau. Bhotia communities in most of these regions are involved in some forms of agriculture as well as nomadic pastoralism and occupy both trans-Himalayan and Himalayan zones. Communities settled along the border were involved in considerable trade with Tibet. A comprehensive knowledge of ethnomedicine has been a hallmark of the *amchis* or traditional healers among the Bhotia. The Lepcha of Sikkim also received significant research attention as did nomadic pastoralists such as the Changpa and the Van Gujjars. Although the majority of studies addressed local communities, a number of TK studies in the trans-Himalaya (especially from the eastern sector in Sikkim) also explored practices among recent migrants from Nepal, Tibet and Bhutan.

COMMUNITY FOCUS / TRANS-HIMALAYA

1 - 5 studies			5 - 10 studies		10 - 15 studies
Sikkim Bhotia	Tibetan	Brokpa	Ladakhi Bhotia	Uttarakhand Bhotia	
Changpa	Nepali	Bhoksa	Lepcha		
Spiti Bhotia	Manger	Bakarwal			
Sherpa	Limbu	Garhwali			
Dokpa	Gurung	Gaddi			
Van Gujjar	Swangla	Jaunsari			
Tharu	Pangwal	Kinnura			
Raji	Lahaula	Kumaoni			

In terms of research effort, a total of 34 studies were recorded in the database. Certain areas such as the Pithoragarh and Darchula districts of Uttarakhand have a larger concentration of studies. Research on traditional systems in the trans-Himalaya is dominated by ethnobotanical and agricultural explorations among local communities especially those targeting local healing traditions. Food preservation, edible plants, oil extraction and fermentation processes were also significant specific components of nutrition and health-centred studies. The contributions of Bhotia *amchis* or healers are particularly significant as these local healers are considered the guardians of traditional medicinal knowledge, and still remain active primary health providers in many far flung regions of the cold desert. These healing traditions encompass most of this ecological zone and has been the subject of a number of phytomedicinal explorations (Sharma et al. 2006) and some areas such as the Darchula area of Pithoragarh District (Uttarakhand) has received focused attention (e.g. Garbyal et al. 2007; Samal et al. 2010). Since agricultural production in most of these areas is constrained by water availability, a number of specialised irrigation and water distribution systems have evolved all across the trans-Himalayan region, particularly in Ladakh, Lahaul and Spiti, and Kangra districts (e.g. Angchok and Singh 2006; Sharma and

Kanwar 2009). Livestock rearing (especially nomadic pastoralism) also figures prominently in numerous studies. Long-distance transhumant pastoralism is a defining feature of many pastoralists in this region, particularly the Changpa. Vertical (altitudinal) pastoralism is also carried out among a number of Bhotia groups who move between trans-Himalayan and Himalayan regions. Pastoral nomadism such as that of the Gujjars, Gaddis and Bakerwals, etc. also straddle both these zones. Knowledge relating to rotation systems of grazing lands, community management and livestock husbandry and veterinary practices involving a variety of species (sheep, goats, horses, yaks and hybrids) is of prime importance to these groups (e.g. Singh and Misri 2006; Tiwari and Pande 2006; Rawat 2009). Most of these traditional systems are of relevance as dispersed agricultural settlements and widespread pastoral nomadism of the trans-Himalaya have resulted in a traditionally unique set of practices that could still form the basis of natural resource governance in the region. While the number of studies that integrate TK with conventional scientific research is limited, enquiries in contemporary forest management, biodiversity conservation, disaster management, cultural and educational aspects, etc. are underway on a small-scale (e.g. Samal et al. 2004; Liang et al. 2009; Zahradková 2013).

Himalaya

The Himalayan biogeographic zone encompasses the Siwalik Range, the Lesser Himalayan Ranges, and the Great Himalaya (the main range) in the northern sector, and in the eastern sector comprises the Eastern Himalaya. In the northern part of the Himalaya, these ranges form part of Jammu and Kashmir, Himachal Pradesh and Uttaranchal states; in the northeastern part of the country the Eastern Himalaya is constituted by parts of Sikkim, West Bengal and Arunachal Pradesh. The Great Himalaya borders the trans-Himalaya on its outer (northern) extremity, whereas the southernmost ranges lie contiguous with the Indo-Gangetic Plain. Seven ranges of the Lesser Himalaya (Nag Tibba, Dhualadhar, Pir Panjal, North Kashmir, Mahabharat, Mussoorie and Ratan Pir) occupy the 150 km stretch in between these extremities. The Himalaya is formally divided into four sections: North West Himalaya, Western Himalaya, Central Himalaya, and Eastern Himalaya.

The Himalayan zone is characterised by an extensive elevational gradient (near sea level to over 8000m) and a large number of altitudinal zones ranging from tropical and sub-tropical humid zones to temperate, subalpine, alpine and nival zones, and translates to a wide array of forest and ecosystem types. This corresponds to a diversity of local communities and livelihood strategies. In the TK database, TK components for 77 Himalayan communities were recorded. The largest number of studies recorded in the TK database was on three communities from the Eastern Himalaya. These included the *Apatani* and *Adi* people of Arunachal Pradesh and the *Lepcha* communities of Sikkim. In the middle sector, the single largest ethnic group is the *Pahari* people who are widely dispersed in the Himalayan zones of Uttaranchal and Himachal Pradesh. Other communities such as the *Bhotia* of the higher elevation zones and the *Tharu* and *Mewar* groups of the lower zones are also found in this region. Further west, *Kashmiri* and *Awan* communities as well as nomadic groups such as the *Gujjars* and *Gaddis* have been studied.

As the biogeographical zone with the largest number of

studies, the Himalayan region has set the standard for TK research in India. Over 200 studies representing TK-related components of 74 communities was recorded from this region. The most prominent research focus in this region has been on agricultural aspects of TK as well as issues relating to ethnobotany and ethnomedicine. Local systems ranging from general agricultural knowledge (Joshi and Singh 2006) to specific practices such as slash and burn (*jhum*) cultivation (), combined aquaculture and agricultural systems (e.g. Rai 2005), beekeeping (e.g. Verma and Attri 2005), fertility management (e.g. Gosai et al. 2011), cereal-based fermentation technologies (Yonzan and Tamang 2010) have been explored. Similarly, ethnomedicine has received extensive coverage in terms of descriptive studies (Sen et al. 2008, Rana et al 2013). The knowledge of prominent tribal communities such as the *Apatani* has been evaluated from a variety of perspectives (e.g. paddy-cum-fish cultivation - Rai 2005; traditional irrigation – Dollo 2009; community-based resource management - Barua and Slowik 2009; biocultural aspects and indigenous biodiversity - Srivastava et al 2010, etc.). The significance of traditional livestock herding systems in the Himalaya have also been widely recognised, especially from the point of view of commons management (e.g. Chakravarty-Kaul 1996). Transhumant pastoral systems such as those of the *Gujjars*, *Gaddis*, *Bhotia* communities, etc. (explained in the previous section) are part of an overlapping livestock system shared between the Himalaya and the trans-Himalaya.

A number of studies address issues related to climate change that are of general relevance to the Himalaya, but only a few look at site specific issues and knowledge in relation to climate change (e.g. Singh et al. 2011; Rana et al. 2013). The role of TK in contributing to forest management, biodiversity conservation and other natural resource management activities have been explored on a regional basis across several sites (e.g., Farooque et al. 2004; Sharma et al. 2009 a; Arunachal – Pangging et al 2011). Responding to an emerging significance of cultural relationships linked

to the environment (Gupta 2006), some communities such as the *Apatanis* of Arunachal Pradesh and the *Danus* and *Takulis* of Uttaranchal have been successful in developing biocultural protocols for their respective

communities. Many cultural explorations also address gender issues, especially the role of women in continuing cultural traditions and livelihoods security (e.g Singh et al. 2013).

COMMUNITY FOCUS / HIMALAYA

	1 - 5 studies		5 - 10 studies		10 - 15 studies
Sikkim Bhotia	Sartang	Aiton	Garhwali		Apatani
Gaddi	Sarki	Awan	Van Gujjar		Adi
Aka	Rawal	Bhahuns	Nepali		Lepcha
Uttarakhand Bhotia	Raika	Bhandari	Limbu		Pahari
KumaonI	Phake	Bhangali	Nyishi		Monpa
Wancho	Padam	Bhujel			
Rai	Newar	Sherdukpen			
Khamti	Miji	Sunuwar			
Galo	Majhis	Syed			
Sherpa	Mager	Tagin			
Bhoksa	Lisu	Tamang			
Ahom	Jogi/Sanyasis	Tangsa			
Spiti Bhotia	Kiranti	Chakma			
Tibetan	Howa	Chettrie			
Tharu	Khombu-Rai	Damais			
Swangla	Kharkhan	Takuli			
Raji	Kashmiri	Thakuri			
Pangwal	Kamis	Thamis			
Lahaula	Kalita	Danu			
Jaunsari	Guro	Turing			
Gurung	Drukpa				
Yakha	Deori				

DESERT

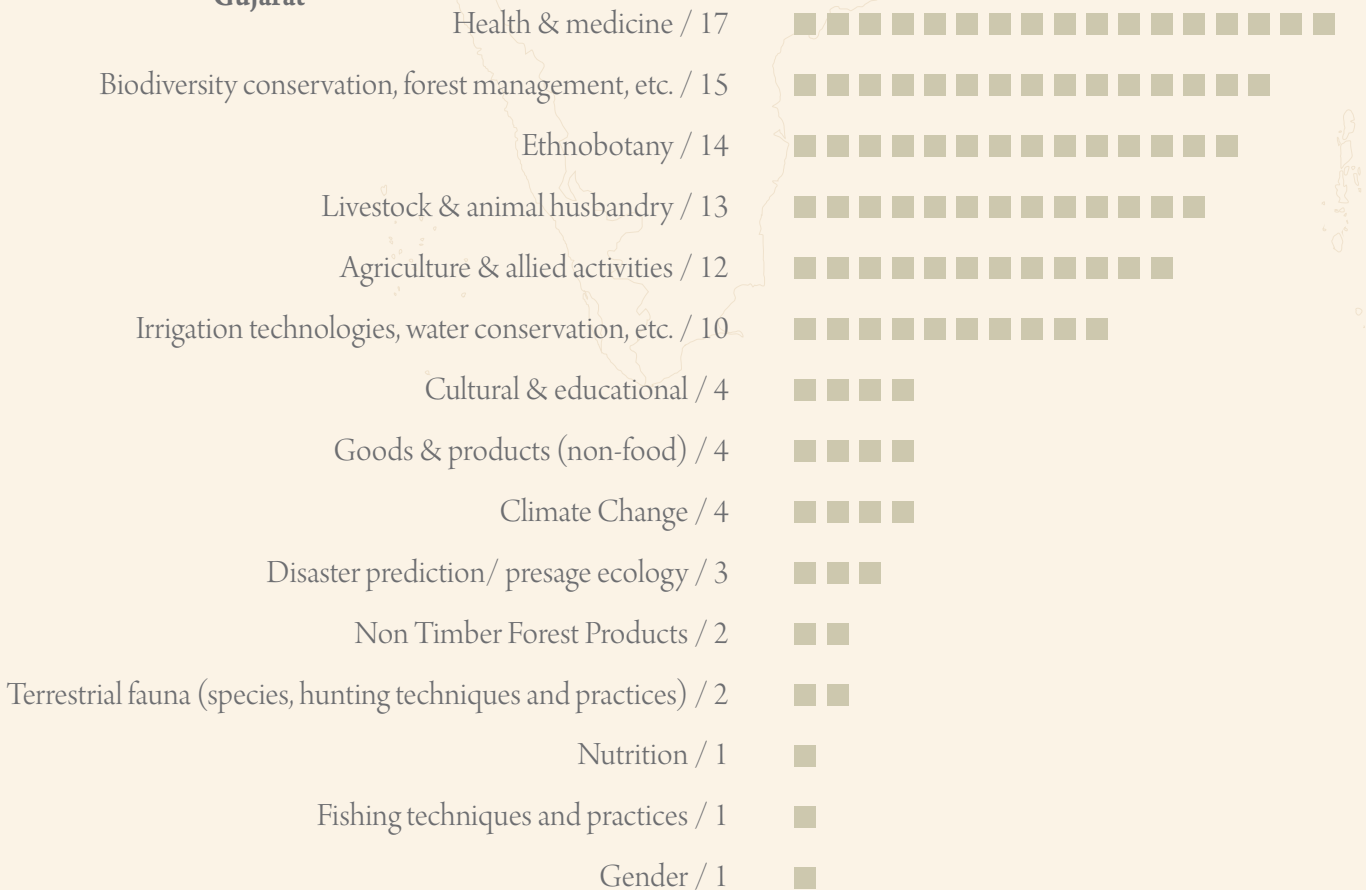
COMMUNITIES & RESEARCH THEMES IN FOCUS



RESEARCH THEMES

■ = 1 study

Gujarat



Desert

The Indian Desert or the Thar Desert is situated along the north western border of the country. Although most of this biogeographic zone is located within the state of Rajasthan, a significant section extends into the Katchchh region of Gujarat and also small areas of Punjab and Haryana. The desert zone is bounded by the Aravallis along its eastern boundary, the rivers Sutlej and Indus in the north and west and the salt marsh known as the Great Rann of Katchchh towards the south. The formal divisions of the Indian Desert are the Thar Desert and the Katchchh region and the predominantly desert districts include Bikaner, Jodhpur, Jaisalmer and Barmer. The Thar desert is one of the most populated deserts globally, and communities living in this region not only practice nomadic livestock herding and husbandry which are typical occupations related to desert livelihoods, numerous communities also practice settled agriculture. This database included 50 studies that had significant components of traditional knowledge distributed among 27 communities in the desert zone. The most focused research effort seems to be on *Bhil* and *Meena* (sometimes considered a subgroup of *Bhil*) communities. While the former are not strictly desert communities, the database also recorded a moderate number of explorations of traditional practices related to nomadic desert groups such as the *Raika* and the *Kalbelia*. Groups such as the *Bishnoi* community have also received attention from the conservation community (e.g. Kumar 2005; Mukhopadhyay 2006).

Research themes that were addressed a number of times include knowledge related to health and medicine, ethnobotanical knowledge and livestock and animal husbandry. Ethnobotanical explorations have been carried out among a number of communities in the region (e.g. Mathur 2013). Numerous studies on dominant communities such as the *Bhil* and *Meena*, as well as that of small groups have been addressed from this perspective. Although most of these communities now practice settled agriculture, tribes such as the *Bhil* are known to possess high levels of ethnobotanical and terrain based knowledge which is an outcome of their long-time engagement in gathering, hunting and *shikar*. Although large-scale sedentarisation of desert communities have taken place over the years, livestock continues to be a crucial component of livelihoods in the regions. Numerous studies therefore address livestock herding and animal husbandry related practices in desert and semi-desert regions. Examples are animal healthcare (e.g. Galav 2010), livestock rearing (Chand 2011), feeding practices (Vyas and Sharma 2006), etc. A number of studies have also attempted to understand TK from the point of common property and natural resource management (e.g. Venkataraman 2011). The traditional knowledge of groups such as the *Kalbelia* and *Sapera* whose occupations as snake charmers is being addressed in terms of their potential for medicinal plant harvesting (Kumar 2013) as well as in anchoring conservation action (e.g. Dutt and Kaleta 2005).

COMMUNITY FOCUS / DESERT

1 - 5 studies			5 - 10 studies		10 - 20 studies
Damor	Dindor	Kushwaha	Chamar	Raika	Meena
Sansi	Bishnoi	Koli	Barar	Kathodi	Bhil
Parmar	Banjara	Charan	Banwaria		
Kalbelia	Ahari	Maher	Ahir		
Gujar	Thakur	Saheria	Kanjar		
Raot	Sapera	Nut			

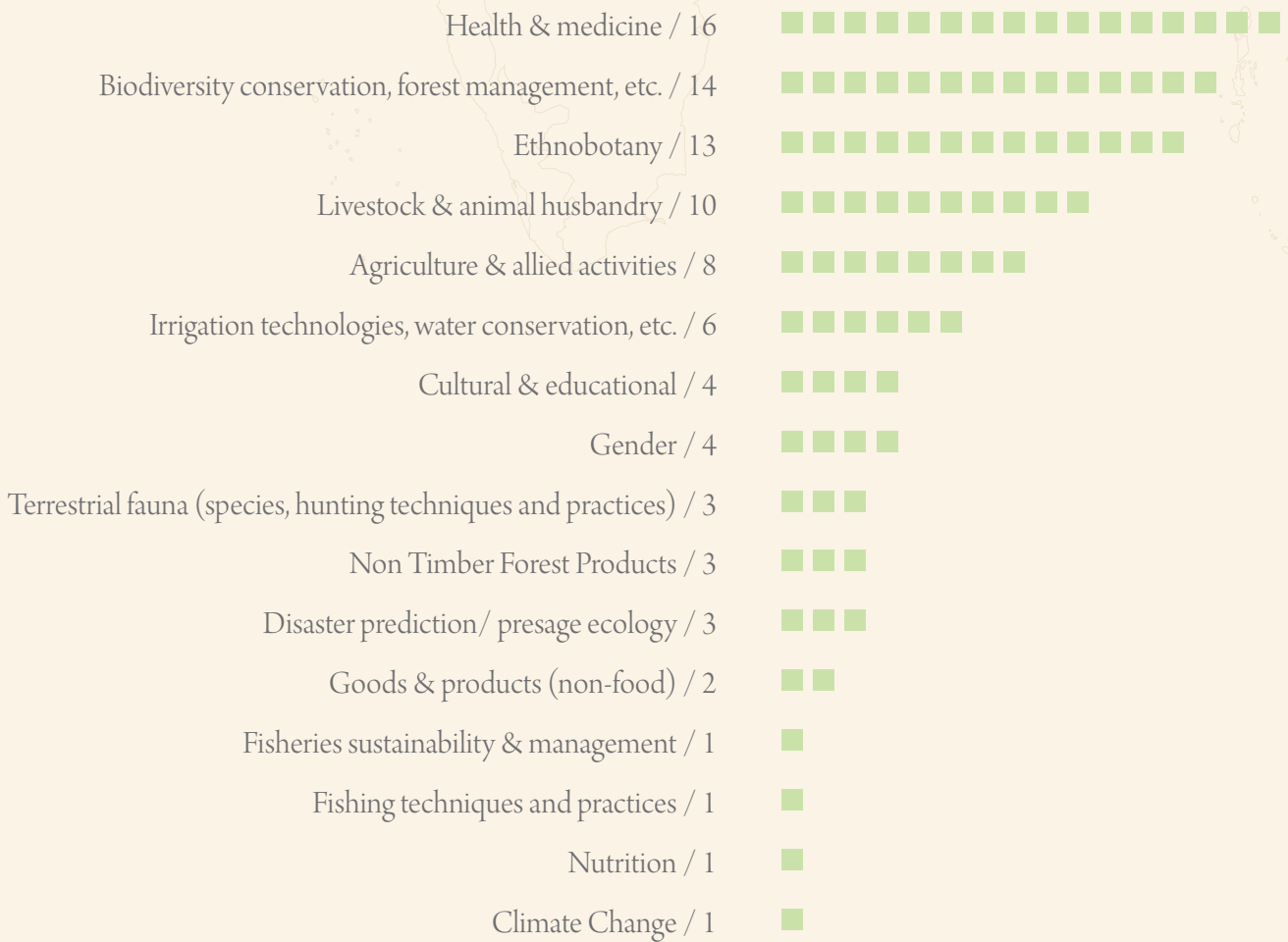
SEMI-ARID

COMMUNITIES & RESEARCH THEMES IN FOCUS



RESEARCH THEMES

■ = 1 study



Semi-arid

The semi-arid zone adjoins the Indian desert is formally divided into the Punjab Plains and the Gujarat-Rajputana region. This area comprises of significant sections stretching from the Aravallis in Rajasthan to the Gir Range in Gujarat, and includes small sections of the Bundelkhand region and the Vindhya Hills. Parts of Rajasthan, Gujarat, Madhya Pradesh, Haryana and Punjab fall within this biogeographic zone.

Over 40 addressing TK components were evaluated at different levels for 45 community groups. The groups receiving the highest research attention were the *Bhil* and *Meena* communities and their subgroups. As the semi-arid zone shares boundaries with the arid zone, the Gangetic plain, the Deccan, and even the Himalya, there is a great deal of overlap in human communities from these zones in the interstitial spaces (e.g. *Gonds*, *Waarlis*, *Oraons*, *Maldharis*, etc.). Additionally, these areas have traditionally been populated by widely dispersed and mobile communities. Many of these groups have knowledge not only about a single occupational strategy but numerous complementary skills (e.g. agriculture, hunting, harvesting of wild plants, livestock rearing, etc.) that allow them to make use of the marginal landscapes that they inhabit (e.g. forests, marginal and sub-marginal common lands, etc.).

TK research in the semi-arid zone focused on similar

themes as the desert zone, but includes studies on a larger number of local communities (a number of studies reported for the semi-arid zone overlap with that of the desert region). As is the case of the desert zone, most of the traditional nomadic groups across this region have been sedentarised, resulting in a greater shift towards agricultural occupations. Despite this shift, a great deal of local knowledge is still possessed and used by communities as is evident from studies on ethnobotany that deal with medicinal plants, poisonous plants, plant-derived remedies for snake bite, etc. (Meena and Yadav 2010; Jain 2011). Similarly, despite a high degree of sedentarisation, livestock herding and animal husbandry practices of numerous communities such as the *Raika*, *Maldhari*, *Bhils*, *Meenas*, etc. remain an important subject for TK research (e.g. Nag et al. 2007; Jadeja et al. 2006). Specific themes such as common property resources and their linkages with traditional knowledge and potential conservation strategies have been studied by several researchers in the Central Indian region. These include studies on communities such as *Bhils*, *Kathiawadies*, *Mendhpals*, *Gujjars*, *Meenas*, etc. (e.g. Ghate 2000; Wisborg 2000; Modi 2011). A few studies on water management have attempted linkages with traditional knowledge and common property resources. These include evaluations of water management strategies to improve tribal livelihoods (e.g. Verma 2007), conservation of water as a common property resource (Modi 2011), etc.

COMMUNITY FOCUS / SEMI-ARID

1 - 5 studies			5 - 10 studies		10 - 20 studies
Raika	Kalbelia	Nut	Charan	Kathodi	Bhil
Damor	Raot	Thakur	Chamar		Meena
Sansi	Kanjar	Sapera	Barar		
Parmar	Dindor	Maher	Ahir		
Gujar	Banjara	Kushwaha	Majhis		
Saheria	Ahari	Koli	Warli		
Santal	Oraon	Naika	Mendhpal		
Maldhari	Mahyavansi	Mahatao	Konkana		
Kathiawadies	Gond	Gameti	Dubla		
Dhodia	Chodra	Bhambi			

Western Ghats

The Western Ghats or the Sahyadri mountains are located along the western coast of peninsular India. Although this zone is formally divided into the Malabar Plains and Western Ghats mountains, the latter itself is comprised of numerous small ranges. The Ghats are a nearly unbroken range in its northern sector with major discontinuities such as the Palghat Gap and the Shencotta Gap located in the southern hills. The southern mountains are also higher, with the highest elevation (2695 m, Anaimudi) being reached at the junction of the Anamalais, the Palnis, and the Cardamom Hills. The Ghats occupy significant areas in Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala.

Over 70 studies accounting for the activities of 45 communities were recorded for the Western Ghats region. The largest number of studies focused on the Kani tribal community of Kerala and Tamil Nadu. The hill communities of the Kurumba tribes and their subcommunities (e.g. Jenu Kurumba, Betta Kurumba, etc.) who are a widely distributed group in Karnataka, Kerala and Tamil Nadu also received nearly the same quantum of research attention as the Kanis. TK-related knowledge of the Irula and Soliga tribes and traditional versus contemporary occupational and livelihood-related shifts have also been researched critically by various authors. Among other groups, the majority of studies focused on the hill tribes of the Western Ghats forests.

When compared to other biogeographic zones in India, the Western Ghats have perhaps received the most rigorous evaluations of traditional systems, at least for a few communities. Ethnobotanical (particularly ethomedicinal) knowledge examinations which are the most researched topic in this biome have been carried

out on a number of tribal communities. In this context, the greatest degree of research attention has targeted on the Kani community in the southern Western Ghats. The discovery of the medicinal properties of jeevani (*Trichopus zeylanicus*) an endemic species used by the Kani community for its rejuvenating and medicinal properties was the starting point of a debate on India's ABS framework (e.g. Anuradha 1998; Suneetha and Pisupati 2009). The hunting and collection activities of communities such as the Kurumbas have also received significant attention (e.g. Mahanty 2003; Tharakan 2007). In recent years, a number of studies have looked at traditional knowledge-related aspects of the Soliga community of the Biligiri Rangan Hills of Karnataka. These studies are among the first examples of long-term work with forest-dwelling tribal communities that look to inform contemporary conservation and livelihoods opportunities that involve traditional ecological knowledge and natural resource management (e.g. Setty et al. 2008 Madegowda 2009). Knowledge related to the collection of NTFP species is a key element of the knowledge of forest-dwelling people. Over 15 studies from this region report on this topic, and some refer to the potential of TK relating to NTFP collection and harvesting to enable to conservation of these species (see Rist 2010). Detailed studies have been carried out addressing a variety of NTFP products such as wild honey, black dammar (*Canarium strictum*), mountain date palm (*Phoenix loureiroi*), *Phyllanthus* sp., etc. Overall assessment of TEK in the Western Ghats have addressed a range of communities, species and interacting research themes. A significant number of studies from this region move away from routine descriptive studies and explore theoretical aspects as well as practical potential for integrating TK into contemporary natural resource management.

COMMUNITY FOCUS / WESTERN GHATS

	1 - 5 studies			5 - 10 studies	10 - 15 studies
Malapandaram	Paliyan	Saliya	Kota	Soliga	Kani
Kadar	Malekudiya	Nayaka	Koraga	Irula	Kurumba
Urali	Malavedan	Nayadi	Katkar	Paniya	
Ulladan	Malayar	Muggera	Bunt	Muthuvan	
Muduga	Malakurava	Maratha	Billava	Kattunaika	
Malasar	Kodava	Mannan	Adikarnataka	Kurumar	
Malaaraya	Badaga	Malayali	Pulaya	Kurichiya	
Cholanaika	Adiya	Malaimalasar	Thakar		
Vokkaliga	Toda	Lingayat	Kurava		

Deccan Peninsula

The Deccan peninsula covers the regions south of the semi-arid zone and the Gangetic Plain. Along the western side it forms the escarpment of the Sahyadri mountains or the Western Ghats and is bordered by the coastal zone in the east. Although this is a large moderate elevation peninsular plateau region, formally, this zone is comprised of five subdivisions: the Central Highlands, Chhota Nagpur, Eastern Highlands, Central Plateau and Southern Deccan. This zone forms a greater part of the peninsular states including Madhya Pradesh, Jharkhand, Chhattisgarh, Odisha, Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu.

An extensive region of diverse ethnicities, the Deccan Plateau remains a vast reservoir of traditional knowledge, much of which is poorly recorded within academic research. Over 140 studies that evaluated the traditional practices of 86 communities were considered as part of the database for this region. However, considering the extent of this region, research effort in this zone can at best be termed moderate. The largest research focus has been on *Gond* communities who are the largest tribal group in the Central Indian zone. The *Gonds* are a Dravidian group comprised by a large number of subcommunities who dispersed across the Deccan area in both forested as well as open landscapes. A closely related ethnic group, the *Khonds*, centred around the states of Odisha have also been the focus of research efforts. Between them, these communities practiced (and continue to practice) a variety of occupations including agricultural activities (both shifting cultivation and settled agriculture, dryland farming), hunting and gathering, livestock herding, etc. on which a number of research evaluations have focused. The third most studied group in this region is the nomadic *Banjara* community which is currently most populous in Telengana and Andhra

Pradesh.

TK relating to ethnobotany, particularly those on medicinal and healing properties of plants were the most researched subjects in the Deccan Plateau. Medicinal plant use was explored among numerous communities such as the Waarli, Kondh, Bhil, Bihrore, Irula, etc. (e.g. Syed et al. 2007; Franco and Narasimhan 2009; Jain et al. 2010; Mairh 2010; Umapriya et al. 2011). Traditional agricultural practices in the Deccan region also received research attention on varied sub themes such as rain-fed agro-ecosystems of *Gond*, *Baiga* and *Pradhan* communities (e.g. Singh and Sureja 2008a), soil conservation practices of *Gond* and *Mawasi* tribes (e.g. Kala 2013), the *bakhar* starch fermentation practices of numerous communities including the *Santal*, *Kondh*, *Gond*, *Munda*, *Kolha*, etc. (e.g. Dhal et al. 2010), indigenous grain storage structures (e.g. Sundaramani et al. 2011) landraces of agricultural crops cultivated by several tribal groups such as the *Gond*, *Kolam*, *Banjara*, etc. (e.g. Pandravada 2013), etc. In addition to the large number of studies that touch upon livestock management in common lands, studies on specific sub themes such as leather processing technologies such as those of the *Arundhatiyar* caste (Sujata 2002), traditional herd management practices (Nagnur et al. 2006), veterinary practices of groups such as *Adikarnataka*, *Besta*, *Idiga*, *Kuruba*, *Vokkaliga*, etc. (Rajakumar and Shivanna 2012) have been carried out. In general, these descriptive studies combined with evaluations of specific topics such as common property resource management has resulted in a large body of literature from the region. However, despite this, there is a dearth in research considering the large extent of area and the urgent need to adequately address urgent livelihood-needs of some of the poorest and most marginalised communities in India.

COMMUNITY FOCUS / DECCAN PENINSULA

1 - 5 studies

Paroja	Paliyan	Bharia	Arundhatiar
Gadaba	Malaimalasar	Asariar	Bhuinya
Malayali	Adikarnataka	Halakki	Bhumij
Yanadi	Saheria	Bhuyan	Idiga
Pardhan	Raot	Juang	Birhore
Koya	Warli	Burad	Kamma
Korku	Mendhpal	Kondareddi	Chellipale
Ho	Kathiawadies	Chettiar	Madiga
Chenchu	Yerukala	Mala	Didayi
Bonda	Yerava	Dom	Mandiya
Baiga	Shetty	Mannadiyar	Ghasi
Irula	Shabar	Manne	Mirdha
Pawra	Sakiliyar	Vokkaliga	Mobasi
Mawasi	Rathiya	Muriya	Bhumia
Lohra	Parayar	Kolam	Nari Kuravar
Kunbi	Nehal	Kolha	Bhatoda
Besta	Halba	Binjhal	Kahar
Chasa	Koyadora	Chick	Mallah
Gawli	Gowda	Guthikoya	Bhatra
Nagesia	Nayakpod Andh		

5 - 10 studies

10 - 15 studies

> 20 studies

Banjara	Khond	Gond
Bhil		
Santal		
Oraon		
Saura		
Munda		

Gangetic Plain

The Gangetic Plain is an extensive, fertile, primarily alluvial landscape, bounded in the north by the Himalaya and in the south by the Bay of Bengal. Formally divided into the Upper and Lower sections, this region comprises the lower drainages and flood plains of the Ganga, the Jamuna and their tributaries. The Gangetic Plain encompasses parts of Uttar Pradesh, Haryana, Bihar, Jharkhand and West Bengal. While the northern sector of this biogeographic zone is primarily agricultural landscapes, areas further south, especially those such as the Sunderbans delta have retained a great deal of natural vegetative cover and associated fauna.

Thirty six studies which touched upon traditional practices of 24 different communities were compiled for this zone. It is clear from the small number of studies that this region has received limited research attention. Unlike other biogeographic zones where multiple studies on single ethnic groups are commonplace, only two communities (*Shabar* and *Majhis*) were represented by more than a single study. The *Shabar* live in the remaining forested areas of the zone in West Bengal, Jharkhand, etc. The *Majhis* are people of the fertile doabs of the Gangetic plain in Punjab, Uttar Pradesh, Bengal, etc. Traditionally, this zone has been home to many nomadic communities including a number of groups who were listed under the Criminal Tribes Act of 1871. Although largely associated with dacoity and robbery, most historical accounts on groups such as the *Bhantu*, *Doms*, *Bawariya*, *Banjara*, *Baoria*, etc. point to their exceptional skills and expertise in hunting and trapping related activities. These are largely unrecorded in contemporary traditional

knowledge literature. Moreover, their traditional lifestyles have clashed with the modern paradigm of exclusionary conservation resulting in more persecution for these communities. Gentrification projects that aim at sedentarisation or weaning people away from forests are also not uncommon.

Most of the contemporary research on TK in this zone relates to agricultural and ethnobotanical practices among communities of the Gangetic plain. Ethnobotanical research includes studies on indigenous rice and wheat-based agroecosystems (Singh and Sureja 2008b), traditional food storage practices (Dhaliwal and Singh 2010), processing and storage of spices (Sharma 2012), etc. As some of these regions are flood prone, TK has in some cases focused on water conservation strategies related to agriculture. These include research on embankments, flood plain agriculture, flood control and water regulation technologies, etc. Pant 1998; Singh et al. 2009; Das et al. 2009 a,b). A significant number of studies have also targeted freshwater fishery. Indigenous fish farming technologies (Goswami et al. 2006), fishing methods (Prasad et al. 2013), construction of indigenous fish traps (Manna and Bhattacharya 2009), etc. are specific topics that have received attention. Cultural and educational aspects of TK as well as a moderate level of attention on climate change has resulted in a few studies that touch upon these themes in this zone. However, on the whole, research interest and effort has been limited for the Gangetic Plain, despite the obvious significance of this region for supporting populations and livelihoods.

COMMUNITY FOCUS / GANGETIC PLAIN

1 - 5 studies

Shabar	Bhumij	Kairi	Thakur	Ahom (Tai-Ahom)
Majhis	Teli	Goala	Kushwaha	Tharu
Santal	Sadgope	Gond	Chamar	Mahatao
Munda	Rajak	Oraon	Barar	
Ho	Muchi	Saheria	Sapera	

Coasts

The coastal and littoral regions of peninsular India are formally divided into 2 geographic subcategories – the West Coast and East Coast. The western zone includes part of Katchchh, Kathiawar, Konkan, Kanara and Malabar coasts (including the coastal zones of the states of Gujarat, the Union Territory of Daman and Diu, Maharashtra, Goa, Karnataka and Kerala). Along the east, the Coromandel coastal zone is a strikingly different landscape, with a wider continental shelf and coastal tract and encompassing the deltas of major rivers such as the Ganga and Brahmaputra, the Baitarani, Brahmani, Mananadi, Krishna and Cauvery (comprising the coastal states of West Bengal, Odisha, Andhra Pradesh and Tamil Nadu and the Union Territory of Pondicherry).

A total of 124 studies dealt with coastal and marine regions but a majority of the studies (88%) failed to provide any details regarding caste groups or even community names. Many studies merely refer to 'fishermen communities', 'rural communities' or 'traditional fishermen'. Only a couple of studies examined knowledge among women in fishing communities. Such studies therefore seem to treat communities as an integrated unit and do not interrogate the role that caste dynamics can play in relation to knowledge production or practice. As a matter of fact, almost all studies in the database treat 'communities' as cohesive

units, and operate with the assumption that since they require resources for their livelihoods, they have the best knowledge of the environment surrounding them. As Agrawal and Gibson highlight (1999), many studies that seek to revive the interest in communities as a central feature of successful resource management, work with assumptions that establish positive correlations between 'communities' or 'fishermen', their knowledge and the health of the ecosystems around them. A few studies that we came across discussed the work of institutions and it is in this literature that one finds a more nuanced understanding of knowledge dynamics and resource politics. Mathew (1991), Lobe and Berkes (2004), Thomson and George (2009), Coulthard (2011) Nayak and Berkes (2011) and Rajagopalan's (2012) work on institutions involved in stake net and lagoon fisheries and Rajan's (2002) study of the Kadakodi system of governance actually investigate how governance systems negotiate knowledge and politics and also identify conditions under which local management systems work or don't.

Most studies we examined address fisheries management in a general way and mostly attempt to document what observations and meanings are generated by fishing communities. A detailed analysis of how LEK is represented in studies in coastal and marine spaces follows in the next section.

COMMUNITY FOCUS / COASTS

1 - 5 studies

Nolia	Saura	Mogaveera	Bovi
Pattinavars	Besta	Karvi	Bauri
Santal	Sundies	Harikantra	Araya
Khond	Oriya	Gangamathasta	Ambiga

Northeast

The northeastern region can be physiographically divided into the North East Hills and the Eastern Himalaya. The North East biogeographical zone is formally classified into the Brahmaputra Valley and the North East Hills. The most prominent hill complexes within the North East zone is the Naga-Patkai Hills and the Lushai Hills. These plains and hills together comprise a diversity of altitudinal zones and ecosystems. All the north eastern states other than parts of Arunachal Pradesh and Sikkim are included within this zone.

The North East zone has received a great deal of research attention from the perspective of traditional knowledge. While studies in the Himalaya and the Deccan Plateau region typically touch upon traditional practices as part of research typically focused on related themes such as common property management or agricultural research, a high degree of ethnocultural diversity and dependence on natural resources in the northeastern region has prompted numerous direct (albeit descriptive) evaluations of traditional knowledge-centric research. This is evident from 120 studies recording the practices of over 90 different community groups. A great deal of research has focused on aspects of traditional knowledge relating to three major communities: the *Khasi* group of Meghalaya, the *Meitei* of Manipur and the *Karbi* community of Assam. Multiple studies pertaining to other communities such as *Bodo*, *Ahom*, *Mishing*, *Jaintia*, *Garo*, *Santal*, *Mizo* and various sub groups of the *Naga* community have also been undertaken by researchers focusing on a variety of themes.

The major themes of research that have received focused attention in the North East zone have centred around agriculture, ethnobotany, health and medicine and nutrition. A large number of studies have also addressed specific areas of interest such as freshwater fisheries and aquaculture, biocultural aspects, fermentation processes, terrestrial hunting and community-based conservation.

The extensive literature on agricultural practices can be categorised into studies that deal with traditional agroforestry practices (e.g. Shrivastava and Heinen 2005; Nath et al. 2009), soil conservation strategies (e.g. Das and Das 2005; Singh 2012), combined agricultural and aquacultural production systems (Barooah and Pathak 2009), pest control (Bhattacharjee and Ray 2010; Thakur et al. 2013; review in Kumar et al. 2009), and production strategies for specific crops (e.g. Das and Das 2005; Sharma et al. 2009 b). Similarly ethnomedicinal research results have been reported from throughout the northeastern region (e.g. Bhattacharjya and Borah 2008; Chakraborty et al. 2012). Paralleling the heavy dependence of local communities on locally available flora and fauna as well as farming practices, nutritional products and strategies receive a significant degree of attention. In this context, the production and preservation techniques surrounding fermentation technologies is a hallmark of the northeastern region, and TK research has documented a large number of these technologies (e.g. Teron 2006; Muzaddadi and Basu 2012). Fish resources (both wild caught and aquaculture derived) and wild terrestrial fauna are also key components of nutritional strategies and hence have received moderate attention by researchers working on traditional knowledge (e.g. Tynsong et al. 2012; Devi et al. 2013). Cultural components of TK research that have received attention include descriptive studies that explore the traditional knowledge women (e.g. Bhattacharjya and Borah 2008 ; Barooah and Pathak 2009), biocultural aspects of conservation including management units such as sacred groves (e.g. Jeeva et al. 2006), and exploration of the cultural significance of traditional systems (e.g. Singh et al. 2007; Singh et al. 2010). The literature on management of forest resources using traditional knowledge is a growing one with numerous studies dealing with locally significant practices such as shifting cultivation (e.g. Malik 2003; Das 2006) community-based forest management (e.g. George and Yhome 2008), etc.

COMMUNITY FOCUS / NORTHEAST

	1 - 5 studies		5 - 10 studies		10 - 15 studies
Santal	Dimasa (Kacharis)	Namashudra	Bodo		Khasi
Mizo	Assamese	Motok	Ahom		Meitei
Lotha (Naga)	Munda	Mog	Mishing		Karbi
Angami (Naga)	Goala	Maran	Jaintia		
Ao (Naga)	Oraon	Mara	Garo		
Sema (Naga)	Bhil	Maibas			
Kachari	Mala	Maal			
Chakhesang (Naga)	Lepcha	Kyong			
Chutia	Sikkim Bhotia	Kurmi			
Pochury (Naga)	Rai	Kuki-Chin-Mizo			
Nepali	Khamti	Konyak (Naga)			
Jogi/Sanyasis	Gurung	Koiri			
Deori	Turing	Khenmungun (Naga)			
Chakma	Phake	Khamyeni			
Zeliang (Naga)	Aiton	Kabiraj			
Tripuri	Yimchunger (Naga)	Jamatia			
Sumi Naga	Ukai	Hmar			
Rengma (Naga)	Teegu	Hira			
Pangal/ Meitei-Pangal	Sonwal Kacharies	Halam			
Paithe	Sangtam (Naga)	Hajong			
Naga	Reang	Gour			
Maring (Naga)	Rabhas	Debbarma			
Lushai	Pnar	Darlong			
Kuki	Phom	Cheimal			
Koch	Pashi	Chang (Naga)			
Kalia	Panica	Biate			
Kaivartas	Noatia	Bengali			
Barman	Auchai				

COMMUNITY FOCUS / ISLANDS

	1 - 5 studies		5 - 10 studies
Onge	Shompen	Karen	Nicobari
Jarawa	Lakshadweep islanders		

ISLANDS

COMMUNITIES & RESEARCH THEMES IN FOCUS



Lakshadweep
Islands

Andaman
& Nicobar
Islands

RESEARCH THEMES

■ = 1 study

Ethnobotany / 9	■ ■ ■ ■ ■ ■ ■ ■ ■ ■
Health & medicine / 6	■ ■ ■ ■ ■ ■
Cultural & educational / 5	■ ■ ■ ■ ■
Goods & products (non-food) / 5	■ ■ ■ ■ ■
Disaster prediction/ presage ecology / 4	■ ■ ■ ■
Biodiversity conservation, forest management, etc. / 4	■ ■ ■ ■
Fisheries sustainability & management / 2	■ ■
Fishing techniques and practices / 2	■ ■
Nutrition / 2	■ ■
Intellectual Property Rights / 2	■ ■
Terrestrial fauna (species, hunting techniques and practices) / 1	■
Agriculture & allied activities / 1	■
Climate Change / 1	■
Gender / 1	■

Islands

The Lakshadweep Islands, situated on the west coast of southern India and the Andaman and Nicobar Islands, situated in the Bay of Bengal, are the country's main archipelagos with distinctive social-ecological systems. While the Lakshadweep group are coral atolls with comparatively sparse flora and fauna; within the Andaman and Nicobar Islands flora and fauna is much greater, more dispersed and comprises biologically diverse groups. The Andaman Islands form part of the Indo-Burma biological hotspot, while the Nicobars constitute the north-westernmost extremity of the Sundaland hotspots. Administratively, both the Lakshadweep islands and the Andaman and Nicobar Islands are Union Territories of India with a more direct involvement of the Central Government in the regions' governance and affairs.

A number of anthropological studies have been conducted on the Andaman and Nicobar Islands and it is from these studies that one gains a better perspective of knowledge systems in the islands. Viswajit Pandya's studies on the Andamanese groups provide insights into belief systems and cosmologies from anthropological investigations revealing, also the effect of change on these communities and their practices (Pandya 1993; Pandya 2009). These studies do not turn up in straightforward searches for traditional knowledge in digital databases, a point to be noted in future Internet-based bibliometric analyses.

Varadarajan's (2000) study of the calendrical systems of the Nicobarese, used to plan fishing, sailing trips and festive events in the islands, is a non-codified one, being dependent on a 'continuous process of self-referencing', implying a 'sophisticated thought process' among the people of Chowra. She notes that despite the introduction of the Gregorian calendar in the islands, the Nicobarese calendars made no names for days of the week or months of the year. She notes that a symbiotic relationship with the islands meant neither linear time nor cardinal directions mattered to the Nicobarese system of life. Thus each island developed its own

calendrical system based on its specific conditions which could still be integrated with the Gregorian calendar within the lunar scale.

For the Lakshadweep Islands, Sharma (2012) has conducted a study that examines TEK among the residents of all the inhabited islands. Her work shows that the islanders possessed a different nomenclature for a wide range of plants and animals found on the island, in the lagoon and the reef. The transmission of knowledge takes place in the form of story-telling. She notes that the local names of fishes, plants, birds, and other fauna in the Jeseri (spoken in all islands) and Mahl (spoken only in Minicoy) dialects have been recorded by other researchers as well. Sharma followed the technique of showing images from animal field guides to arrive at people's understandings about them. From studies that are more in-depth it is clear that the levels of knowledge differ greatly among members of even relatively smaller communities. Sharma has recorded that fishers of the Lakshadweep use mental maps, stories and proverbs to suggest ecological associations and the beliefs and knowledge of people help in making rules regarding the resource. Other important contributions to our understanding of LEK among the Lakshadweep Islanders are Lotika Varadarajan's edited book *Rahmani of M.P. Kunhikunhi Malmi of Kavarati – a sailing manual of Lakshadweep* (2004), her book on the sewn boats of the islands (1998) and T.A. Kunhi's *Marjan- a study of traditional Navigation Science in Lakshadweep* (2001). Both establish the dependence of the islanders on their observations and knowledge of astronomy, sailing, ocean and weather patterns to undertake long distance navigation, while exhibiting a deep knowledge and expertise in cartography and nautical instrumentation.

Sharma's studies reveal a concern among islanders about their 'eroding' knowledge and changes in lifestyles and professions. She however concludes by arguing for a better understanding of TEK systems and proposes the creation of opportunities and spaces to practice, develop and transmit the same.

3

Knowledge at the Margins

LEK on Coastal and Marine Systems of India

Aarthi Sridhar

Introduction

This section of the report provides a detailed analysis of publications related to coastal and marine ecosystems and the manner in which LEK is presented here. The Indian coastline has been a space of diversity, accommodating a range of specialised habitats such as mangrove forests, sandy beaches, rocky outcrops, offshore islands, reef systems, promontories, sand dunes and mudflats, making for a vibrant biodiversity. In step with this diversity is the

multitude of human communities that occupy these stretches. Thus coastal communities in India vary widely in cultural practices related to natural resource dependency not just between states, but between ecosystems. The histories of each of these composite units are rich with accounts of human use, knowledge, institutions, norms and rules around nature though very few scholarly accounts fully examine the breadth of these topics.

Identifying LEK literature for analysis

A brief explanation is necessary regarding the LEK publications that we encountered using specific search protocols. We found that several studies were not included in the database despite the detailed keyword searches conducted across search engines such as Google, Google Scholar, Research Gate and Web of Knowledge, besides a detailed search across over a hundred websites and online repositories. We followed the keywords specified in the figure on pages 40-41 and searched across specialised websites and digital repositories that we were aware would contain information on fisheries or coastal issues in India. However, we were able to obtain a number of other publications based on our own prior knowledge and through the advice of domain experts that we contacted. We acknowledge that it is possible that we have failed to include some studies that examine LEK in coastal regions. We also acknowledge that the subject itself is a broad one and often the best accounts are embedded in detailed anthropological studies which are ethnographies of particular communities. In this regard, the scholarly works of Pandya (1990; 1993, 2009), (anthropological investigations on the

Andamanese, the Ongee and the Jarawa in particular), Varadarajan (1998, 1990) (on navigation and maritime instrumentation technologies, boat building and sailing norms and knowledge in the Indian Ocean), Bharathi (1999) (on the Pattinavar fishers of Tamil Nadu), Ram (1991) (on women of the Mukkuvar community in Kanyakumari district, Tamil Nadu), Raychoudhury (1980) (study of the fishers of Jambudwip in West Bengal, Singh (2003) and Maish Chandi (2006; 2011) (studies of cultural practices and common property resource use arrangements among indigenous communities in the Nicobar Islands as well as changes brought about by the 2004 tsunami) and more recently Annu Jalais, (2008, 2010) (on coastal communities in the Sundarbans and their divinely mediated relations with the tiger and lifestyle/livelihood practices) shed light on the cosmology, belief systems and relations that define these 'people in nature'¹. The detailed sociological investigations that examine fisher's institutions, governance systems or livelihood patterns in India [select examples include Kurien and Willmann (1982), Bavinck (1998, 2001a,b, 2005), Coulthard (2005), Johnson (2006)], provide us the social context

¹Silvius et al (2004)'s book bearing the title *People in Nature*, is an interesting contribution to the literature on Southern experiences of conceptualizing conservation and 'wildlife management' using indigenous ecological knowledge. Thus, their use of the term 'people in nature' may be seen representing not just indigenous communities but also other epistemic communities such as formally trained ecologists and biologists, as well as engagements and collaborations between these epistemic groups.

within which to understand practices, values, norms and rules in activities such as fisheries. These studies also draw attention to the conflicts and tensions arising out of clashes between governance systems and resource use patterns, based on different knowledges, logics, ethical and moral ideas associated with each. Perhaps it is these studies that are more intellectually challenging, viewing such knowledge as embedded in 'a social ground' and set of practices (Agrawal 2009), in comparison to the studies that attempt a more direct documentation of LEK.

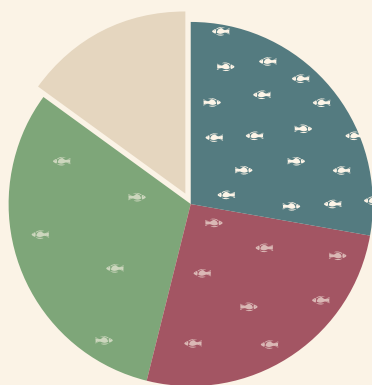
While the above cited studies do make important contributions to our understanding of knowledge, practice and belief systems of coastal communities, many of these did not turn up on keyword searches in our database. Nor were these studies referred to by the other studies that investigated LEK in similar sites. We present an analysis of studies that we encountered in the keyword-based publication searches which ostensibly (based on their title, author-assigned keywords and abstract) had IEK, TEK or LEK in coastal communities as a central focus.

This section of the report thus deals with an analysis of 124 publications from our database, which are exclusively concerned with coastal and marine ecosystems. As we see from infographic on page 90, coastal and marine publications on LEK form about 12 % (124/1008) of all studies conducted in India. As mentioned earlier, the database is not an exhaustive collection of all publications on this subject, but is a representative sample of the academic literature and policy related publications available in the public domain on this subject. The findings of this analysis, we hope will highlight the research focus as well as gaps in our understanding regarding the complex notion of LEK.

A number of studies have examined the use of marine species and their parts. Aside from the publications devoted to the catch of marine fish, a number of studies from a range of disciplines have examined human use of marine pearls, sea turtle shells, sea turtle eggs, the meat of a range of marine animals, skin, teeth, fins, oil, fat, ambergris, operculum of molluscs, the flesh and shell of molluscs, sea weed, coral, mangroves and other coastal plants. Few studies examine the knowledge systems behind the use of these resources, and thus our inference of TEK/LEK in coastal and marine systems comes largely from the work on anthropologists.

Studies have shown that coastal communities are aware of a range of properties of marine species which makes their harvest important not just for nutritional purposes, but also for medicinal properties, as luxury items (hawksbill shell products), and a number of other uses. The fat of several marine animals (such as whales, sharks, turtles, dolphin etc) has been used for centuries as a lubricant and to prevent the corrosion of hulls. Frazier (1980), Rajagopalan (1984), Tripathy and Choudhury (2007), and others document the commercial use of sea turtles from India to meet a number of the above purposes. Tripathy and Choudhury record that in a few villages of Andhra, local fishers believe that sea turtle liver and bile can treat specific ailments that arise during pregnancy. However, a more detailed exploration of ethno medicine was not attempted in any of the papers that discussed marine species use. Of the coastal and marine papers, only a single paper dealt with sea turtles, while 11 papers were concerned with marine fisheries. 4 papers were concerned with marine molluscs while one paper dealt with crustaceans.

LEK IN COASTAL/ MARINE STUDIES



SIGNIFICANCE OF LEK

No. of studies with LEK as:

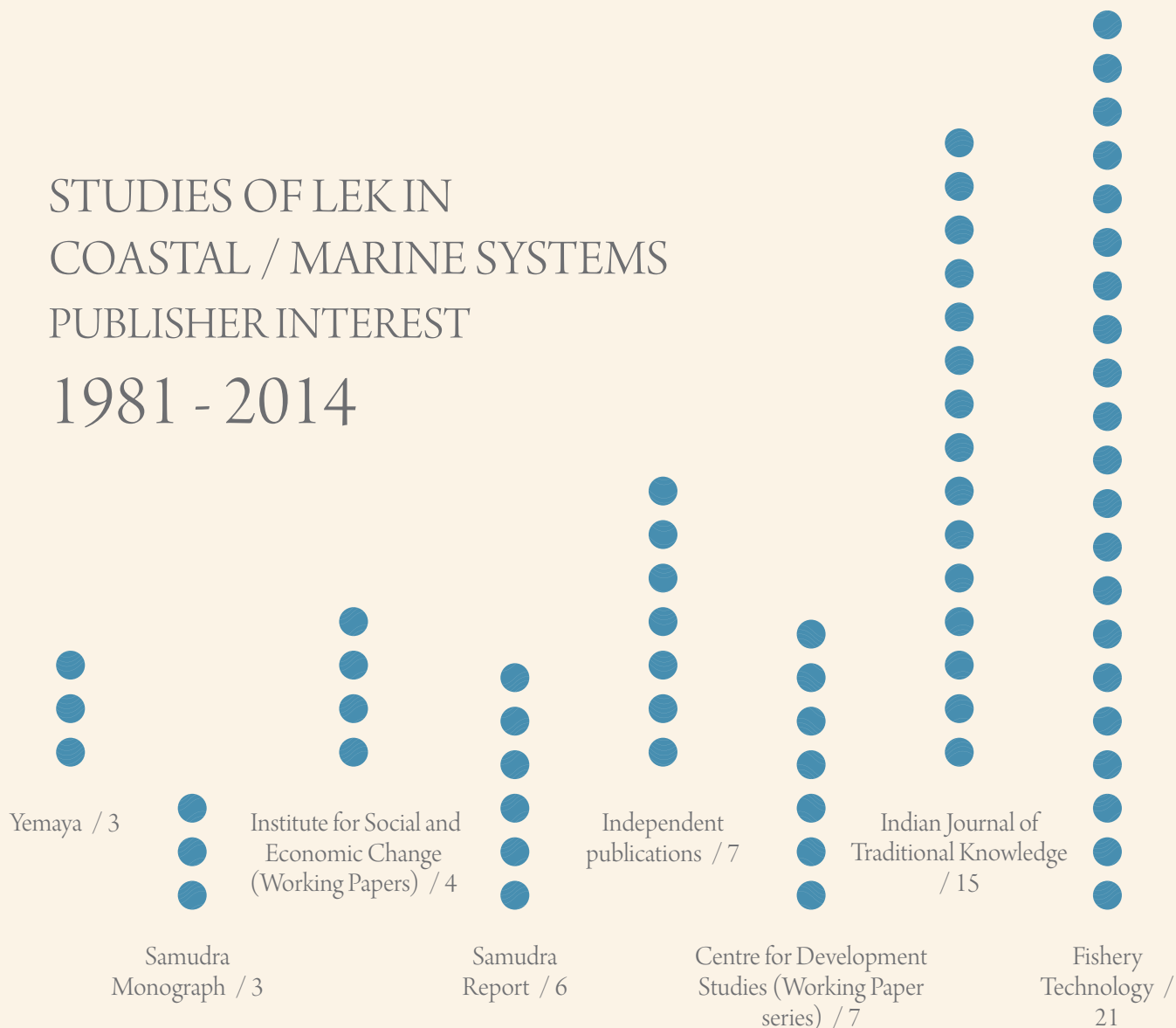
- Primary focus: 35 (28%)
- Secondary focus: 32 (26%)
- Cursory interest: 39 (31%)
- Others: 7 (15%)

Total number of studies: 124

STUDIES OF LEK IN COASTAL / MARINE SYSTEMS

PUBLISHER INTEREST

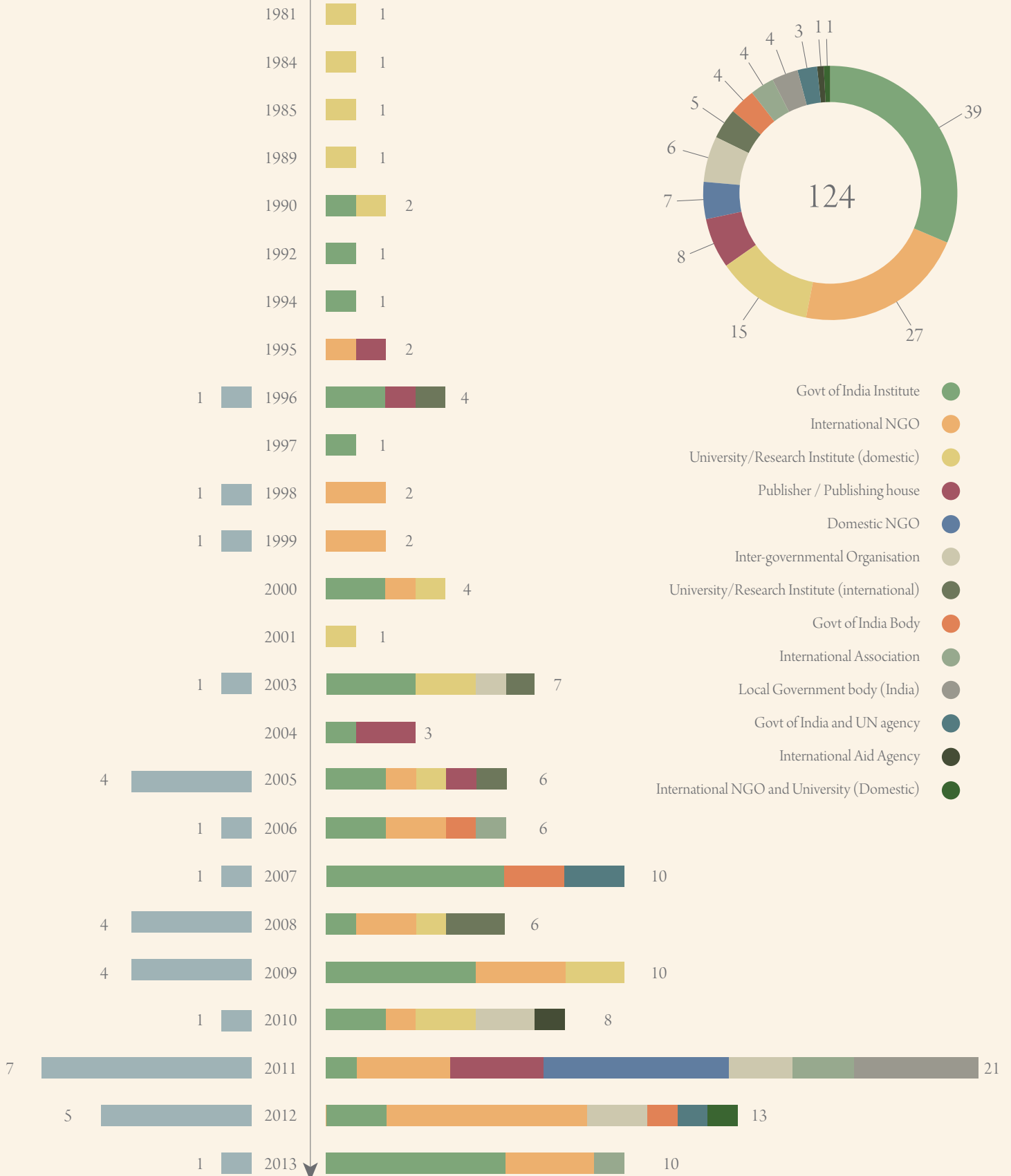
1981 - 2014



ARTICLES WITH LEGAL CONTENT

TOTAL NO. OF ARTICLES

TOTAL NO. OF ARTICLES BY PUBLISHER TYPE



LEK studies across publication types

Once an academically neglected area, compared to India's terrestrial hinterland regions, coastal and marine environments and communities are only recently drawing scholarly attention in disciplines such as anthropology, history, economics, and sociology. Scientists in the natural sciences enjoyed a longer association with these regions, contributing to the fields of oceanography, fisheries science, marine biology and more recently the climate sciences. Social science scholarship on coastal and marine systems in India has not been evenly distributed across the coastline. The volume of scholarship about these regions is slim in comparison to the academic interest in the hinterland, and perhaps unsurprisingly, save for a few scholars, much that is written on coastal and marine ecosystems in India is either limited in the subjects it addresses, or in the rigour with which questions are pursued. Indian civil society organisations and researchers outside academia have contributed a large amount to our understanding of Indian fisheries, coastal communities and the complex challenges faced in the governance of these regions. Thus, if one discounts the number of publications appearing in *Fishery Technology* (FT) and the *Indian Journal of Traditional Knowledge* (IJTK), which accounts for the majority of government publications on TEK/LEK in coastal and marine systems (39/124: 31%), the majority of publications are produced by international non-governmental organisations (26/124) led by the International Collective in Support of Fishworkers (ICSF) (14/124: 21%) through their magazine *Yemaya* and the *Samudra* monographs and reports, and by domestic research institutes (15/124) led by the Centre for Development Studies (CDS), Trivandrum (7/124). Independent reports accounted for nearly 9 publications related to LEK in coastal and marine ecosystems.

The total number of studies published in the journal *Fishery Technology* was 21/124 (17%). This journal has been produced from 1964 by the Society of Fisheries Technologists (India) located at the Central Institute

of Fisheries Technology, Cochin an ICAR (Indian Council of Agricultural Research) organisation. Keyword searches on the journal site revealed that only a handful of studies examined LEK in any detail (see Shankar et al. 2014; Thomson and George 2009). These studies discuss the range of domains of knowledge that fishing communities engage with in practicing fishing, and establish the centrality of practice to knowledge production. The remaining issues of the journal are all devoted to assessing fishing craft and gear efficiency, problems with bycatch, and possible craft and gear modification for the purposes of enhancing catch, for better fisheries management, and securing suitable profitable markets for marine products. Most authors who publish in *FT* appear to have primary affiliations with an ICAR research institute, prominently, CIFE (Central Institute of Fisheries Education, Mumbai), CMFRI (Central Marine Fisheries Research Institute, Cochin) or CIFT (Central Institute of Fisheries Technology, Cochin). We also found that in our database on coastal and marine publications, over 70% of papers from *FT* pertained to Kerala.

The next journal that focused on LEK most prominently with 15 publications devoted to coastal regions was the *Indian Journal of Traditional Knowledge* (IJTK) produced by the National Institute of Science Communication and Information Resources (NISCAIR). The content of these publications is largely descriptive, containing details such as local uses of coastal legumes (Bhagya and Sridhar 2009), coastal and marine species nomenclature and use (Nirmale et al. 2004; Nirmale et al. 2012; Panda and Mishra 2007a; Panda and Mishra 2007b), local fishing craft design (Swathi Lekshmi et al. 2013a), coastal proverbs (Swathi Lekshmi and Dineshababu 2009), coastal communities' abilities to interpret weather patterns and thus make adaptive strategies (Sethi et al. 2011). Some studies also document particular fishing practices and technologies such as the use of traps, hooks, spears and in some cases plant based poisons (Ahmed 2013).

However none of these publications address any theoretical problems or conceptual aspects regarding LEK and stick largely to a descriptive documentation.

We conducted a search on publications related to LEK in the CMFRI E-prints digital open access repository and traced a total of 14 of these. Aleem's study documents historical documents that suggest knowledge of navigation skills among Arab sailors and importantly that such knowledge was transmitted to the Portuguese and Turkish navigators through the written scripts maintained by the Arabs (Aleem 1973). Other studies tried to test fishers' knowledge regarding marine species and document their observations (Anoop et al. 2011) while also engaging in scientific verification of the same (Vipinkumar et al. 2013; Shyam and Antony 2013). Some of these studies provide a rich insight into such knowledge systems and practices. A spurt in interest in LEK in CMFRI publications has only emerged in the present decade with most papers being published in the year 2013. Perhaps this is on account of a shift in programmatic

focus in the ICAR's research programmes. The value that these scientists who write about LEK at CMFRI place on the same is seen from their writings. Mainly, their research is aimed at documentation of practices and tangible expressions of knowledge, its subsequent scientific verification and thereafter its possible incorporation within formal management. In some publications, these authors make an argument for integration of knowledges but do not provide much detail on how to accomplish this. Other papers argue for putting such knowledge to greater commercial use besides fisheries management. There doesn't appear to be a common definition of what constitutes either IEK/TEK/LEK among the CMFRI publications, despite these multi-author papers having a common lead author (see Swathi Lekshmi and Dineshbabu 2009; Swathi Lekshmi 2013; Swathi Lekshmi et al. 2013a; Swathi Lekshmi et al. 2013b).

Those publications that explore fishing technologies, especially publications in *FT* are concerned with the implications of fishing practices using a wide range of

LEK and technology

fishing gear and craft. Most studies assume a simple hierarchy in technology whereby bigger, more expensive and efficient craft and gear are considered superior. The demarcating category of efficiency is used most often in publications in *FT* and publications authored by staff of central government fisheries research institutes, namely CMFRI, CIFT or CIFE. 'Technological gap', a term used by Mohan et al. (1996) in a publication in *FT* thus refers to the difference in usage of different types of fishing gear by fishermen. Some studies suggest that greater capitalisation and technological sophistication displays a 'labour saving' character of fisheries (Gopal et al. 2000). Gopal et al. describe non-motorised craft as the 'least improved' of technologies. They also show that fishers themselves sometimes make decisions to upgrade. No doubt such studies generate useful information regarding the implications of such use, but they do not engage with the idea of indigenous contributions to technology development, diffusion or innovations per se. Further, the use of terms such as 'gap' or 'lag' in technology suggests that development in fisheries ought to move in a particular linear trajectory – from artisanal craft to motorised and eventually mechanised.

Regulations related to technological growth are barely discussed as a central problem in such publications. Most papers merely suggest that greater innovation is needed, there ought to be greater diffusion and greater efficiency in technology. However few papers actually discuss what pathways this takes, or the challenges that regulations can pose by themselves to innovation or diffusion. Bavinck and Karunaharan's (2006) paper on the Pattinavar's history of regulating fishing net technologies and Gulati's (1984) paper on impacts of technology on women in fishing communities are exceptions but are not categorised by most databases as publications dealing with LEK. None of the papers that dealt with technologies in Tamil Nadu made any reference to this paper either. Also it was noted that none of the publications relating to fishery technology and traditional knowledge, make any mention of the caste group of the fishers interviewed. No social data was provided regarding the communities studied, except for some cursory mention in a few papers. The only studies which discussed gender, aimed at an evaluation of the knowledge, aptitude and practice (KAP) among women in fishing communities, to test how they might take to new technologies of value addition in fisheries (Srinath 1987).

State-wise distribution of studies

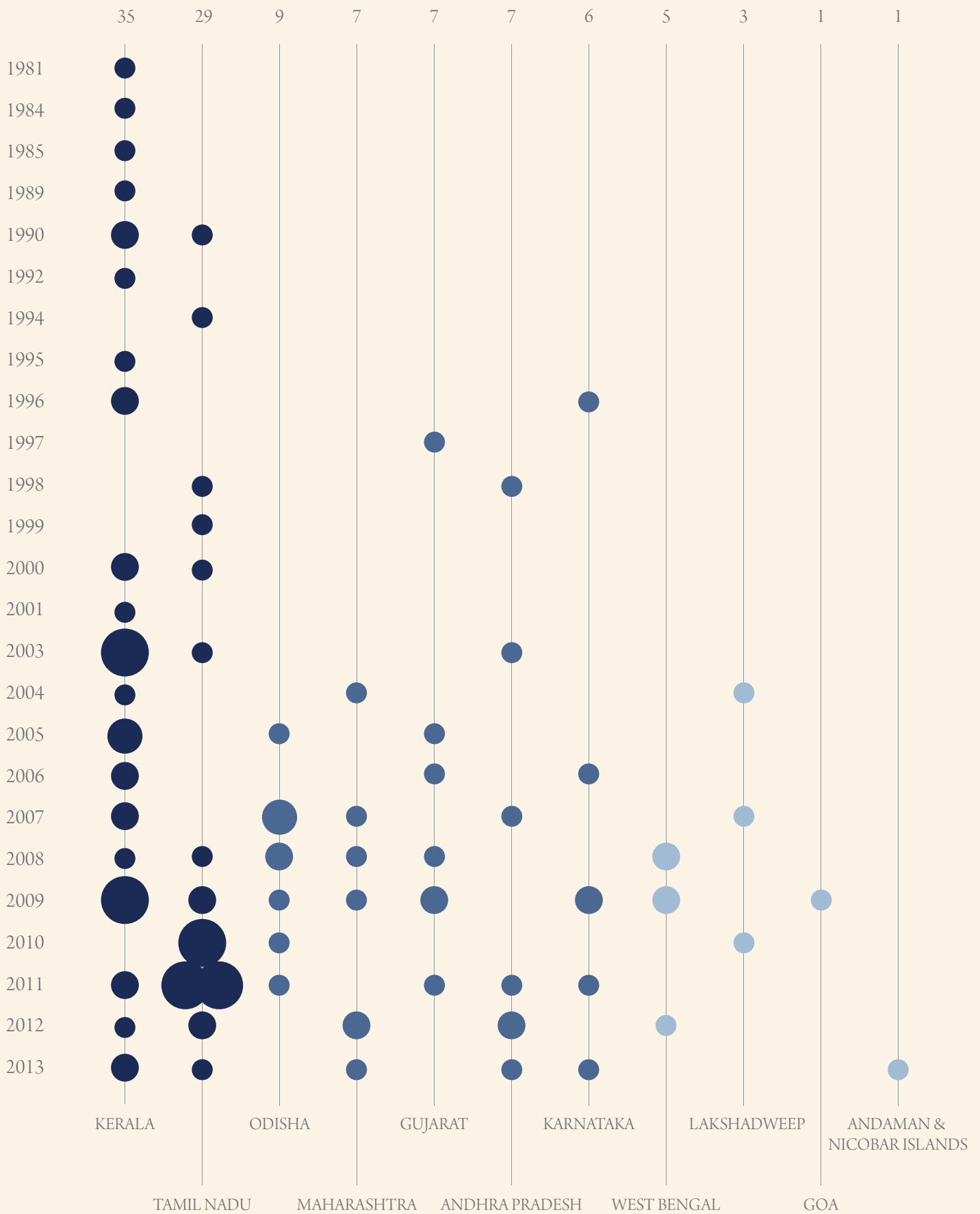
The largest number of publications related to coastal and marine systems appear after the year 2000 (a total of 101), averaging 7 publications a year. The figure on pages 96-97 shows the state-wise distribution of these studies. We see that most studies are conducted in Kerala (28%) and Tamil Nadu (23%). This is not surprising as much of the government fisheries development programmes and civil society interest in fisheries has emerged from the experiences of these two states. Many publications were published by the Central Institute of Fisheries Technology, Cochin, Centre for Development Studies (located in Trivandrum) and the FAO and World Bank sponsored Fisheries Management for Sustainable Livelihoods (FIMSUL) project¹ operational in Tamil Nadu and Puducherry which discussed fisheries management related issues. The policy documents of the FIMSUL project were included in our search since it is the first comprehensive project that aims at co-management in fisheries and devotes a considerable

among of attention to the problem of knowledge driving fisheries management.

However, mere geographical location of publishers is not responsible for the above-mentioned bias in studies. The authors of documents in these regions appear to have devoted several years of research interest to these particular sites accounting for their interest in studying a number of aspects regarding TEK/LEK. For instance, Kurien's papers that relate to TEK span a time period from 1985 to 2003. Other authors who have discussed alternative ways of knowing than formal science on the whole have been associated in some form with civil society movements related to fishing communities. Thus, the intellectual interest in TEK/LEK (whether descriptive, conceptual or otherwise) appears to be dependent on prior personal engagement of authors with particular coastal communities and areas of the coast.

¹Under the World Bank trust fund for tsunami recovery, the Governments of Tamil Nadu and Puducherry along with the Food and Agriculture Organization of the United Nations (FAO) implemented a project called Fisheries Management for Sustainable Livelihoods (FIMSUL) from April 2010 to December 2011. For more, see <https://www.sites.google.com/site/fimsul/>.

STATE-WISE STUDIES OF LEK OVER THE YEARS



Cross references and citations: contributions to existing knowledge

Internationally, a large number of studies have been conducted on coastal and marine ecosystems and some of the seminal papers on the subject of TEK/IEK/LEK have been produced by authors whose own professional and academic careers have been crafted over a long engagement with these communities and ecosystems¹. However, the majority of the literature on LEK in coastal and marine ecosystems in India does not cite any of this literature. We found that most of the literature on LEK in India is produced in government publications, engages largely in descriptive accounts of observations made by coastal communities on aspects such as navigation, astronomy, animal behaviour, knowledge of medicinal properties of plants and animals and prediction of weather conditions by a range of cues.

As seen in the previous section, the number of articles published on coastal areas, and over questions of maritime knowledge of communities has been modest in comparison to those of the hinterland. Studies that devote some attention to LEK in this biogeographic region emerged only in the 1980s, in conjunction with the global interest in indigenous knowledge and resource management. Not unlike the bulk of studies published in other countries (see Agrawal 1995 and Sinha et al. 1997 for a critique of TEK literature

globally), a large proportion of the literature from India, particularly those that are published in the *Indian Journal of Traditional Knowledge* and minor publications that are not subject to wider scrutiny, is devoted to valorising 'traditional' knowledge systems. Such studies make little reference to the existing literature even from India, and demonstrate only a superficial engagement with theoretical problems raised in the global literature on this subject. In 2010, Ruddle and Davis had identified through bibliometric analysis, a list of authors whose work was most cited across the world.² None of the papers in the literature that dealt with LEK in coastal and marine ecosystems, engaged with this body of work. We worked with the assumption that important conceptual understanding need not necessarily remain in the realm of peer-reviewed publications, and included in our analysis all other publication types. However, we found that few papers made important contributions to our conceptual understanding of LEK.

Thus, research conducted in India on LEK in coastal and marine systems mainly contributes to descriptive accounts of practices in multiple sites, rather than on conceptual ideas. As mentioned earlier, insights into questions of alternative ways of knowing are better addressed in the anthropological literature.

¹Robert Johannes, Fikret Berkes, Kenneth Ruddle, Nigel Haggan and Barbara Neis are leading names whose publishing records on coastal and marine systems reveal field-based empirical research which has made important theoretical contributions to the idea of traditional, indigenous and local ecological knowledge. These are the some of the most cited scholars on the subject of TEK/LEK in coastal and marine systems.

²This list included the following authors: F. Berkes, H.P. Huntington, M.G. Stevenson, N.J. Turner, P.J. Usher, A. Davis and J. Wagner, M. Gadgil, P. Olsson, S. Aswani & Hamilton, R. Pierotti and D. Wildcat, M.A.D. Ferguson and F. Messier, R.E. Johannes and C. Folke. For full references see Davis and Ruddle, 2013.

LEK in publications on traditional management

40 publications were concerned with LEK as a primary focus of interest while in 32 publications it was of secondary interest. For a closer analysis of the representation of LEK, we examined in greater detail, the 40 publications where LEK was a primary focus. By this we mean that in these publications, IEK/TEK/LEK appeared either in the title, the abstract or was an explicit subject of discussion. We classed publications as according LEK a secondary focus, where we found that in the abstract as well as a reading of the text, the paper did not devote direct attention to LEK. However, most of these papers discuss community management or traditional management and speak about traditional knowledge in association with these subject areas. However, these publications make no effort to examine either conceptual ideas related to LEK, or investigate LEK in its operation as part of the study objectives. Thus we find, that there is a tendency to interchangeably use the terms 'traditional management' and 'traditional knowledge'.

To understand the implications of LEK within the discourse on traditional governance, one must turn to the literature that addresses the latter directly. As seen in Bavinck and Karunaharan's (2006) study of bans on fishing nets, communities operate with logics other than ecological ones in deciding on matters related to fisheries management. Their concerns are not singularly on the matter of ecological health but also on community cohesion, and justice. Other scholars note that indigenous sea tenure practices are based on spiritual and cultural values towards strengthening the sense of social identity, place, and social order rather than ecological sense (Cordell 2000), in relation to Brazilian customary sea tenure). The official system of fisheries management in many parts of the coast follows a similar rationale of maintaining social order, but the legal text suggests that it is purely interested in fisheries management. The whole idea that fisheries management is more about managing people, than a technical subject with scientific knowledge driving it is not admitted to

openly but is discernable in the negotiated engagements between fishing communities and department officials (Bavinck and Karunaharan 2006). Thus, the reasoning behind community institutions' regulations is not always grounded in traditional knowledge alone. They are part of the knowledge-value-norms complex and guided by principles of justice, community welfare and cohesion, as interpreted by leaders periodically. Thus, the timeless quality attributed to both traditional knowledge and traditional management systems need to be revised, just as the science and rules emerging from official institutions needs scrutiny. It is practical, if not prudent, to view the myriad activities of knowledge generation undertaken by multiple entities (including state and community), and their choices of knowledge application as historical, economic, social and political considerations (or contingencies) rather than mere responses to changes in a nature separated from culture.

Research has shown that traditional governance institutions within fishing communities can be discriminatory, regressive and sectarian (Gomathy 2006; Rajagopalan 2012; Sundar 2012). However, neither are formal governance systems immune to unjust, discriminatory practices and the literature on fishing communities is replete with references to instances of this. In discussing the disdain that fisheries managers have for fishers' pronouncements over the health of fisheries, it is noted that there is no official interest in even validating such knowledge claims using formal scientific methods. Only few papers discuss this subject for Indian waters and some of these acknowledge not just the hierarchies in knowledge-governance systems but highlight the contempt for non-state understandings and approaches (Bavinck and Karunaharan 2006; Kurien 1998; Sharma 2008). Thus, Bavinck and Karunaharan note that the Coromandel fishers' claim that new synthetic gill nets could putrefy fish faster and drive away other fish by its stench has never been tested by government scientists despite the general knowledge that marine species communicate

through interpreting chemical presence or absence in water, most likely through the medium of smell. These represent lost opportunities for scientists in testing hypotheses.

Some of the studies on fisheries management point to the fact that belief systems changed with changing practices in fishing. Hence the initial apprehension that Pattinavar fishing communities of the Coromandel coast felt, regarding the impacts of synthetic nylon nets on catch depletion, led to a change in belief systems when they began observing that their ideas were wrong. It is not clear from such studies though, what the fishers' impressions were regarding their own knowledge systems or beliefs that led them to ask for a ban in the first place. Did this affect their self image? Did they find that their own knowledge system was denigrated? In a study in Costa Rica on encounters of local people with 'external knowledge', Thrupp (1988) identified that rural communities often displayed a range of overlapping reactions from complete denial of other forms of knowledge to a deep embarrassment of their own local knowledge and beliefs. Such shifting perspectives of knowledge within coastal communities have not been enquired into in any detail in the literature that we examined. None of the studies focus exclusively on the issue of what generations of marginalisation had done to fishers' self image, or ideas of their knowledges in respect to other communities or social groups that they interacted with. What individual or social processes were set off when the fisheries manager or the fisheries scientist claimed a superior share of their domain of expertise? A study of the self image of the fisher in relation to scientists and fisheries officials as domain experts awaits further exploration.

The broader literature that discusses community management, fisheries management and rights of fishing communities as its primary focus, often anchors many of its critiques or prescriptions based on the idea that traditional knowledge is indeed central to community management and must be acknowledged. However, most of these studies also call for exercises of

validation of LEK systems with scientific knowledge. They do so largely for two reasons. Firstly, validation exercises conducted by scientists trained in the 'western way' lend greater credibility and wider acceptance of LEK holders as legitimate knowledge producers. A second important reason why authors express caution when valorizing traditional knowledge is that a range of regressive and discriminatory values and norms are often couched in the language of tradition. Thus, regulations that rely on such belief systems (seen variously as right wing or repressive or regressive) or knowledge expressed in terms that are suggestive of irrational and unjust sentiment must be subject to the scrutiny of science which they believe affords the best means to be transparent if not objective. Mathew (2003) highlights the need for small scale communities to also expand their knowledge base to incorporate new ideas that they 'hitherto ignored or (had) not understood sufficiently' such as 'the greater impact of natural factors, the broader picture of prey-predator relationship, the larger role of fish habitats, and factors that contribute to unprecedented habitat degradation, such as pollution'. This suggests a discomfort with the nature of information that LEK in isolation can generate for it to be useful (for its practitioners even) beyond a local scale.

A few studies that examine TEK/LEK also undertake assessments by 'experts' who are trained in disciplines such as fisheries science. Nirmale et al. (2004) explore specific questions such as whether LEK works, is it scientifically valid, the nature of its application, and its applicability across various environments. In this study, traditional / local knowledge based practices are evaluated by a range of experts. The point of such studies has been to demonstrate that LEK is indeed useful and plays an important role in decision-making around cost-effectiveness, resource governance and efficient practices in relation to the use of natural resources. There is a clear hierarchy here in terms of LEK based practices and understandings having to require scientific validation of external experts.

Challenges of making a place for LEK in modern legal frameworks

The formal 'management' of coastal and marine ecosystems in India has drawn attention from scholars interested in the social and ecological impacts of developmental processes, since the 70s (for instance, see Silas et al. 1984 on scientific management of shrimp resources and Kurien 1988 on the role of fishermen's organisations in fisheries management). The present institutional structure for the environmental governance of these zones was assembled gradually from this time and reflects the state of knowledge and normative ideas regarding natural resource use in these spaces¹. In fact, most of these coastal and marine laws owe their existence to civil society action ranging from rural grassroots movements to independent initiatives of conservationists belonging to urban elite social groups. Each of these laws and its associated bureaucratic pathways marked a shift in the relations between the state and its citizens, aided by changes in how relations between humans and non-humans within these environments were understood. Thus, the coastal and marine management related discourse discloses a complex of ideological perspectives not just of nature, but also of development, human agency, social hierarchy and not least of all, the hierarchies of systems of knowledge.

Bavinck (1998) has examined the question of why the state fisheries department is reluctant to follow a 'consistent law practice' or a legal mechanism which also integrates fishers' local laws into the formal legal system. He examines this problem from a series of studies undertaken along the Coromandel coast of Tamil Nadu. He attributes this reluctance to government officials' perceptions of fishers as well as the limitations inherent in the text of the Marine Fisheries Regulation

Act (MFRA) itself. State law, he says, neither has the 'range nor flexibility' to deal with cases such as this. Since many of the MFRA do not really acknowledge local regulations, it is not possible for implementing officers to adjudicate or settle disputes relying on the MFRA. The fisheries officials in this study believed that fishing regulations must emanate from the community itself and be based on local knowledge. Interestingly, this does not suggest an acceptance by the scientifically trained fisheries manager of the fishermen's knowledge. They believed that fisher regulations were steeped in superstition and lacked scientific basis. Local regulations are formulated by fisher community members based on regular and systematic observations and monitoring of resources and use patterns. It might not be correct to assume that all local management systems rely on the traditional or local knowledge alone. While information forms the basis of perceptions, it is not often the case that this is shared knowledge. From Bavinck's study it appears that local fisher councils often make decisions favouring particular interest groups on matters of resource use, betraying an absence of community knowledge driving such decisions. The instances of collaboration or agreement between the fisheries department officials and fishers over management measures is almost entirely based on the department's assumed role of restoring law and order in situations of conflict and 'maintaining the peace' among communities perceived as volatile and non-modern. However very few studies explore such dynamics in the operation and use of traditional knowledge, and none of the studies we examined in our database, made such conceptual connections or attempted such analyses.

In his other work examining the regulations of fishing nets, Bavinck shows that the principle behind fisher

¹Some of the key legislations that emerged were the Marine Fisheries Regulations Acts (MFRA) (from the 80s onward), the Coastal Zone Regulation 1991 (and the current 2011 version), a number of additions and deletions by amendment and notification to the Wild Life Protection Act, 1972 and the Forest Conservation Act (1980).

rule-making was perceptions of 3 kinds of harm (to the fish stock in village waters, to the majority ways of fishing , and to the community as a whole) (Bavinck 1997, 2006). Such regulations follow from local observations and knowledge but also from value judgements regarding community resource use. Thus, traditional governance mechanisms can be said to constitute a complex of knowledge-values-norms. However, these elements are not unique to local law but are embedded in all governance systems. Perhaps the reason why LEK systems do not find their way into official regulations is not just the incompatibility of knowledges (with

its epistemological differences) but also with the sanctioning systems. It is here that the knowledge-power nexus finds its most tangible expression. While the distinction between western science and traditional knowledge is probably guilty of the charge of being a 'false dichotomy' in specific ways (see Agrawal 1995), the examination of the place of law (state law and local law) emphasises the agency of the practitioner in determining divergent outcomes of the knowledge-power nexus inherent in different ways of knowing.

The FIMSUL project has produced select reports

Knowledge management and documentation

that deal exclusively with the problem of knowledge management (FIMSUL 2011a, b). In the course of their workshops, studies and deliberations, the project has identified poor data on fish catch, on stock assessments, and inconsistent data protocols and collection methods as being problematic for knowledge-based management (FIMSUL 2010: 11).

In a critique of 'knowledge management' (or KM) Wilson (2002) wrote an influential paper titled *The Nonsense of Knowledge Management* where he demonstrated how this 'new fad' among consultants actually had very little to do with the actual management of knowledge per se. KM actually concerned itself more with the management of work practices with the assumption that improved communication patterns will lead to greater information sharing. KM, he declared, was a Utopian idea and likely not to persist, like many other management practices such as business process downsizing since it required the idea to be followed in every part of the organisation, at all times and often ignored the historical shaping and material motivations within these organisations. He makes an important distinction between 'knowledge' and 'information';

"Whenever we wish to express what we know, we can only do so by uttering messages of one kind or another - oral, written, graphic, gestural or even through 'body language'. Such messages do not carry 'knowledge', they constitute 'information', which a knowing mind may assimilate, understand, comprehend and incorporate into its own knowledge structures. These structures are not identical for the person uttering the message and the receiver..."

The FIMSUL project itself has been especially concerned with the problem of data and information sharing and management and elaborates on this in two of its reports (FIMSUL, 2011a; FIMSUL, 2011b). The system of 'knowledge management' promoted by the project is a novel one in policy documents on fisheries management in India. Under the FIMSUL project, this is envisaged as encompassing a few steps, chiefly a) broadening the demand for knowledge to assist in decision-making, b) capacity building among officers of the Departments of Fisheries of Puducherry and Tamil Nadu to use knowledge effectively c) creating cultures that value learning. The FIMSUL documents acknowledge the dangers in treating knowledge as something that can be

effectively 'captured', stored, shared, retrieved etc, quite like a commodity, but cannot avoid doing the same in many of its recommendations. In short, there are many instances when the terms 'knowledge' and 'information' are used interchangeably despite quoting critics of such practices such as Wilson. In its formulation, being concerned with the functioning of the departments of fisheries themselves, the FIMSUL project does not provide any radical re-formulations as far as LEK are concerned. It sees fishers' knowledge as being useful for fisheries management practice and seeks to find ways that enables this, through the idea of co-management. For a number of the new communication protocols and systems, the project relies on the idea of mutual trust, strengthening relationships and partnerships between the 'stakeholders' in the fisheries sector. These project reports identify data flows (or the lack thereof) between research organisations, government bodies and fisher associations and make some important suggestions on areas where data accuracy can be improved and technical suggestions on how data sharing can be enhanced. However, the entire edifice of 'knowledge management' or in World Bank terminology 'knowledge sharing', appears to be heavily technology oriented (Wilson 2002). Institutions such as the CMFRI have invested in examining the role of Information Communication Technologies (ICT) in knowledge management (Vipinkumar et al. 2013a). It remains to be seen in what manner this experiment with managing information will engage with the contestations of resource use. Thus far, the literature on traditional tenure systems that we examined suggests that politics around resource use is not structured

around explicit and tangible forms of knowledge, whether better managed or otherwise.

Wilson's paper is useful in drawing attention to the manner in which LEK is sought to be 'managed' by a range of publications, as well as the initiatives across the country that attempt to document this knowledge. Hardly any of the literature that we came across in our searches dealt with Karl Polyani's idea of 'tacit knowledge' (or even referred to Polyani). The term refers to cognitive processes and or behaviours that may not be accessible even to the consciousness of the knower and hence in Polyani's words "*we know more than we can tell*" (Polyani, 1958). Unmindful of this aspect of knowledge, many development consultants and indeed the authors of many publications we examined assume that the documentation of 'traditional ecological knowledge' is possible if undertaken systematically and such documentation is indeed the best way to protect the same.

In his criticism of KM, Wilson questions whether organisations engaging with information or formally tasked with knowledge generation (whether fisher associations or fisheries research institutes in India) are capable of nurturing a culture whereby benefits of information sharing are shared by all, where all individuals have complete autonomy in developing expertise and where 'communities of practice' are in a political position to determine how their expertise will be used. These are important considerations for those concerned with the democratisation of knowledge.

4

Engaging the Divide

Knowledge and Democracy in India

Aarthi Sridhar and Meera Anna Oommen

In a recent publication, Agrawal and Ribot (2014), leading scholars in the area of forest governance, asked a provocative question of Ostrom's Institutional Design Principles for the management of the commons – were these Design Principles really enough to help us design? They highlighted the problems encountered when trying to apply the abstract principles to concrete new institutional arrangements for the governance of the commons – an activity that several non-governmental organisations and governments across the world are aiming to do. Tempering the value of Ostrom's abstract principles to such practical endeavours, they suggest instead that the Design Principles serve us better as heuristic devices for the management of commons. Interestingly, they find that the most important quality of the Design Principles is that they tell you what-not-to-do when designing an intervention for the governance of the commons.

Are there specific principles of the production,

dissemination, diffusion and integration of TEK/LEK that can be identified from our review of studies in the country? As in the literature on the commons, scholars of TEK/LEK have also been compelled to offer a set of principles that help define such knowledge, account for the way in which it operates, and to proffer potential uses and ways of rescuing the same (Ruddle 2000; Berkes et al. 1995). In what way can the experience with common property design principles engage with the literature on TEK/LEK principles, and to what effect? Following the idea behind Agrawal and Ribot's interrogation of abstract principles, we too suggest that future steps need not be a litany of prescriptions or "Dos". In fact, we find that the literature on TEK/LEK from India yields more proscriptions than prescriptions for scholars and practitioners. We present below, a sample of what the future promises in terms of the questions to ask, problems to address, ideas and experiments, by summarising emerging themes in the literature on resource governance that seeks to be knowledge-based.

The problem of legibility: Language and the demarcation divide

Nearly 15 years after questioning the epistemological divide between 'scientific knowledge' and 'indigenous knowledge' (Agrawal 1995), Agrawal (2009) states that the tension between these categories is at the heart of most literature on the subject, but continues to receive little scholarly attention. The problem of demarcation and 'boundary-making' in knowledge, the idea of 'legibility' of knowledge systems has been discussed by Christie (2007) and others. This argument states that indigenous knowledge is often understood in an incomplete way since the less tangible elements within it are ignored and rendered illegible and marginalised. Thus, elements which are 'singular, non-transferable, tacit and unable to be expressed in words' are simply not recognised, however central these ideas may be to the making of such knowledge (Christie, 2008). Berkes (1999) implicates the role of (trained) scientists in dismissing ideas of indigenous scientists where the latter's paradigms don't align with those of the former.

Acknowledging that knowledge is socially constructed, some scholars argue that there are fundamental differences in the ways that indigenous and non-indigenous knowledges are socially constructed (Christie 1990; Sarewitz 2004; Briggs 2005).

Thus some studies that we encountered suggest subjecting TEK to the rigours of mainstream science, other papers talk about the limitations of doing so and point to the dangers to TEK from the adoption of such an approach. Yet others believe that knowledge holders themselves can play an important role in this regard, emphasising their agency in the knowledge production process. This amounts in their view to greater collaborations between those involved in the projects of knowledge generation, for the fostering of egalitarian spaces where such collaborations can be effected and can result in mutual benefits (Castillo 2009).

In our review of the representation of TEK/LEK in studies conducted in India, we noted that every single study adopted a clear demarcation between categories of knowledge. Not a single study adopted a view point that suggested that they preferred to view knowledge as a single category. We too are intrigued by the question of why this is so. We follow Agrawal (1995) in his analysis that there are far too many similarities between the epistemic activities that are labelled scientific knowledge and those as indigenous knowledge. In trying to answer

why scholars continue to discuss a special category of IEK/TEK/LEK, one finds clues in the purpose they accord to TEK. Scientific knowledge appears to have some self-evident purpose to it, whereas epistemological acts by those not trained and labelled as scientist need to establish themselves as legitimate. Agrawal surmises that this enduring classification 'effectively represents durable underlying social confrontations' and therefore 'indigenous knowledge' as an idea, will continue to prevail long after what it represents disappears.

TEK/LEK - Museumisation to practice

We provided a brief introduction in section 1, to the 'desiccationist' argument that was to determine the manner in which colonial forest governance was influenced. We discern a strong museumisation approach which influences almost all the publications that we encountered in our searches. Here, all knowledge that is classed as traditional, local or indigenous is seen as being in danger of decaying or disappearing and hence needs to be 'preserved' or 'conserved'. The idea of documenting such knowledge in repositories follows from this 'picking' approach. The

international literature that dissects this approach is less enthusiastic about such initiatives, and argues instead that knowledge is often an outcome of some degree of hybridity and dynamism. Briggs (2005) describes indigenous knowledge forms as being driven by the pragmatic, utilitarian and everyday demands of life and elements of knowledge, including non-indigenous sciences, and is incorporated into a hybrid, mediated and continually reworked form. Thus, providing greater room for practice and belief and hybridity is valuable for the development of knowledge.

Knowledge as a constructed ideal

Post modern and post structuralist scholarship has made important and radical shifts in the way theories around knowledge, development, and nature are understood. Foucault (2012) argued that all knowledge was constructed and 'truth' did not exist in the singular; there were only *narratives* of truth. One of Foucault's most important ideas has been the manner in which he relates power and knowledge choosing to hyphenate the two (knowledge-power), thus presenting them as inseparable yet non-synonymous. While this nexus has been critiqued from various viewpoints it remains important in that it wishes us to think differently from the Enlightenment tradition that sought to separate knowledge and power, especially through ideas of

objectivity in science.

The constructivist approach to knowledge is important to the debate on plural ways of knowing and the promotion of biodiversity knowledge. Constructivists view knowledge as a personal experience that is actively shaped and constructed. This view stands in contrast to a somewhat superficial notion that knowledge, like any commodity can be transmitted, encoded, and reproduced. Constructivists also contest the idea that reality exists 'out there' waiting to be explained by scientists, but is instead given meaning by personal experience. Theories of communities of practice hold that it is by practice that knowledge about the world is actively constructed.

The relation between resources and knowledge

Different sites or organisations are likely to exhibit variations in resources. Following Wenger, (1998: p 5), “practices include a *shared repertoire* of historical, social and physical resources that shape and sustain mutual engagement in action”. This suggests that ‘resources’ that determine practices and consequently knowledge, are not only physical in nature, but also include rules, roles, structures, and conceptual aids that enable the utilisation of the same. Knowledges are constructed differently (whether in ‘Western’ science or local knowledge) and are dependent on practices / work / experiences across sites. Recognising that practices evolve in response to resource constraints is an important step in understanding ‘ways of knowing’ in different contexts. The introduction of technology as a source and resource of knowledge-production and collaboration is important to analyse here.

The application of digital and telecommunication devices for the purpose of mapping, monitoring and reading phenomenon in oceans and seas is being promoted in a large scale through a variety of government and civil society initiatives (Dineshbabu 2013; Chrispin et al. 2012). Studies of society and technology have established the deep impact that it has on human lives, bodies and ways of knowing and living (Scharff and Dusek 2013). Not only is the current literature of TEK/LEK in India bereft of such insights, but even the critiques

of technology on sectors such as fisheries, do not empirically address or investigate its agency to examine exactly how technologies can shape society, particularly in the marine field. For instance, will the provision of GPS units to all fishers enhance their knowledge of the sea or lead to a loss of ability to ‘read’ signs in nature? Will the use of mobile phone apps showing maps and weather attributes enable a richer understanding of marine species or will this deaden fishers’ abilities to use their own skills? These questions demand an engagement with the philosophical problem of technology in the context of knowledge and perspectives over nature.

We acknowledge that situations of plenty as well as scarcity end up generating different ways of knowing and uniformity in knowledge production processes can neither be achieved (nor is desirable) by a mere redistribution of resources. Thus we argue for a reflexive broadening of the discursive space which simply means that as students of epistemology, we need to be attentive to India’s ‘social ground’ that generates, underlies, and is shaped by contestations over knowledges. Thus, a beginning towards plurality and diversity must recognize the opposition to such ideas in the first place. Such opposition is embedded in a range of knowledge traditions and across a range of epistemic communities, including scientists in labs and those in farms, forests, and seas.

Interdisciplinarity in understanding education pathways and learning cultures

As Agrawal prophesies, if the interest in ‘indigenous knowledge’ is going to persist for another 15 years, we must find ways to make it far more intellectually interesting and challenging in the coming days. A good point of departure would be to reach into the literature in other disciplines that deals with knowledge – particularly in the field of education, and science studies.

Advances in the field of leadership studies and business management involve a close examination of the systems

of education. Many feminist scholars have questioned the view that formal thinking is necessarily the most mature form of intellectual development (Ackerman 1991). Thus a critical examination of the science system and the models of education regarding the ecological sciences and nature studies might reveal ways in which the formal educational system either inhibits or facilitates rich and diverse ‘learning paths.’ Raina’s (1992 and 1999) historical studies of the agricultural sciences in India offers good insights into the making of the

professional agricultural scientist and what determines the ways in which such sciences prevail over farmers systems of knowledge. Ackerman (1991) notes that “an emphasis on the richness and diversity of learning paths challenges the normative view of cognitive growth as a universal increment toward some specific form of hypothetico-deductive thinking!”

Some scholars argue for greater attention to situated knowledge, rather than categories of indigeneity, tradition and so on. Situated knowledge is knowledge that is embedded in particular locations or places (a stretch of a coastline, say the northern Palk Bay for instance) rather than in particular settings (such as fishing harbours in general). In this manner it differs from knowledge that exists within a functional group (fishers or trawl boat operators). Thus situated knowledge will vary in different sites even if people

in each site carry out the same set of activities (such as bottom trawling). Location or place is therefore critical to the idea of situated knowledge. Put differently, situated knowledge lies at the heart of the scale-related dichotomy that is perceived between the sciences and indigenous knowledge. Experiments to understand the potential of spatially dispersed knowledge producers shows that dispersed teams contain a range of specialists but teams that are at multiple sites have enhanced awareness of a greater breadth of situated knowledge (Townsend et al 1998, cited in Sole and Edmonson 2002). However, Sole and Edmonson (2002) show through their empirical study that dispersed groups also face the problem of communication in learning on account of this situated knowledge. While answers to many practical problems might still appear elusive, learning across cultures of academic knowledge itself appears to be indispensable.

Research agendas and collaborations

In 1998, Kurien argued that proverbs offer insights into the worldviews of communities and thus a glimpse of ways in which they manage their resources. Stating that social values are communicated via proverbs and metaphors, he made an argument not just for better *explanations* of the functioning of nature but also ways of relating to it as emotional, spiritual humans. Berkes and Berkes (2009) offer that research questions must be formulated which have a particular resonance and relevance within and for local communities. It has also been argued by some (Sillitoe 2004) that TEK/LEK/IEK can enrich and broaden the understandings of the wider scientific and development community. For this to take place equitably, some scholars suggest that development practitioners must first concede power (Laurie et al 2005 and MacKinnon, 2006).

Assessments of collaborations between scientists and fishers are discussed by Wilson (1999) the context of North American fisheries but but there are virtually no well-documented efforts at collaborations in India.

Only one study discusses the idea of participatory GIS in fisheries (Dineshbabu 2013), but these are still examples of what Wilson terms the ‘deference model’ where the community gathers material for the scientist or a slight modification of the model, where TEK enables the scientist to collect better location specific data.

Briggs (2013) states that the manner in which ITK studies are framed are seen by development practitioners as unhelpful in addressing immediate poverty reduction related problems. In an attempt to make indigenous knowledge more relevant to development practice and poverty reduction, he calls for a focus on process which he re-terms as ‘practice’ (Briggs 2005). He sees this focus on practice as improving our understanding of indigenous ways of knowing, and of understanding the power relations associated with knowledge at the local level. In this manner implicit and explicit power in local and modern science can be fairly negotiated.

To this list, we must add, that it is also time to imagine ways of forging research questions, collaborations and understanding practical relations with nature which explicitly account for the darker aspects of social interactions, which manifest in a range of social, political, and epistemological injustices. This is implied

in Agrawal's (2002) argument in favour of 'greater indeterminacy', which he sees as the potential outcome of a 'shift in perspective' – one that advocates a method of appreciating knowledge as embedded in a web of political and material relations.

Plurality of knowledge as experiments with democracy

Vishwanathan (2011) has suggested the idea of 'cognitive justice' and 'epistemological pluralism' – pointing to a paradigm shift in theory and practice that grapple with problems of democracy and knowledge (Vishwanathan 2001). There is a strong case to push further the idea of plurality of knowledge or multiple ways of knowing in a democracy, by conducting committed practical and theoretical experiments that test the operation of knowledge and power under varying circumstances of market conditions, social demographics, and problems of resource use. Not only do we need a better understanding of how plurality might come about, but the limits to plurality, the value of universals (such as human rights) and a keen observation of how such processes are historically shaped.

Shiv Vishwanathan often uses the metaphor of a *jugalbandi* to describe encounters between seeming incommensurables, to evoke the idea of two entities successfully communicating despite varying genealogies or traditions. Wilson refers to a model in fisheries collaborations that captures a similar format

– that of the competing constructions model (Wilson 1999). While we may agree with Agrawal that the categories of indigenous and scientific knowledge are false dichotomies, we believe that a straightforward acknowledgement of the processes that have created not just the dichotomy but hierarchies and resistance to the unhindered flourishing of certain epistemic communities is an important political act. In a world, where knowledge-power is associated with a distinct apparatus, the village scientists of India's forests, coastal stretches or high altitude pastures are clearly disadvantaged in most contests of knowledge. The Environment Impact Assessment based environmental governance processes, and official conservation rules are instances where decisions based on specific types of information and knowledge prevail over all others. The egalitarian platform necessary to execute a *jugalbandi* of knowledge simply does not exist. We have no way to predict the generative possibilities of such an epistemological symphony, but in the tradition of all science - modern, western, eastern, traditional, local or indigenous, till such experiments are conducted sincerely, we may never know.

References

- Ackermann, E. K. 1991. From de-contextualized to situated knowledge: Revisiting Piaget's water-level experiment. *Constructionism* 367-379.
- Adas, M. 1989. *Machines as the measure of men: science, technology and ideologies of western dominance*. Cornell University Press, New York.
- Agarwal, A. 1985. Ecological destruction and the emerging patterns of poverty and peoples' protests in rural India. *Social Action* 35(1): 54-80.
- Agarwal, A. 1998. False predictions. *Down to Earth* 7: 3 – 10.
- Agrawal, A and J. Ribot. 2014. Are Ostrom's design principles sufficient for design? *Policy Matters*, 19 (April). IUCN-CEESP.
- Agrawal, A and C. Gibson. 1999. Community and Conservation: Beyond Enchantment and Disenchantment. *World Development* 27(4): 629-49.
- Agrawal, A. 1995. Dismantling the divide between indigenous and western knowledge. *Development and Change*. 26(3): 413-39.
- Agrawal, A. 2002. Introduction: in favour of indeterminacy. *International Social Science Journal* 54(173), 283-285.
- Agrawal, A. 2009. Why "Indigenous" Knowledge? *Journal of the Royal Society of New Zealand* 34(4):157-58.
- Ahmed, S. K., Ravikumar, T., Krishnan, P. and Jeyakumar, S. 2013. Traditional fishing crafts and gears used by the Nicobari tribes in Car Nicobar. *Indian Journal of Traditional Knowledge* 12(1), 144-148.
- Aleem, A. 1973. History of Arab navigation in the Indian Ocean. *MBAI Special Publication dedicated to Dr. N K Panikkar* (2). pp.255-269.
- Ambirajan, S. 1978. *Classical Political Economy and Policy in India*. Cambridge University Press, New York.
- Amrith, S. S. 2013. *Crossing the Bay of Bengal*. Harvard University Press.
- Andersson, K.P., 2004. The politics of decentralised natural resource governance. PS Online 421-426. URL:http://www.indiana.edu/~workshop/publications/materials/reprints/R04I_17.pdf Accessed on June 23, 2014.
- Angchok, D. and P. Singh. 2006. Traditional irrigation and water distribution system in Ladakh. *IJTK* 5(3): 397-402.
- Anoop, B and Yousuf, K S S M and Abhilash, K S and Jeyabaskaran, R and Vivekanandan, E. 2011. Fishermen knowledge and perception on marine mammals in Kerala and Maharashtra. In: *Dr. S Jones Centenary Colloquium on 'Challenges in Marine Mammal Conservation & Research in the Indian Ocean'*, 26-27 August 2011, Kochi.
- Anuradha, R.V. 1998. Mainstreaming Indigenous Knowledge-Developing Jeevani. *Economic and Political Weekly* 33(26): 1615-1619.
- Arasaratnam, S. 1967. Dutch Commercial Policy in Ceylon and its effects on the Indo-Ceylon Trade (1690-1750). *Indian Economic & Social History Review*, 4(2), 109-130.
- Arnold, D. 1993. *Colonising the body: state medicine and epidemic disease in nineteenth century India*. University of California Press.
- Arnold, D and R. Guha. 1995. *Nature, Culture, Imperialism*. Oxford University Press.
- Arnold, J.E.M. 1990. Common property management and sustainable development in India. Working paper 9, Forestry for Sustainable Development Programme, University of Minnesota.
- Arora, V. The forest of symbols embodied in the *Tholung* scared landscape of north Sikkim, India. *Conservation and Society* 4(1): 55-83.
- Arunachalam, S. 1952. *The history of the pearl fishery of the Tamil coast* Annamalai University.
- Attwood, D.W. 2005. Big is ugly? Large-scale institutions prevent famines in western India. *World Development* 33(12): 2067-2083.

- Baden-Powell, B.H. 1876 – 1877. Forest conservancy in its popular aspect. *Indian Forester* 2(1): 1-17.
- Baker, J.M. 2005. *The kuhls of Kangra: community managed irrigation in the Western Himalaya*. University of Washington Press, Seattle.
- Bandopadhyay, A. 2010. The colonial legacy of forest policies in India. *Social Scientist* 38(1,2): 53-76.
- Barooah, M. and A. Pathak. 2009. Indigenous knowledge and practices of Thengal Kachari women in sustainable management of *bari* system of farming. *IJTK* 8(1): 35-40.
- Barua, K.K. and J. Slowik. 2009. Traditional ecological knowledge and community based sustainable natural resource management in the Eastern Himalaya – A case study of the Apatani Tribe. University of Gottingen. *Unpublished manuscript*.
- Bavinck, M. 1997. Changing balance of power at sea: Motorisation of artisanal fishing craft. *Economic and Political Weekly* 32(5) 198-200.
- Bavinck, M. 1998. "A matter of maintaining the peace." State accommodation to subordinate legal systems: The case of fisheries along the Coromandel Coast of Tamil Nadu, India. *J. Legal Pluralism* 40:151–170.
- Bavinck, M. 2001a. Caste panchayats and the regulation of fisheries along Tamil Nadu's Coromandel Coast, *Economic and Political Weekly* 36 (13): 1088-94.
- Bavinck, M. 2001b. *Marine resource management: conflict and regulation in the fisheries of the Coromandel Coast*. Sage Publications, India.
- Bavinck, M. 2005. Understanding fisheries conflicts in the South—a legal pluralist perspective. *Society and Natural Resources* 18(9), 805-820.
- Bavinck, M. and K. Karunaharan. 2006. A history of nets and bans: Restrictions on technical innovation along the Coromandel Coast of India, *Mast* 5(1): 45-.59
- Baviskar, A. 2005a. Indian indigeneities: adivasi engagements with Hindu nationalism in India. *Paper written for conference on 'Indigenous Experience Today' Wenner Gren Foundation, March 19-24, 2005*.
- Baviskar, A. 2005b. Claims to knowledge, claims to control environmental conflict in the Great Himalayan National Park, India. In, *Indigenous environmental knowledge and its transformations: critical anthropological perspectives* (eds. Ellen, R. et al.), pp. 101-118, Routledge.
- Bayly, C. 1990. *The Indian society and the making of the British empire*. Cambridge University Press.
- Berkes, F. 1993. Traditional ecological knowledge in perspective. In: *Traditional ecological knowledge: concepts and cases* (ed. J.T. Inglis). International Program on Traditional Ecological Knowledge and International Development Centre.
- Berkes, F., C. Folke and M. Gadgil. 1995. Traditional ecological knowledge, biodiversity, resilience and sustainability. In: *Biodiversity Conservation* (eds) C.A. Perrings, K.G. Mäler, C. Folke, B.O. Jansson and C.S. Holling. pp. 281-299. Kluwer Academic Publishers, Dordrecht,
- Berkes, F. 1999. *Sacred ecology: traditional ecological knowledge and resource management*. Taylor & Francis, Philadelphia and London.
- Berkes, F. and M. K. Berkes. 2009. Ecological complexity, fuzzy logic and holism in indigenous knowledge. *Futures* 41: 6-12.
- Berland, C. J. and Rao, A. (eds.). 2004. *Customary strangers: new perspectives on peripatetic peoples in the Middle East, Africa, and Asia*: Westport PraegerCT/London.
- Berland, C.J. 2003. Servicing the ordinary folk: peripatetic peoples and their niche in southwest Asia. In, *Nomadism in South Asia* (eds. Rao, A. and M. Casimir), Oxford University Press, New Delhi.
- Bhagya, B. and Sridhar, K. R. 2009. Ethnobiology of coastal sand dune legumes of Southwest coast of India. *Indian Journal of Traditional Knowledge*, 8(4), 611-620.
- Bharathi, S.B. 1999 *Coromandel fishermen. An ethnography of Pattanavar Subcaste*. Pondicherry: Pondicherry Institute of Linguistics and Culture. p277.
- Bhatia. B. 1963. *Famines in India, 1850-1945*. Bombay, 1963; In *This fissured land: an ecological history of India* (eds. R. Guha and M. Gadgil) Oxford University Press, Delhi.
- Bhattacharjee, R.P. And D.C. Ray. 2010. Pest management beliefs and practices of Manipuri rice farmers in Barak

- Valley, Assam. *IJTK* 9(4): 673-676.
- Bhattacharjya, D.K. and P.C. Borah 2008. Medicinal weeds of crop fields and role of women in rural health and hygiene in Nalbari district, Assam. *IJTK* 7(3): 501-504.
- Bhattacharya, N. 1995. Pastoralists in a colonial world. In, *Nature culture and imperialism: essays on the environmental history of South Asia* (eds. Arnold, D. and R. Guha), pp. 49-85. Oxford University Press.
- Blench, R.M. 2000. *Extensive pastoral livestock systems: issues and options for the future*. Overseas Development Institute, London.
- Brandis, D. and A. Smythies (eds.). 1875. Proceedings of the Forest Conference, Simla. Calcutta 1875.
- Briggs, J. 2005. The use of indigenous knowledge in development: problems and challenges. *Progress in Development Studies* 5(2), 99-114.
- Briggs, J. & J. Sharp. 2006. Indigenous knowledges and development: a postcolonial caution. *Third World Quarterly* 25(4): 661-676.
- Briggs, J. 2013. Indigenous knowledge: A false dawn for development theory and practice? *Progress in Development Studies* 13(3), 231-243.
- Bryant, R.L. 1994. Shifting the cultivator: The politics of teak regeneration in colonial Burma. *Modern Asian Studies* 28: 225-250.
- Bryant, R.L. 1997. *The political ecology of forestry in Burma: 1824 – 1994*, University of Hawaii Press.
- Cain, P.J. & Hopkins A.G. 1993. *British imperialism: Innovation and expansion 1688-1914*, Vol. 1., and *Crisis and deconstruction, 1914-1990*, Vol. 2. Longman, London.
- Caldwell, J.C. 1998. Malthus and the less developed world: the pivotal role of India. *Population & Development Review* 24(4): 675-696.
- Castillo, A.R. 2009. The whizz of electrons and the wisdom of elders: Linking traditional knowledge and western science, *Traditional Knowledge Bulletin*. July 2009. UNU-IAS. Tokyo.
- Castree, N.M. 2010. Neoliberalism and the biophysical environment 1: What neoliberalism is, and what difference nature makes to it. *Geography Compass* 4: 1725-1733.
- Chakrabarty, D. 2002. *Habitations of modernity: essays in the wake of subaltern studies*. University of Chicago Press.
- Chakravarty-Kaul, M. 1996. Claiming the Alps: The Himalayan commons in the Punjab and Himachal Pradesh. In: *Sixth Annual Conference of the International Association for the Study of Common Property: Voices from the Commons*, Berkeley, California, June 5-8, 1996.
- Chambers, R. 1992. The self-deceiving state. *IDS Bulletin* 23(4): 31-43.
- Champion, H.G. 1928. Forest and stream-flow experiment at Wagon Wheel Gap, Colorado. Final report on compilation of the second phase of the project. *Indian Forester* 54: 675.
- Chand, K. 2011. Traditional knowledge of processing and value addition to dromedary camel wool. *IJTK* 10(2): 316-318.
- Chandi, M. 2006. The use and knowledge of herpetofauna on Little Nicobar Island, India. *Conservation and Society*, 4(1), 155.
- Chandi, M. 2011. Common property resources and the cultural keystone concept: A conceptual contribution toward adaptive resource management. In: *12th Conference of the International Association for the Study of the Commons*, Hyderabad.
- Chaudhuri, K. N. 1985. *Trade and civilisation in the Indian Ocean: an economic history from the rise of Islam to 1750*. Cambridge University Press.
- Chrispin, C. L., Ananthan, P. S., Krishnan, M. and Mahalakshmi, P. 2012. Effectiveness of institutional arrangements for delivery of Potential Fishing Zone and ocean state forecast advisory services to fishers in Tamil Nadu. *Agricultural Economics Research Review* 25(2012).
- Christie, M. J. 1990. Aboriginal science for the ecologically sustainable future. *Ngoonjook* (4), 56.
- Christie, M. 2008. Digital tools and the management of Australian desert aboriginal knowledge. In: *Global indigenous media: Cultures, practices and politics* (eds) Wilson

- P. and Stewart, M. 270-286,, Duke University Press.
- Cordell, J.C. 2000 Remaking the waters: the significance of sea tenure-based protected areas. In: *Third Conference on Property rights, economics and environment*. International Center for research on Environmental issues, Aix-en-Provence, France.
- Correspondence with the Secretary of State for India. 1881, BP7/3.
- Coulthard, S. 2005. *Developing a people-centred approach to the coastal management of Pulicat lake, a threatened coastal lagoon in South India*. Ph.D thesis. University of Bath, U.K.
- Coulthard, S. 2011. More than just access to fish: the pros and cons of fisher participation in a customary marine tenure (Padu) system under pressure. *Marine Policy* 35(3), 405-412.
- Darwin, C. 1859. *On the origin of species (or the preservation of favoured races in the struggle for life)*. John Murray, London.
- Das, D. 2006. Demystifying the myth of shifting cultivation: agronomy in the North-East. *EPW* 41(47): 4912-4917.
- Das, P. et al. 2009a. Adjusting to Floods on the Brahmaputra Plains, Assam, India. Report. *ICIMOD Independent Publication* with Aranyak.
- Das, P. et al. 2009b. Policy and Institutions in Adaptation to Climate Change Case study on flood mitigation infrastructure in India and Nepal. Report. *ICIMOD Independent Publication* with Aranyak.
- Das, T. and A.K. Das. 2005. Local soil knowledge of smallholder rice farmers: A case study in Barak Valley, Assam. *IJTK* 41(1): 94-99.
- Davis, A. and K. Ruddle. 2010. Constructing confidence: rational skepticism and systematic enquiry in local ecological knowledge research. *Ecological Applications* 20(3), 880-894.
- Davis, M. 2001. *Late Victorian holocausts: El Nino famines and the making of the Third World*. Verso, London.
- Deakin, A..1893. *Irrigated India. An Australian view of India and Ceylon and their Irrigation and Agriculture*. W. Thacker & Co.. London.
- Deckla, S. S. 2004. *Maritime History of The Pearl Fishery Coast with Special Reference to Thoothukudi*. Ph.d thesis. Manonmaniam Sundaranar University.
- Desiraju, G.R. 2003. Sir Arthur Cotton. *Current Science* 85(3): 236.
- Devi, B.N. 2013. Traditional fishing methods in Central valley region of Manipur, India. *IJTK* 12(1): 137-143.
- Dhal, N.K. et al. 2010. *Bakhar* starch fermentation – A common tribal practice in Orissa. *IJTK* 9(2): 279-281.
- Dhaliwal, R.K. and G. Singh. 2010. Traditional food grain storage practices of Punjab. *IJTK* 9(3): 526-530.
- Dineshbabu, A P .2013. Importance of Participatory GIS (PGIS) tool in marine fisheries. In: *ICAR funded Short Course on "ICT -oriented strategic extension for responsible fisheries management, 05-25 November, 2013, Kochi*.
- Dodds, G.B. 1969. The stream-flow controversy: a conversation turning point. *The Journal of American History* 56: 57-69.
- Dollo, M. 2009. Traditional irrigation system: A case of Apatani tribe in Arunachal Himalaya. *Mountain Forum Bulletin* 9(1): 9-11.
- Drèze, J. 1991. Famine prevention in India. In, *The political economy of hunger: famine prevention'* (Drèze, J. and A. Sen eds.), Oxford University Press, Oxford.
- D'Souza, R. 2002. Damming the Mahanadi river: the emergence of multi-purpose river valley development in India, 1943-1946. *Environmental Values* 11: 369-394.
- Dutt, B. 2004. Livelihood strategies of a nomadic hunting community of eastern Rajasthan. *Nomadic Peoples* 8(2): 260-273.
- Dutt, B. and R. Kaleta. 2005. From charmers to educators: Using indigenous knowledge for conservation education. Presented at 'Education for a Sustainable Future Conference'.
- Dyer, C. and A. Choksi. 2006. "With god's grace and with education, we will find a way", In, *The education of nomadic peoples: current issues future perspectives*, (ed. Dyer, C.), Berghahn Books: New York, Oxford.

- Eckholm, E. 1976. *Losing ground: environmental stress and world food prospects*. WW. Norton and Company Inc.
- Ehrlich, P. 1968. *The population bomb*. Buccaneer Books.
- Escobar, A. 1995. *Encountering Development: The Making and Unmaking of the Third World*. Princeton, New Jersey.
- Fanon, F. 1959. *A dying colonialism*. Grove Press, New York.
- Farooquee, N.A., et al. 2004. Indigenous knowledge systems and sustainable management of natural resources in a high-altitude society in Kumaun Himalaya, India. *Journal of Human Ecology* 16(1): 33-42.
- FIMSUL, 2010 . Report of the study orientation and methodology workshop 28- 30th September 2010 Chennai, Tamil Nadu. *Fisheries Management for Sustainable Livelihoods (FIMSUL), Report No. FIMSUL/R6A*.
- FIMSUL. 2011a. Report of short course on knowledge management for fisheries and on fisheries livelihoods. *Fisheries Management for Sustainable Livelihoods (FIMSUL), Report No. FIMSUL/R/21*
- FIMSUL. 2011b. Understanding the implications of knowledge management for fisheries in Tamil Nadu and Puducherry. *Fisheries Management for Sustainable Livelihoods (FIMSUL), Report No. FIMSUL/R22*.
- Fletcher, R. 2010. Neoliberal environmentalism: towards a post-structuralist political ecology of the conservation debate. *Conservation & Society* 8(3): 170-181.
- Forsyth, T. 2003. *Critical political ecology: the politics of environmental science*. Routledge.
- Foucault, M. 1978-79. *The birth of biopolitics: lectures at the Collège de France, 1978-1979 (Lectures at the College de France)*, Reprint edition, 2010, Picador.
- Foucault, M. 1979. *Security, territory, population: lectures at the Collège de France 1977-1978 (Lectures at the College de France)*, Reprint edition, 2009, Picador.
- Foucault, M. 1980. *Power/ knowledge: selected interviews and other writings, 1972-1977*. Pantheon, New York.
- Foucault, M. 2012. *The archaeology of knowledge*. Random House LLC.
- Franco, M.F. and Narasimhan, D. 2009. Plant names and uses as indicators of knowledge patterns. *IJTK* 8(4): 645-648.
- Frazier, J. 1980. Exploitation of marine turtles in the Indian Ocean. *Human Ecology* 8(4), 329-370.
- Gadgil, M. and R. Guha. 1993. *This fissured land: an ecological history of India*. University of California Press.
- Galav, P. 2010. Animal healthcare practices by livestock owners at Pushkar animal fair, Rajasthan. *IJTK* 9(4): 660-663.
- Garbyal, S.S. et al. 2007. Traditional phytomedicinal knowledge of *Bhotias* of Dharchula in Pitthoragarh. *IJTK* 6(2): 360-364.
- George, J. and K. Yhome. 2008. Community Forest Management: A Case Study of Nagaland, India. In: *Governing Shared Resources: Connecting Local Experience to Global Challenges, the Twelfth Biennial Conference of the International Association for the Study of Commons*. 14-18 July. IASC. Cheltenham, UK
- Ghate, R. 2000. Joint Forest Management: Constituting New Commons. In: *Constituting the Commons: Crafting Sustainable Commons in the New Millennium, the Eighth Biennial Conference of the International Association for the Study of Common Property*. Bloomington, Indiana, May 31-June 4, 2000
- Gilmartin, D. 1993. Models of the hydraulic environment: colonial irrigation, state power and community in the Indus basin. In, *Nature culture and imperialism: essays on the environmental history of South Asia* (eds. Arnold, D. and R. Guha), pp. 210-236. Oxford University Press.
- Goldman, M. 2007. Tracking wildebeest, locating knowledge: Maasai and conservation biology understandings of wildebeest behaviour in northern Tanzania. *Environment and Planning D: Society and Space* 25: 307-331.
- Goldman, M. et al. (eds.) 2011. *Knowing nature: conversations at the intersection of political ecology and science studies*. The University of Chicago Press, Chicago.
- Gomathy, N.B. January, 2006. The role of traditional Panchayats in coastal fishing communities in Tamil Nadu, with special reference to their role in mediating Tsunami relief and rehabilitation. In: *Proceedings from the ICSF post-tsunami rehabilitation workshop*.

- Gooch, P. 1998. At the tail of the buffalo: Van Gujjar pastoralists between the forest and the world arena. *Lund Monographs in Social Anthropology* 6.
- Gooch, P. 2009. Victims of conservation or rights as forest dwellers: Van Gujjar pastoralists between contesting codes of law. *Conservation & Society* 7(4): 239-248.
- Gopal, N., Menon, S. J. and Annamalai, V. 2000. Technology induced productivity in fisheries. *Fishery Technology* Vol. 37(1) 63-68
- Gosai, K. et al. 2011. Indigenous knowledge of soil fertility management in the humid tropics of Arunachal Pradesh. *IJTK* 10(3): 508-511.
- Goswami, B. et al. 2006. Indigenous Technological Knowledge in fish farming. *IJTK* 5(1): 60-63.
- Grove, R. 1993. Conserving eden: The (European) East India companies and their environmental policies on St. Helena, Mauritius and in Western India, 1660 to 1854. *CSSH* 35: 318-351.
- Grove, R. 1995. *Green imperialism: colonial expansion, tropical island edens and the origins of environmentalism, 1600-1800*. Cambridge University Press.
- Gubbi, S., M. Linkie, and N. Leader-Williams. 2009. Evaluating the legacy of an integrated conservation and development project around a tiger reserve in India. *Environmental Conservation* 35(4): 331-339.
- Guha, R. 1983. Forestry in British and post-British India: a historical analysis, *Economic & Political Weekly* 18(44), 1983, pp. 1882-96.
- Guha, R. 1997. The authoritarian biologist and the arrogance of anti-humanism: wildlife conservation in the Third World. *The Ecologist* 27(1): 14-20.
- Guha, R. 1989. Radical American environmentalism and wilderness preservation: a Third World critique. *Environmental Ethics* 11:71-83.
- Guha, R. 1990. *The unquiet woods: ecological change and peasant resistance in the Himalaya*. University of California Press, Berkeley.
- Guha, R. 2001. The prehistory of community forestry in India. *Environmental History* 6(2): 213-238.
- Guha, S. 1999. *Environment and ethnicity in India, 1200 – 1991*. Cambridge University Press, Cambridge.
- Guhati, L. 1984. Technological change and women's work participation and demographic behaviour: A case study of three fishing villages. *Economic and Political Weekly*, 2089-2094.
- Gupta, A. 1998. *Postcolonial developments: agriculture in the making of modern India*. Duke University Press.
- Gupta, H.K. 2006. Cultural Significance of Indigenous Institutions and Forest Management Practices in the Indian Himalayas: Implications for Policy and Sustainable Livelihoods. In *Survival of the Commons: Mounting Challenges and New Realities, the Eleventh Conference of the International Association for the Study of Common Property*, June 19-June 23, 2006 Bali, Indonesia
- Guthman, J. 1997. Representing crisis: the theory of Himalayan degradation and the project of development in post-Rana Nepal. *Development & Change* 28: 45-69.
- Gyan Prakash. 1990. *Bonded histories: genealogies of labour servitude in colonial India*. Cambridge University Press, Cambridge.
- Habib, I. 1963. *The agrarian system of Mughal India, 1556 – 1707*. Oxford University Press. London.
- Haraway, D. 1991. *Simians, cyborgs and women: the reinvention of nature*. Free Association of Books, London.
- Hardiman, D. 1995. Small-dam systems of the Sahyadris. In, *Nature culture and imperialism: essays on the environmental history of South Asia* (eds. Arnold, D. and R. Guha), pp. 185-209. Oxford University Press.
- Hardin, G. 1968. Tragedy of the commons. *Science* 162: 1243-1248.
- Hoeppe, G. 2007. *Conversations on the beach: fishermen's knowledge, metaphor and environmental change in South India* (Vol. 2). Berghahn Books.
- hooks, b. 1990. Marginality as a site of resistance. In, *Out there: marginalisation and contemporary cultures* (eds. R. Ferguson et al.). Cambridge, MA.
- Hornell, J. 1920. The origins and ethnological significance of Indian boat designs. *Memoirs of the Asiatic Society of Bengal*,

- Calcutta.
- Hough, F.B. 1878, 1888, 1889. *Report upon forestry*, Vol. 1-3. Washington.
- Hughes, R. and F. Flintan. 2001. Integrating conservation and development experience: a review and bibliography of the ICDP literature. IIED, London.
- Igoe, J. and D. Brockington. 2007. Neoliberal conservation: a brief introduction. *Conservation & Society* 5: 432-449.
- Inden, R. 1986. Orientalist constructions of India. *Modern Asian Studies* 20(30): 401-446.
- IUCN. 1980. *World conservation strategy: living resource conservation for sustainable development*. IUCN, UNEP, WWF & FAO..
- Ives, J.D. and B. Messerli. 1989. *The Himalayan dilemma: reconciling development and conservation*. Routledge, London and New York.
- Jadeja, B.A. et al. 2006. Indigenous animal healthcare practices in district Porbandar, Gujarat. *IJTK* 5(2): 253-258.
- Jain, A. 2011. Snakelore and indigenous snakebite remedies practiced by some tribals of Rajasthan. *IJTK* 10(2): 258-268.
- Jain, A.K. et al. 2010. Folklore claims on some medicinal plants used by *Bheel* tribe of Guna district Madhya Pradesh. *IJTK* 9(1): 105-107.
- Jalais, A. 2008. Bonbibibi: Bridging worlds. *Indian Folklife*, (28).
- Jalais, A. 2010. *Forest of Tigers: People, Politics, and Environment in the Sundarbans*. Routledge, India. .
- Janu, C.K. 2004. *Mother forest: the unfinished story of C.K. Janu*. Kali for Women.
- Jeeva, S. et al. 2006. Traditional knowledge and biodiversity conservation in the sacred groves of Meghalaya. *IJTK* 5(4): 563-568.
- Jenks, L.H. 1927. *The migration of British capital to 1875*. Knopf, London and New York.
- Joshi, C.P. and B.B. Singh. 2006. Indigenous Agricultural Knowledge in Kumaon hills of Uttaranchal. *IJTK* 5(1): 19-24.
- Johnson, D. S. 2006. Category, narrative, and value in the governance of small-scale fisheries. *Marine Policy* 30(6), 747-756.
- Kala, C.P. 2013. Traditional ecological knowledge on characteristics, conservation and management of soil in tribal communities of Pachmarhi Biosphere Reserve, India. *Journal of Soil Science and Plant Nutrition* 13(1): 201-214.
- Kalland, A. 2000. Indigenous knowledge: prospects and limitations. In, *Indigenous environmental knowledge and its transformations: critical anthropological perspectives* (eds. Ellen, R. et al.), pp. 319-335, Routledge.
- Kapoor, D. 2010. Learning from Adivasi (original dweller) political-ecological expositions of development: claims on forests, land and place in India. In, *Indigenous knowledge and learning in Asia/Pacific and Africa: perspectives on development, education and culture* (eds. Kapoor D and E. Shizha). pp. 17–34, Palgrave Macmillan, New York.
- Kapoor, D. 2011. Subaltern social movement (SSM) post-mortems of development in India: locating translocal activism and radicalism. *Journal of Asian & African Studies* 46(2): 130–148.
- Kapoor, D. 2012. Human rights as paradox and equivocation in contexts of *adivasi* (original dweller) dispossession in India. *Journal of Asian and African Studies* 47(4): 404-420.
- Klingsmith, D. 2007. *One valley and a thousand: dams, nationalism and development*. Oxford University Press, India.
- Kothari, A. 2009. Natural Resource Management and the Promise of Decentralised Governance : Learning from Experience in India. In, 'Institutional and infrastructure resources: national and regional institutions and infrastructures', *Encyclopedia of Life Support Systems* (ed. Neil E. Harrison). Developed under auspices of the UNESCO, Eolss Publishers, Oxford, UK. <http://www.eolss.net>.
- Kumar, G. et al. 2009. Indigenous pest and disease management practices in traditional farming systems in north east India. A review. *Journal of Plant Breeding and Crop Science* 1: 28-38.

- Kumar, M. 2005. Claims on Natural Resources: Exploring the Role of Political Power in Pre-Colonial Rajasthan, India. *Conservation and Society* 3: 134-149.
- Kunhi, T.K. 2001. *Marjan- a study of traditional navigation science in Lakshadweep*. Lakshadweep Coral Reef Monitoring Network.
- Kurien J and Willmann, R. 1982 Economics of Artisanal and Mechanised Fisheries in Kerala: A Study of Costs and Earnings of Fishing Units, *FAO/UNDP Working Paper*.
- Kurien, J. 1988. Studies on the role of fishermen's organizations in fisheries management. The role of fishermen's organizations in fisheries management of developing countries (with particular reference to the Indo-Pacific region). *FAO Fisheries Technical Paper*, (300):29-48
- Kurien, J. 1998. Traditional ecological knowledge and ecosystem sustainability: new meaning to Asian coastal proverbs. *Ecological Applications* 8(sp1), S2-S5.
- Kurien, J. 2002. People and the Sea: A 'Tropical-Majority' World Perspective, *MAST* 1(1). p9.
- Latour, B. 1987. *Science in action: how to follow scientists and engineers through society*. Harvard University Press.
- Laurie, N., Andolina, R., Radcliffe, S.A., 2005. Ethno-development: social movements, creating experts and professionalising Indigenous knowledge in Ecuador Antipode. *Journal of Radical Geography* 39 (3), 470-496.
- Lele, S. 2004. Decentralising governance of natural resources in India. Review paper submitted to UNDP Drylands Development Centre, Nairobi.
- Lewis, M. 2005. Indian science for Indian tigers? Conservation biology and the question of cultural values. *Journal of the History of Biology* 38: 185-207.
- Liang, L. et al. 2009. Sikkim Himalayan-Agriculture: Improving and scaling up of the traditionally managed agricultural systems of global significance. *Resources Science* 31(1): 21-30.
- Lobe, K. and Berkes, F. 2004. The *padu* system of community-based fisheries management: change and local institutional innovation in south India. *Marine Policy* 28(3), 271-281.
- Lowdermilk, W.C. 1935. Civilisation and soil erosion. *Journal of Forestry* 33: 554.
- Ludden, D. 1989. *Peasant history in south India*. Oxford University Press, New Delhi.
- Ludden, D. 1992. India's development regime. In, *Colonialism and culture* (ed. Dirks, N.D.), pp. 247-288. University of Michigan, Ann Arbor, MI.
- MacKenzie, J.M. 1988. *The Empire of nature*. Manchester University Press, Manchester.
- MacKenzie, J.M. 1990. *Imperialism and the natural world*. Manchester University Press, Manchester.
- MacKinnon, K. 2006: An orthodoxy of the 'local': Post-colonialism, participation and professionalism in northern Thailand. *Geographical Journal* 172, 22-34.
- Madegowda, C. 2009. Traditional Knowledge and Conservation. *Economic and Political Weekly* XLIV (21): 65-69.
- Mahanty, S. 2003. Insights from a Cultural Landscape: Lessons from Landscape History for the Management of Rajiv Gandhi (Nagarahole) National Park. *Conservation and Society* 1(1): 23-47.
- Mairh, A.K. 2010. Traditional botanical wisdom of *Birhore* tribes of Jharkhand. *IJTK* 9(3): 467-470.
- Malik, B. 2003. The 'Problem' of Shifting Cultivation in the Garo Hills of North-East India, 1860-1970. *Conservation and Society* 1(2): 87-102.
- Mani, M.S. 1974. *Ecology and biogeography in India*. Dr. W. Junk. bv. Publishers, The Hague. 775 pages.
- Manna, R.K. and B.K. Bhattacharya. 2009. Incorporation of new construction material into indigenous technological knowledge: A case study of V shaped fish trap of eastern India. *IJTK* 8(4): 48-50.
- Marsh, G.P. 1864. *Man and nature, or physical geography as modified by human action*. C. Scribner, New York.
- Mathew S. 1991. Study of territorial use rights in small-scale fisheries: traditional systems of fisheries management in Pulicat Lake, Tamil Nadu, India. *FAO Fisheries Circular* 839. Rome.

- Mathew, S. 2003. Small-scale fisheries perspectives on an ecosystem-based approach to fisheries management. In *Responsible fisheries in the marine ecosystem*, (eds, M. Sinclair and G. Valdimarsson), 47-63. CaBI Publication, Wallingford, Cambridge, U.K.
- Mathur, M. 2013. Economic assessment and conservation priorities of the Indian Thar desert medicinal plants *Indian Journal of Natural Products and Resources* 4(3), 283-294.
- Mazzocchi, F. 2006. Western science and traditional knowledge: despite their variations, different forms of knowledge can learn from each other. *EMBO Reports* 7(5): 463-466.
- McGinn, P. 2009. Capital, 'development' and canal irrigation in colonial India. Working Paper 209, Institute for Social and Economic Change.
- Meena, K.L. and B.L. Yadav. 2010. Some ethnomedicinal plants of Southern Rajasthan. *IJTK* 9(1): 169-172.
- Minchin, F.F. 1921. *Working plan for Gumsur forests, Ganjam District*. Government Press, Madras.
- Modi, A. 2011. What Lead to Conservation of Commons by the Community? In: *Sustaining Commons: Sustaining Our Future, the Thirteenth Biennial Conference of the International Association for the Study of the Commons*. January 10-14, Hyderabad, India.
- Mohan, B., Balasubramaniam, S. and Kandoran, M. K. 1996. Technological gaps among fishermen operating motorised and non-motorised fishing crafts. *Fishery Technology* Vol. 33(1) 58 – 65
- Moore, W.L. 1910. The influence of forests on climate and floods. Report prepared for the House of Representatives, United States, Committee on Agriculture, Government Printing Office, Washington.
- Mukarji, N. 1989. Decentralization below the state level: need for a new system of governance. *Economic & Political Weekly* 23: 467-472.
- Mukhopadhyay, D. 2006. Indigenous Knowledge and Sustainable Natural Resource Management in the Indian Desert. In: *International Scientific Conference on Desertification and Drylands Research, Tunis, Tunisia*, 19-21 June 2006.
- Münster, D. and U. Münster. 2012. Consuming the forest in an environment of crisis: nature tourism, forest conservation and neoliberal agriculture in south India. *Development & Change* 43(1): 205-227.
- Muzaddadi, A.U. and S. Basu. 2012. Shidal - A traditional fermented fishery product of North east India. *IJTK* 11(2): 323-328.
- Nag, A. et al. 2007. Indigenous animal healthcare practices from Udaipur district, Rajasthan. *IJTK* 6(4): 583-588.
- Nag, S. 1999. Bamboo, rats and famines: famine relief and perceptions of British paternalism in the Mizo Hills. *Environment & History* 5: 245-252.
- Nagnur, S. et al. 2006. Traditional dairy herd management practices during pregnancy and calving. *IJTK* 5(2): 243-244.
- Nandy, A. 1989a. Introduction: science as a reason of state. In, 'Science, hegemony and violence: a requiem for modernity' (ed. A. Nandy). Oxford University Press.
- Nandy, A. 1989b. Shamans, savages and the wilderness: on the audibility of dissent and the future of civilisations. *Alternatives* 14(3): 263-277.
- Nath, A.J. et al. 2009. Traditional knowledge base in the management of village bamboos: A case study in Barak Valley, Assam, Northeast India. *IJTK* 8(2): 163-168.
- Nayak, P. K. & Berkes, F. 2011. Commonisation and decommonisation: Understanding the processes of change in the Chilika Lagoon, India. *Conservation and Society*, 9(2), 132.
- Nigam, S. 1990. Disciplining and policing the 'criminals by birth', Part 1: the making of a colonial stereotype – the criminal tribes and castes of North India. *Indian Economic & Social History Review* 27: 131-136.
- Nirmale, V. H., Gangan, S. S., Yadav, B. M., Durgale, P. and Shinde, K. M. 2012. Traditional knowledge on mud crab; ethnoecology of *Scylla serrata* in Ratnagiri coast, Maharashtra. *Indian Journal of Traditional Knowledge* 11(2), 317-322.
- Nirmale, V., Sontakki, B., Biradar, R. S. and Metar, S. 2004. Assessment of indigenous knowledge of coastal fisherfolk of greater Mumbai and Sindhudurg districts of Maharashtra. *Indian Journal of Traditional Knowledge* 3(1), 27-36.

- Panda, A. and Misra, M. K. 2007a. Traditional lime preparation-A case study in coastal Orissa, India. *Indian Journal of Traditional Knowledge* 6(2), 262-269.
- Panda, A. and Misra, M. K. 2007b. Traditional methods of mollusc shell collection for lime preparation in East coast of India. *Indian Journal of Traditional Knowledge*, 6(4), 549-558.
- Pandian, M.S.S. 1990. *The political economy of agrarian change: Nanchilnadu 1880 – 1939*. SAGE Publications, New Delhi.
- Pandravada, S.R. 2013. Sorghum landraces patronized by tribal communities in Adilabad district, Andhra Pradesh *IJTK* 12(3): 465-471.
- Pandya, V. 1990. Movement and space: Andamanese cartography. *American Ethnologist*, 17(4), 775-797.
- Pandya, V. 1993. *Above the forest: a study of Andamanese ethnoanemology, cosmology, and the power of ritual*. Delhi: Oxford University Press.
- Pandya, V. 2009. *In the Forest: Visual and Material Worlds of Andamanese History (1858-2006)*. University Press of America.
- Pangging, G. et al. 2011. Traditional management practices of natural resources of forest dependent communities in Arunachal Pradesh – A case study of fringe villages in Banderdewa forest range. *IJTK* 10(2): 269-275.
- Pant, N. 1998. Indigenous Irrigation in South Bihar, India: A Case of Congruence of Boundaries. In: *Crossing Boundaries, the Seventh Biennial Conference of the International Association for the Study of Common Property*, IASC. June 10-14 , Vancouver, British Columbia, Canada
- Pereira, W. 1992. The sustainable lifestyle of the Warlis. *India International Centre Quarterly* 19: 1 and 2.
- Pereira, W. and J. Seabrook. 1990. *Asking the earth: the spread of unsustainable development*. The Other India Press, Mapusa.
- Phadke, R. 2011. Reclaiming the technological imagination: water, power and place in India. In, *Knowing nature: conversations at the intersection of political ecology and science studies* (M. Goldman et al. eds.) pp.244-262, The University of Chicago Press, Chicago.
- Philip, K. 2004. *Civilising natures: race, resources and modernity in colonial south India*. Rutgers University Press, New Brunswick, New Jersey.
- Poffenberger, M. and C. Singh. 1996. Communities and state: re-establishing the balance in Indian forest policy. In, *Village voices, forest choices: joint forest management in India* (eds. Poffenberger, M. and B. McGean eds.), pp.133-159, Oxford University Press, New Delhi.
- Polanyi, M. 1958. *Personal knowledge: towards a post-critical philosophy*. Chicago, IL: University of Chicago Press.
- Pope, A. 1995. British steamshipping and the Indian coastal trade, 1870-1915. *Indian Economic & Social History Review* 32(1), 1-21.
- Pouchepadass, J. 1995. Colonialism and environment in India: comparative perspective. *Economic & Political Weekly* 30(33): 2059-2067.
- Prasad, L. et al. 2013. Few indigenous traditional fishing method of Faizabad district of eastern Uttar Pradesh, India. *IJTK*. 12(1): 116-122.
- Pratt, M.L. 1992. *Imperial eyes: studies in travel writing and transculturation*. Routledge, London.
- Pyne, S. 1994. Nataraja: India's cycle of fire. *Environmental History Review* 18(3): 1-20.
- Quarterly, Vol. 33(1), 2006, pp. 50–64.
- Chakraborty, R. et. al. 2012. North-East India an Ethnic Storehouse of Unexplored Medicinal Plants. *Journal of Natural Products and Plant Resources* 2(1): 143-152.
- Radhakrishna, M. 2001. *Dishonoured by history: criminal tribes and British colonial policy*. Sangam Books.
- Rai, S.C. 2005. Apatani paddy-cum-fish cultivation: An indigenous hill-farming system of North East India. *IJTK* 4(1): 65-71.
- Raina, R. S. 1999. Patronage and evaluation in the Indian Council of Agricultural Research. *Evaluation*, 5(3), 278-302.
- Raj, K. 2010. *Relocating modern science: circulation and the construction of knowledge in South Asia and Europe, 1650 – 1900*. Palgrave MacMillan.

- Rajagopalan, M. 1984. Value of sea turtles to India. In: *Proceedings of the workshop on sea turtle conservation, Special Publication Vol. 18*, pp. 49-58, CMFRI, Cochin.
- Rajagopalan, R. 2012. Pulicat's Padu System, *Yemaya* 39.
- Rajakumar, N., and Shivanna M.B. 2012. Traditional veterinary healthcare practices in Shimoga district of Karnataka, India. *IJTK* 11(2): 283-287.
- Rajan J.B. 2002. Declining indigenous regulations on fishery: A case of Kadakkodi (sea court) in Kerala, South India, legal pluralism and unofficial law. In: *Social, Economic and Political Development, Papers of the XIIIth International Congress 7-10 April, 2002* Chiangmai, Thailand.
- Rajan, R.S. 1994. *Imperial environmentalism: the agendas and ideologies of natural resource management in British colonial forestry*. Ph.D. Thesis, University of Oxford, Oxford.
- Rajeswari, S. 1992. *The Organisation of Agricultural Research in India: An Economic Analysis of Technology Generation 1860- 1990* unpublished Ph D dissertation. Centre for Development Studies, Trivandrum, University of Kerala.
- Ram, K. 1991. *Mukkuvar Women: Gender, hegemony, capitalist transformation in a South Indian fishing community*. Kali for Women, New Delhi.
- Rana, C.S. et al. 2013a. Faith herbal healer knowledge document of Nanda Devi Biosphere Reserve, Uttarakhand, India. *IJTK* 12(2): 308-314.
- Rana, R.S. et al. 2013b. Indigenous perceptions of Climate change vis-a-vis Mountain Agricultural activities in Himachal Pradesh, India. *IJTK* 12(4): 596-604.
- Rangan, H. 2000. *Of myths and movements: rewriting Chipko into Himalayan history*. Verso.
- Rangarajan, M. 1994. Imperial agendas and India's forests: the early history of Indian forestry, 1800-1878. *IESHR* 31(2): 147-167.
- Rangarajan, M. 1996a. *Fencing the forest: conservation and ecological change in India's Central Provinces, 1860-1914*. Oxford University Press.
- Rangarajan, M. 1996b. Environmental histories of South Asia: a review essay. *Environment & History* 2(2): 129-143.
- Rangarajan, M. 1998. The Raj and the natural world: the war against 'dangerous beasts' in colonial India. *Studies in History* 14(2): 265-299.
- Rangarajan, M. 2006. Ideology, the environment and policy: Indira Gandhi, India International Centre.
- Rao, A. and M.J. Casimir (eds.). 2003. *Nomadism in South Asia*. Oxford University Press.
- Rashkow, E. 2014. Making subaltern *shikaris*: histories of the hunted in colonial central India. *South Asian History & Culture* 5(3): 293-313.
- Rashkow, E. 2015. Resistance to hunting in pre-Independence India: religious environmentalism, ecological nationalism or cultural conservation? *Modern Asian Studies*. (AM. publication expected).
- Rashkow, E.D. 2014. Perfumed the axe that laid it low: the endangerment of sandalwood in southern India. *Indian Economic & Social History Review* 51(1): 41-70.
- Rawat, G.S. 2009. Traditional livelihood based on sheep grazing in the Khangchendzonga national park, Sikkim. *IJTK* 8(1): 75-80.
- Raychaudhuri, B. 1980. *The Moon and the Net: Study of a Transient Community of Fishermen at Jambudwip*. Anthropological Survey of India, Government of India. Calcutta.
- Reeves, P. 1995. Inland waters and freshwater fisheries: issues of control, access and conservation in colonial India, In: *Nature, Culture, Imperialism. Essays on the environmental history of South Asia* (eds, Arnold, D. and R. Guha), Oxford University Press, p 260-292.
- Reeves, P. 2002. Regional diversity in South Asian Inland fisheries: Colonial Bengal and Uttar Pradesh compared, South Asia: *Journal of South Asian Studies* 25:2, 121-135.
- Reeves, P., Pope, A., McGuire, J. and Pokrant, B. 1996a. Mapping India's marine resources: Colonial state experiments, C. 1908-1930. *South Asia: Journal of South Asian Studies* 19(1), 13-35.
- Reeves, P., Pope, A., McGuire, J. and Pokrant, B. 1996b. The Koli and the British at Bombay: The structure of their relations to the Mid Nineteenth century. *South Asia: Journal of South Asian Studies* 19(s1), 97-119.

- Ripbentrop, B. 1900. *Forestry in British India*. Indus Publishing, Calcutta.
- Rich, B. 2010. *To uphold the world: a call for a new global ethic from ancient India*. Beacon Press, Boston.
- Ripon.1881. Marquis of Ripon, KG to the Marquis of Hartington, Viceroy's Camp, Agra, November 12, 1881, No 59, 1881. The Marquis of Ripon.
- Rist, L. 2010. Assessing a threat to sustainable NTFP harvest using ecological data and traditional ecological knowledge. *Ecology and Society* 15(1): 3.
- Robbins, P. 1994. Goats and grasses in western Rajasthan: interpreting change. In *A Collection of Papers from Rajasthan and Gujarat* (ed. Koller-Rollefson, I) ODI. URL: <http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/5405.pdf> Accessed on 1 August 2014.
- Roche, P.A. 1984. *Fishermen of the Coromandel: A social study of the Paravas of the Coromandel*. New Delhi: Manohar.
- Rodgers, W.A. and H.S. Panwar. 1988. *Planning a Wildlife Protected Area Network in India*. A report prepared for the Ministry of Environment and Forests and Wildlife, Government of India, volumes 1 and 2.
- Rodgers, W.A., Panwar, H.S. and V.B. Mathur. 2002. *Wildlife Protected Area Network in India: A Review (Executive summary)*. Wildlife Institute of India. Dehradun.
- Ruddle, K. 2000. Systems of knowledge: dialogue, relationships and process. *Environment, Development and Sustainability* 2(3-4), 277-304.
- Saberwal, V.K. 1997. Science and the desiccationist discourse of the 20th century. *Environment & History* 4(3): 309 -343.
- Said, E. 1978. *Orientalism*. Vintage Books.
- Samal, P.K. et al. 2004. Indigenous healthcare practices and their linkages with bioresource conservation and socio-economic development in Central Himalayan region of India. *IJTK* 3(1): 12-26.
- Samal, P.K. et al. 2010. Indigenous medicinal practices of Bhotia tribal community in Indian Central Himalaya. *IJTK* 9(1): 140-144.
- Sangwan, S. 1994. Reordering the earth: the emergence of geology as a scientific discipline in colonial India. *IESHR* 31(3): 291-310.
- Sangwan, S. 1997. The strength of scientific culture: interpreting disorder in colonial science. *Indian Economic & Social History Review* 34(2): 217-250.
- Sanjayan, M.A., S. Shen, M. Jansen. 1997. *Experiences with integrated-conservation development projects in Asia*. The World Bank, Washington, D.C.
- Sarewitz, D. 2004. How science makes environmental controversies worse. *Environmental Science & Policy* 7(5), 385-403.
- Satya, L.D. 2004. *Ecology, colonialism and cattle: Central India in the nineteenth century*. Oxford University Press.
- Satya, L.D. n.d. The British empire, ecology and famines in late 19th century Central India. *The IUP Journal of History and Culture*, 12 pages. URL: http://www.iupindia.in/707/IJHC_British_Empire_in_India_35.html. Accessed on 17 July 2014.
- Schiff, A. 1962. *Fire and water: scientific heresy in the Forest Service*. Harvard University Press, Cambridge, MA.
- Scharff, R. C. and V. Dusek (Eds.). 2013. *Philosophy of technology: The technological condition: An anthology*. John Wiley & Sons.
- Scott, J.C. 1998. *Seeing like a state: how certain schemes to improve the human condition have failed*. Yale University Press, New Haven.
- Sekar, NU. and I. Jørgensen. 2003. Social forestry in South Asia: myths and realities. *Noragric Working Paper* 30.
- Sekhsaria, P. 2007. Conservation in India and the need to think beyond 'tiger vs. tribal'. *Biotropica* 39(5): 575-577.
- Sen, P. et al. 2008. Documentation of traditional herbal knowledge of Khamptis of Arunachal Pradesh. *IJTK* 7(3) 438-442.
- Seth, S. 2009. Putting knowledge in its place: science, colonialism, and the postcolonial. *Postcolonial Studies* 12(4): 373-388.

- Sethi, S. N., Sundaray, J. K., Panigrahi, A. and Chand, S. 2011. Prediction and management of natural disasters through indigenous Technical Knowledge, with special reference to fisheries. *Indian Journal of Traditional Knowledge* 10(1), 167-172.
- Setty, S.R. et al. 2008. Evaluation of a participatory resource monitoring system for Non Timber Forest Products: The Case of Amla (*Phyllanthus* spp.) fruit harvest by Soligas in South India. *Ecology and Society* 13(2): 19.
- Shankar, S. S., Anand, G. A., Immanuel, S., and Vennila, A. Fishers' knowledge on marine fisheries management and conservation. *Fishery Technology* 51(2).
- Sharma, A. 2012. *Traditional knowledge in Union Territory of Lakshadweep, India: Where Tradition is a Way of Life* International Collective in Support of Fishworkers, Chennai.
- Sharma, A. 2011. South Asian nomads – a literature review. Create Pathways to Access Series, Research Monograph No. 58. DFID, UK.
- Sharma, A. 2012. Traditional processing of *Shotti* (*Curcuma angustifolia* Roxb.) - A rhizome based ethnic weaning food. *IJTK* 11(1): 154-155.
- Sharma, C. 2008. Securing economic, social and cultural rights of fishworkers and fishing communities. In: *Global conference on small-scale fisheries, Bangkok, Thailand, 13 to 17 October 2008*. Downloaded from http://www.icsf.net/images/resources/papers_presentations/44_icsf_presentation_lo.pdf
- Sharma, G. et al. 2009a. Sikkim-Himalayan agriculture: improving and scaling up of the traditionally managed agricultural systems of global significance. *Resources Science* 31(1): 21-30.
- Sharma, G. et al. 2009b. Traditional knowledge systems in large cardamom farming: biophysical and management diversity in Indian mountainous regions. *IJTK* 8(1): 17-22.
- Sharma, N. and P. Kanwar. 2009. Indigenous water conservation systems – a rich tradition of rural Himachal Pradesh *IJTK* 8(4): 510-514.
- Sharma, P.K. et al. 2006. Ethnomedicinal observations among the inhabitants of cold desert area of Himachal Pradesh. *IJTK*. 5(3): 358-361.
- Shiva, V. 1986. *Chipko: India's civilisational response to the forest crisis*. INTACH Environmental Series. INTACH.
- Shiva, V. 1988. *Staying alive: women, ecology and survival in India*. Kali for Women.
- Shiva, V. 1989. Reductionist science as epistemological violence. In, *Science, hegemony and violence: a requiem for modernity* (ed. Ashis Nandy). Oxford University Press.
- Shiva, V. 1993. Monocultures of the mind. *Trumpeter*. 10(4): 1-11.
- Shrivastava, R. and J.T. Heinen. 2005. Migration and Home Gardens in the Brahmaputra Valley, Assam, India. *Journal of Ecological Anthropology* 9: 20-34.
- Shyam, S.S and Antony, P. 2013. Indigenous Technical Knowledge (ITK) in capture fisheries: A case study in Vypeen island of Ernakulam district. *Discovery Nature* 4 (11). pp. 7-10.
- Silas, E. G., M.J. George and Jacob, T. 1984. Review of the shrimp fisheries of India: a scientific basis for the management of the resources. In: *Penaeid shrimps- their biology and management*. Gulland, J.A and Rothschild, B. J.(eds.) pp. 83-103. Fishing News Books, England
- Silas, E.G. 2003. History and development of fisheries research in India. *Journal of Bombay Natural History Society* 100(2 & 3): 502–520.
- Sillitoe, P. 2004. Interdisciplinary experiences: working with indigenous knowledge in development. *Interdisciplinary science reviews* 29(1), 6-23.
- Silvius, K. M., Bodmer, R. E., and Fragoso, J. M. (Eds.). 2004. *People in nature: wildlife conservation in South and Central America*. Columbia University Press.
- Singh, A. et al. 2007. Cultural significance and diversities of ethnic foods of Northeast India. *IJTK* 6(1): 79-94.
- Singh, C. 1986. *Common property and common poverty*. Oxford University Press, New Delhi.
- Singh, L.K. 2012. Soil Conservation for Settled Agriculture Using Echo, a Traditional Soil Conservation Structure, in Wokha District, Nagaland, India. Working paper,

- ICIMOD, Kathmandu.
- Singh, P. et al. 2009. Life in the Shadow of Embankments – Turning Lost Lands into Assets in the Koshi Basin of Bihar, India. *ICIMOD Independent Publication* with Winrock, India.
- Singh, R. and B. Misri. 2006. Traditional goat health management practices in Chamba district of Himachal Pradesh. *IJTK* 5(3): 373-375.
- Singh, R.K. and A.K. Sureja. 2008a. Indigenous knowledge and sustainable agricultural resources management under rainfed agro-ecosystem *IJTK* 7(4): 642-654.
- Singh, R.K. and A.K. Sureja. 2008b. Management of indigenous sugarcane under rice-wheat based agroecosystem through informal institutions *Indian Journal of Traditional Knowledge*, 7(3), 469-477.
- Singh, R.K. et al. 2010. Traditional knowledge and biocultural diversity: learning from tribal communities for sustainable development in northeast India. *Journal of Environmental Planning and Management* 53(4): 511-533.
- Singh, R.K. et al. 2011. Biocultural diversity, climate change and livelihood security of the *Adi* community: Grassroots conservators of eastern Himalaya Arunachal Pradesh. *IJTK* 10(1): 39-56.
- Singh, R.K. et al. 2013. Elderly *Adi* Women of Arunachal Pradesh: "Living Encyclopedias" and Cultural Refugia in Biodiversity Conservation of the Eastern Himalaya, India. *Environmental Management*. 52(3): 712-735.
- Singh, S. 2003. *In the sea of influence: A world system perspective of the Nicobar islands* (Vol. 6). Lund University. Sweden.
- Sinha, S., Gururani, S., and Greenberg, B. 1997. The 'new traditionalist' discourse of Indian environmentalism. *The Journal of Peasant Studies* 24(3), 65-99.
- Sivaramkrishnan, K. 1996. The politics of forest regeneration in colonial Bengal. *Environment & History* 2: 145-194.
- Sivaramkrishnan, K. 2000. State sciences and development histories: encoding local forestry knowledge in Bengal. *Development & Change* 31: 61-89.
- Smith, T.D. 1994. *Scaling fisheries: the science of measuring the effects of fishing, 1855–1955*. Cambridge: Cambridge University Press.
- Sole, D. and A. Edmondson. 2002. Situated knowledge and learning in dispersed teams. *British journal of management* 13(S2), S17-S34.
- Sparke, M. 1994. White mythologies and anemic geographies: a review. *Environment & Planning D: Society and Space* 12: 105-123.
- Sпивак, G. 1988. Can the subaltern speak? In, *Marxism and the interpretation of culture* (eds. C. Nelson and L. Grossberg), Macmillan.
- Sridhar, A. and N. Namboothri, N. 2012. *Monitoring with logic and illogic: A case for democratising observation in isheries*. Discussion Paper. Dakshin Foundation, Bengaluru and Foundation for Ecological Security, Anand. 12p
- Srinath, K. 1987. How KVK-trained women utilise the new knowledge? *Marine Fisheries Information Service (Technical and Extension Series)* (74) 13-16.
- Srivastava, R.C. et al. 2010. Indigenous biodiversity of *Apatani* plateau: Learning on biocultural knowledge of *Apatani* tribe of Arunachal Pradesh for sustainable livelihoods. *IJTK* 9(3): 432-442.
- St. Martin, K. 2001. Making space for community resource management in fisheries. *Annals of the Association of American Geographers* 91(1): 122–142.
- Stebbing, E.P. 1922 – 1927. *The forests of India*, 3 Volumes. John Lane, Ltd. London.
- Stokes, E. 1980. Bureaucracy and ideology: Britain and India in the nineteenth century, *Transactions of the Royal Historical Society*, 5th series 30 pp.131-156.
- Stone, I. 1984. *Canal irrigation in British India: perspectives on technological change in a peasant economy*. Cambridge University Press, Cambridge.
- Subramanian, A. 2009. *Shorelines: space and rights in South India*. Stanford University Press.
- Sujata, V. 2002. Tamil Nadu: leather Processing: Role of Indigenous Technology. *Economic and Political Weekly* XXXVI (47).
- Sundar, A. 2012. Thinking beyond secularism: The Catholic

- Church and Political Practice in Rural South India. *South Asia Multidisciplinary Academic Journal*. [Online], Free-Standing Articles, Online since 19 April 2012. URL : <http://samaj.revues.org/3368>
- Sundar, N. 2005. The construction and deconstruction of 'indigenous' knowledge in India's Joint Forest Management Programme. In, *Indigenous environmental knowledge and its transformations: critical anthropological perspectives* (eds. R. Ellen et al.), pp. 79-100, Routledge.
- Sundaramani, M. et al. 2011. Indigenous grain storage structures of South Tamil Nadu. *IJTK* 10(2): 280-283.
- Suneetha, M.S. and B. Pisupati. 2009. *Learning from the Practitioners: Benefit Sharing Perspectives from Enterprising Communities*. Report of the UNU-IAS and UNEP.
- Swathi Lekshmi, P S .2013.Relevance of indigenous technical knowledge for responsible fisheries. In: *ICAR funded Short Course on "ICT-oriented strategic extension for responsible fisheries management*, 05-25 November, 2013, Kochi.
- Swathi Lekshmi, P. S., Dineshbabu, A P, Purushottama, G. B., Thomas, S., Sasikumar, G., Rohit, P, Vivekanandan, E. and Zacharia, P U .2013b. *Indigenous Technical Knowledge (ITKs) of Indian Marine Fishermen with reference to Climate Change*. Central Marine Fisheries Research Institute, Kochi.
- Swathi Lekshmi, P.S. and Dineshbabu, A. P. 2009. Indigenous Technical Knowledge and ancient proverbs of the coastal fisher folk of Kerala and their implications. *Indian Journal of Traditional Knowledge* 8(2), 296-297.
- Swathi Lekshmi, P.S., Sasikumar, G., Kemparaju, S., Saravanan, R. and Sampathkumar, G. 2013a. Agarala: A traditional fishing boat of Karnataka. *Indian Journal of Traditional Knowledge* 12(1), 166-168.
- Syed, N.Z. et al. 2007. Herbal remedies used by Warlis of Dahanu to induce lactation in nursing mothers. *IJTK* 6(4): 602-605.
- Teron, R. 2006. Hor, the traditional alcoholic beverage of Karbi tribe in Assam. *Natural Product Radiance* 5(5): 377-381.
- Thakur, N.S.A. et al. 2013. Indigenous Traps for the management of rodent outbreak in North Eastern Hill region of India. *IJTK* 12(4): 730-735.
- Tharakan, G. C. 2007. The Muduga and Kurumba of Kerala, South India and the Social Organization of Hunting and Gathering. *Journal of Ecological Anthropology* 11(1): 5-24.
- Thomson, K.T. and M.A. George. 2009. Collaborative estuarine management: A study on Cochin Estuary. *Fishery Technology*, 46(1).
- Thrupp, L. A. 1988. *The political ecology of pesticide use in developing countries: dilemmas in the banana sector of Costa Rica*. Ph.D thesis. Institute of Development Studies, University of Sussex, Brighton.
- Tiwari, L. and P.C. Pande 2007. Indigenous veterinary practices of Darma valley of Pithoragarh district, Uttaranchal. *IJTK* 5(2): 201-206.
- Tolen, R.J. 1991. Colonising and transforming the criminal tribesman: the Salvation Army in British India. *American Ethnologist* 18(1): 106-125.
- Townsend, A. M., DeMarie, S. M., and Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *The Academy of Management Executive*, 12(3), 17-29.
- Tripathy, B. and Choudbury, B. C. 2007. A review of sea turtle exploitation with special reference to Orissa, Andhra Pradesh and Lakshadweep Islands, India. *Indian Journal of Traditional Knowledge* (6) 285-291.
- Turnbull, D. 2000. *Masons, tricksters and cartographers: comparative studies in the sociology of scientific and indigenous knowledge*. Harwood Academic, Amsterdam.
- Tynsong, H. et al. 2012. Bird hunting techniques practised by War Khasi community of Meghalaya, North-east, India. *IJTK* 11(2): 335-341.
- Umapiya, T. et al. 2011. Ethnobotany of Irular tribe in Palamalai Hills, Coimbatore, Tamil Nadu. *Indian Journal of Natural Products and Resources* 2(2): 250-255.
- Varadarajan, 1998. *Sewn Boats of Lakshadweep*, National Institute of Oceanography Panaji, Goa.
- Varadarajan, L. 1980. Traditions of indigenous navigation in Gujarat. South Asia. *Journal of South Asian Studies*, 3(1), 28-35.

- Varadarajan, L. 2000. Calendrical Systems of the Nicobars. In: *Social institutions and cultural values of the Indian artisans* (ed) R.K. Bhattacharya. Anthropological Survey of India, Calcutta.
- Varadarajan, L. (ed). 2004. The Rahmani of M.P. Kunhikunhi Malmi of Kavaratti: A sailing manual of Lakshadweep. (annotated translation) Manohar, New Delhi.
- Varma, K. 2009. The Asiatic lion and the Maldharis of Gir forest: an assessment of Indian eco-development. *The Journal of Environment & Development* 18(2): 154-176.
- Venkataraman, A. 2011. Gaon Ganrajya (Village Republic) Movement in Rajasthan: Asserting Traditional Rights of Tribes over Community Resources. In: *Sustaining Commons: Sustaining Our Future, the Thirteenth Biennial Conference of the International Association for the Study of the Commons*, 10th to 14th January 2011, Hyderabad, Andhra Pradesh.
- Verma, S. 2007. Rethinking Tribal Development: Water Management Strategies for Revitalizing Tribal Agriculture in Central India. *Water Policy Brief*, International Water Management Institute, Colombo.
- Verma, S. And P.K. Attri. 2008. Indigenous beekeeping for sustainable development in Himachal Himalaya. *IJTK* 7(2): 221-225.
- Vipinkumar, V. P., Athira, P. V. and Mini, K. G. 2013a. Role of ICT in knowledge management. In: *ICAR funded Short Course on "ICT -oriented Strategic Extension for Responsible Fisheries Management*, 05-25 November, 2013, Kochi.
- Vipinkumar, V. P., Swathi Lekshmi, P. S., Salini, K. P., Ambrose, T. V., Sunil, P. V. and Dhanya, G. 2013b. Compilation of indigenous technical knowledge in marine fisheries sector of Karnataka. *Discovery Agriculture* 1 (1). pp. 43-50.
- Visvanathan, S. 1989. On the annals of the laboratory state. In, *Science, hegemony and violence: a requiem for modernity* (ed. A. Nandy), Oxford University Press.
- Visvanathan, S. 1997. *A carnival for science: essays on science, technology and development*. Oxford University Press, New Delhi.
- Visvanathan, S. 2011a. The search for cognitive justice. *Seminar* (http://www.india-seminar.com/2009/597/597_shiv_visvanathan.htm)
- Visvanathan, S. 2001. Democracy, governance and science: Strange case of the missing discipline. *Economic and Political Weekly* 3684-3688.
- Vishvanathan, S. 2011. The logic of knowledge commons, *Common Voices* Issue No 8.
- Vyas, V. and R. Sharma. 2006. Study of the Feeding Practices through Lopping in Barawa. *Working Paper*, Seva Mandir, Udaipur.
- WCED. 1987. *Our common future*. Oxford University Press, Oxford.
- Wenger, E. 1998. Communities of practice: Learning as a social system. *Systems thinker* 9(5), 2-3.
- Weiler, H. 2006. Challenging the orthodoxies of knowledge: epistemological, structural and political implications for higher education. In, *Knowledge, power and dissent: critical perspectives on higher education and research in knowledge society* (ed. G. Neave), pp. 61-87. UNESCO Publishing, Paris.
- Whitcombe, E. 1971. *Agrarian conditions in northern India. The United Provinces under British rule, 1860-1900*. Thompson Press, New Delhi.
- Whitcombe, E. 1972. Irrigation. In, *The Cambridge economic history of India, Col. 2, c. 1757 – 1970* (ed. Kumar, D.), pp. 677-736. New Delhi.
- Whitcombe, E. 1993. The environmental costs of irrigation in British India: waterlogging, salinity and malaria. In, *Nature, culture and imperialism: essays on the environmental history of South Asia*. (eds. Arnold, D. and R. Guha), pp. 237-259. Oxford University Press.
- Wilson, T.D. 2002. The nonsense of knowledge management. *Information Research* 8(1), 8-1.
- Wilson, D.C. 1999. Fisheries science collaborations: The critical role of the community. In: *Conference on holistic management and the role of fisheries and mariculture in the coastal community. November 11–12, 1999*. Research Publication No. 45. Tjärnö Marine Biological Laboratory, Sweden..
- Wisborg, P. 2000. Rehabilitation of CPRs Through Re-Crafting of Village Institutions: A Comparative Study from Ethiopia and India. In: *Constituting the Commons:*

- Crafting Sustainable Commons in the New Millennium, the Eighth Biennial Conference of the International Association for the Study of Common Property*. Bloomington, Indiana, May 31-June 4, 2000
- Wittfogel, K. 1957. *Oriental despotisms: a comparative study of total power*. Yale University Press, New Haven.
- Wolfe, P. 2006. Settler colonialism and the elimination of the native. *Journal of Genocide Research* **8**: 387-409.
- Worster, D. 1985. *Nature's economy: a history of ecological ideas*. Cambridge University Press.
- Yonzan, H. and J.P. Tamang. 2010. Indigenous knowledge of traditional processing of *Selroti*, a cereal-based ethnic fermented food of the Nepalis *IJTK* 9(7): 271-274.
- Zahradková, L. 2013. *Traditional knowledge in education of nomadic people in Changthang (Ladakh, India)*. Ph.D Thesis. Masaryk University.
- Zook, D.C. 2000. Famine in the landscape: imagining hunger in South Asian history, 1860 – 1990. In, *Agrarian environments: resources, representations, and rule in India* (eds. Agrawal, A. and K. Sivaramakrishnan), pp. 107-131, Duke University Press, Durham.

Appendix 1

Local community groups that have been identified in TEK literature in India. This categorisation retains tribal as well as caste-based community identities as identified within the database. Standardisation has been carried out for phonetic similarity or in the case of obvious synonyms.

Bhil (= Bheel; subcommunities Barda, Dungri, Garasia, Vasava, Bhil Mavchi, Kotwal, Bhil Garasia, Dholi Bhil, Dungri Bhil, Dungri Garasia, Mewasi Bhil, Rawal Bhil, Tadvi Bhil, Bhagalia, Bhilala, Pawra, Vasave)	Van Gujjar	Nolia
Meena	Oraon (= Uraon, Oran, Orang = Kurkh, Oram)	Shabar
Gond (Subcommunities: Dev Gond, Dholi, Kolan, Kaliabut, Mudipal, Padal, Raj Gond; Dhuriya, Nayak, Ojha, Pathari, Pathar, Kahar, Godia, Dhimar, Sorhia, Raikwar, Dhurvey, Dhruw)	Damor	Thakur
Lepcha	Limbu (= Subba)	Kushwaha
Khasi (including War Khasi)	Munda (= Mundari)	Chamar
Kathodi (= Kathodia)	Paniya	Barar
Khond (= Kondh, Kondha, Kandha, Kond) sub: Nanguli Kandha, Sitha Kandha [Kondh, Kui, Buda Kondh, Bura Kandha, Desia Kandha, Dungaria Kondh, Kutia Kandha, Kandha Gauda, Muli Kondh, Malua Kondh, Pengo Kandha, Raja Kondh, Raj Khond]	Nyishi	Tharu
Meitei (= Manipuri)	Nicobari	Sapera (= Barwa Sampheriya)
Banjara (= Lakha Banjara, Lakhapati, Banjari, Pindari, Bangala, Banjori, Banjuri, Brinjari, Lamani, Lamadi, Lambani, Lambada, Labhani, Lambara, Lavani, Lemadi, Lumadale, Labhani Muka, Goola, Gurmarti, dhadi, Gormati, Kora, Sugali, Sukali, Tanda, Vanjari, Vanzara, and Wanji)	Mishing (= Mising/Miri)	Yanadi
Raika (= Rabari, Rewari, Desai, Railbari, Dewasi, Hiravanshi, Rebari, Rebadi, Rayka)	Jaintia	Pardhan
Apatani	Garo	Koya
Adi	Saura (= Saora, Savara, many variants)	Korku
Uttarakhand Bhotia (sub: Johari, Juthora, Darmi, Chudan, Byansi, Marccha, Tolchha, Jad)	Saheria (Sahariya)	Chenchu
Santal (= Santhal, Ozai)	Muthuvan	Bonda (= Bondo, Bondo Poraja, Bhonda, Remo)
Karbi	Kattunaika	Baiga (sub: Bijhwar, Narotia, Bharotiya, Nahar, Rai Bhaina, and Kadh Bhaina)
Kani	Sansi	Vokkaliga
Pahari	Parmar	Paliyan
Irula	Gujar (= Gujjar, Gurjar)	Urali
Kurumba (including Jenu Kurumba, Betta Kurumba, Kattu Kurumba)	Ladakhi Bhotia	Ulladan
Nepali	Raot	Muduga
Monpa	Kurumar	Malasar
Garhwali (Pravati, Bangani)	Kurichiya	Malaaraya
Bodo (including Boro-Kachari)	Kalbelia	Cholanaika
Ahom (Tai-Ahom)	Gaddi	Nut (= Nat)
Sikkim Bhotia	Spiti Bhotia	Wancho
Soliga	Mizo (is part of Kuki)	Galo
	Lotha (Naga)	Bhoksa
	Angami (Naga)	Shompen
	Ao (Naga)	Lakshadweep islanders
	Rai	Pochury (Naga)
	Khamti	Zeliang (Naga)
	Ho	Tripuri
	Majhis	Sumi Naga
	Paroja	Rengma (Naga)
	Gadaba	Pangal (Meitei-Pangal)
	Malayali	Paithe (a part of Kuki)
	Malapandaram	Naga – unspecified and (Mao, Maram, Tangkhul, Tadubi, Kolya, Khoiras/ Mayangkhong, Koirang, Chiru)
	Kadar	Maring (Naga)
	Kanjar	Lushai
	Dindor	Kuki (consists of Mizo, Paite, Thadou and Vaiphei)
	Ahari	Koch
	Aka	Kalia
	Kumaoni	Kaivartas
	Sherpa	Dimasa (Kacharis)
	Changpa	Assamese
	Ongee	Goala
	Jarawa (Ang)	Mala
	Sema (Naga)	Turing
	Kachari	Phake
	Chakhesang (Naga)	Aiton
	Chutia	Pattinavars
	Jogi/Sanyasis	
	Deori	
	Chakma	
	Gurung	

Besta
 Bhumij
 Mahatao
 Pawra
 Mawasi
 Lohra
 Kunbi
 Kolha (= Kolh)
 Kolam
 Bhumia
 Bhatra
 Malaimalasar
 Adikarnataka
 Warli (= Vaarli)
 Mendhpal
 Kathiawadies
 Pulaya
 Malekudiya
 Malavedan
 Malayar
 Malakurava
 Kodava
 Badaga
 Adiya
 Maher (= Mer, Mihir, Mair, Mehr)
 Koli
 Charan
 Ahir
 Bishnoi
 Tibetan
 Swangla
 Raji
 Pangwal
 Lahaula
 Jaunsari
 Dokpa
 Karen
 Yimchunger (Naga)
 Ukai
 Teegu
 Sonwal Kacharies
 Sangtam (Naga)
 Reang
 Rabhas
 Pnar
 Phom
 Pashi
 Panica
 Noatia
 Namashudra
 Motok
 Mog
 Maran
 Mara
 Maibas
 Maal
 Kyong
 Kurmi
 Kuki-Chin-Mizo
 Konyak (Naga)
 Koiri
 Khenmungang (Naga)
 Khamyeni
 Kabiraj
 Jamatia
 Hmar
 Hira
 Halam

Hajong
 Gour
 Debbarma
 Darlong
 Cheimal
 Chang (Naga)
 Biate
 Bengali
 Barman
 Auchai
 Sundies
 Oriya
 Mogaveera
 Karvi
 Harikantra
 Gangamathasta
 Bovi
 Bauri
 Araya
 Ambiga
 Teli
 Sadgope
 Rajak
 Muchi
 Kairi
 Yerukala (= Yerukula, Erukala, Erukula)
 Yerava
 Shetty
 Sakiliyar
 Rathiya
 Parayar
 Nehal
 Nayakpod Andh
 Nari Kuravar
 Nagesia
 Muriya
 Mobasi
 Mirdha
 Manne
 Mannadiyar
 Mandiya
 Mallah
 Madiga
 Koyadora
 Kondareddi
 Kamma
 Kahar
 Juang (part of Munda family)
 Idiga
 Halba
 Halakki (= Halakki Vokkal)
 Guthikoya
 Gowda
 Ghasi
 Gawli
 Dom
 Didayi
 Chick
 Chettiar
 Chellipale
 Chasa
 Burad
 Birhore
 Binjhal
 Bhuyan
 Bhuinya
 Bhatoda
 Bharia

Asariar
 Arundhatiar (= Chakkiliyar)
 Toda
 Thakar
 Saliya
 Nayaka
 Nayadi
 Muggera
 Maratha
 Mannan
 Lingayat
 Kurava
 Kota
 Koraga
 Katkar
 Bunt
 Billava
 Naika
 Maldhari
 Mahyavansi
 Konkana
 Gameti
 Dubla
 Dhodia
 Chodra
 Bhambi
 Banwaria
 Yakha
 Thamis
 Thakuri
 Takuli
 Tangsa
 Tamang
 Tagin
 Syed
 Sunuwar
 Sherdukpen
 Sartang
 Sarki
 Rawal
 Padam
 Newar
 Miji
 Mager
 Lisu
 Kiranti
 Khowa
 Khombu-Rai
 Kharkhan
 Kashmiri
 Kamis
 Kalita
 Guro
 Drukpa
 Danu
 Damais
 Chettrie
 Bhujel
 Bhangali
 Bhandari
 Bhahuns
 Awan
 Manger
 Kinnura
 Brokpa
 Bakarwal

2014

Published by

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered office
GIZ Office, New Delhi
21, Jor Bagh, New Delhi- 110003

Conservation and Sustainable Management of Existing and
Potential Coastal and Marine Protected Areas (CMPA) Project

Indo-German Biodiversity Programme
A2/18, Safdarjung Enclave
New Delhi- 110029, India
T: +91- 11- 4949 5353
F: +91- 11- 4949 5391
E: biodiv.india@giz.de
W: www.indo-germanbiodiversity.com

GIZ is a German government owned not-for-profit enterprise supporting sustainable development. This *Representing Knowledge: LEK and Natural Resource Governance in India* publication is a part of the project developed by Dakshin Foundation, under the GIZ Project –‘Conservation and Sustainable Management of Existing and Potential Coastal and Marine Protected Areas (CMPA)’, under the Indo-German Biodiversity Programme, in partnership with the Ministry of Environment, Forests and Climate Change (MOEFCC) Government of India. The CMPA Project is commissioned by the German Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB) with the funds provided under the International Climate Initiative (IKI).The CMPA project is implemented in selected costal states in India, namely Goa Gujarat, Maharashtra and Tamil Nadu.

Indo-German Biodiversity Programme
Conservation and Sustainable Management of Existing
and Potential Coastal and Marine Protected Areas (CMPA)
PN: 11.9299.6-001.00



A MAP
OF THE
PENINSULA OF INDIA
from THE 10th DEGREE NORTH LATITUDE to CAPE COMORIN.
MDCXCII.
NOTE