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Representing Knowledge: Local Ecological Knowledge and Natural Resource Governance in India- A Summary Report

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Conservation and Sustainable Management of Coastal and Marine Protected Areas

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Representing Knowledge: Local Ecological Knowledge and Natural Resource Governance in India - A Summary Report

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Aarthi Sridhar & Meera Anna Oommen

(Dakshin Foundation)

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Indo-German Biodiversity Programme
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List of Acronyms

BMUB	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
CBD	Convention on Biological Diversity
CIFE	Central Institute of Fisheries Education, Mumbai
CIFT	Central Institute of Fisheries Technology, Cochin
CMFRI	Central Marine Fisheries Research Institute, Cochin
CMPA	Conservation and Sustainable Management of Existing and Potential Coastal and Marine Protected Areas
FIMSUL	Fisheries Management and Sustainable Livelihood Project of the World Bank
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICAR	Indian Council of Agricultural Research
ICT	Information and Communication Technology
IGBP	Indo-German Biodiversity Programme
IJTK	Indian Journal of Traditional Knowledge
KAP	knowledge, aptitude and practice
KM	knowledge management
LEK	local ecological knowledge
MoEFCC	Ministry of Environment, Forest and Climate Change, Government of India
MPA	Marine Protected Areas
NISCAIR	National Institute of Science Communication and Information Resources
TEK	traditional ecological knowledge

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Executive Summary

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.

Chapter 1

Introduction

This document is the summary of a study supported by the 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 and Forests, Forests and Climate Change (MoEFCC), Government of India and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB), to be implemented by the GIZ. The CMPA project aims to improve biodiversity conservation and management practices 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 of and engagement with local, indigenous and traditional knowledges of communities. Reflecting these developments, an interest in what is widely called local or traditional ecological knowledge (LEK/TEK) has emerged within the global literature.

The present review of the literature on local ecological knowledge is aimed at enhancing our understanding of the place of knowledge in environmental governance in India, with a special focus on coastal and marine systems. In the first few pages, a brief synthesis of self-explanatory, descriptive infographic results from a TEK/LEK compilation exercise that was carried out for India along different themes of enquiry is provided along with a more detailed examination of coastal, marine and island zones. This is followed by a short analysis that traces the role of knowledge in the role of knowledge in maritime governance (which includes fisheries) from late colonial to contemporary India. This is followed by a more detailed attempt at outlining issues related to knowledge which are encoded in the literature on coastal and marine systems and identifying potential pathways for democratization when dealing with the same. Here, the aim has been to distil useful principles not only from TEK/LEK literature but also from the wider literature on overlapping thematic areas such as common property management and governance. While being far from exhaustive, the themes addressed

in this study are nevertheless useful starting points for experiments at knowledge-based governance of natural resources 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. For a more comprehensive analysis, please refer to the detailed report from the above-mentioned study, available with GiZ.

Chapter 2

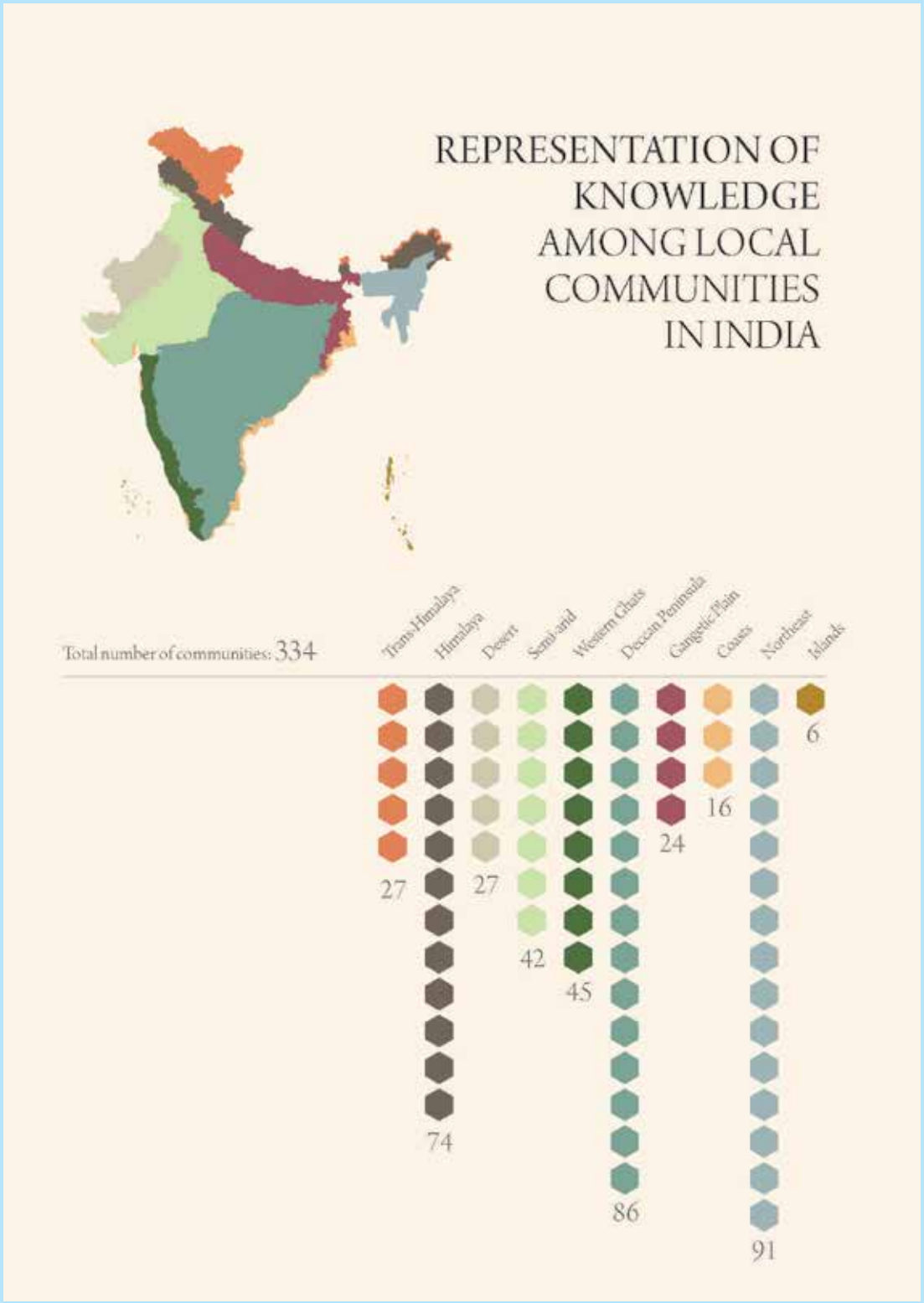
LEK in India

A Biogeographic Analysis

As one of the mega-diverse countries of the world, India not only hosts a diverse array of biodiversity, but an equally impressive complement of human communities that depend on natural resources for their livelihoods. Since the 1980's, research on traditional knowledge systems has been gaining a great deal of importance as the needs of biodiversity conservation and livelihood challenges have brought issues concerning local use systems to the fore. Traditional and local knowledge related explorations have particularly been prominent after India became a signatory to the Convention on Biological Diversity (CBD) in 1992. This convention emphasises 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, 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 in diverse ways. 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.

The following pages summarise contemporary scholarship on traditional and local ecological knowledge (henceforth TEK/LEK) in India. Studies on the subject published between1980 and 2014 were compiled and summarised systematically to create a database of traditional knowledge literature for India. These analyses relate to the spatial units of study, time lines, patterns of distribution of studies in different states and key biogeographic zones, etc. 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

Figure 1
Representation of Knowledge Among Local Communities in India



units and their attendant human communities. Individual results are provided for information on biogeographical zones comprising coastal and marine and island systems. While the infographics provided are self explanatory, a more comprehensive account of this analysis is available as part of the detailed report of this project.

Figure 2
Research Focus in LEK Studies in India

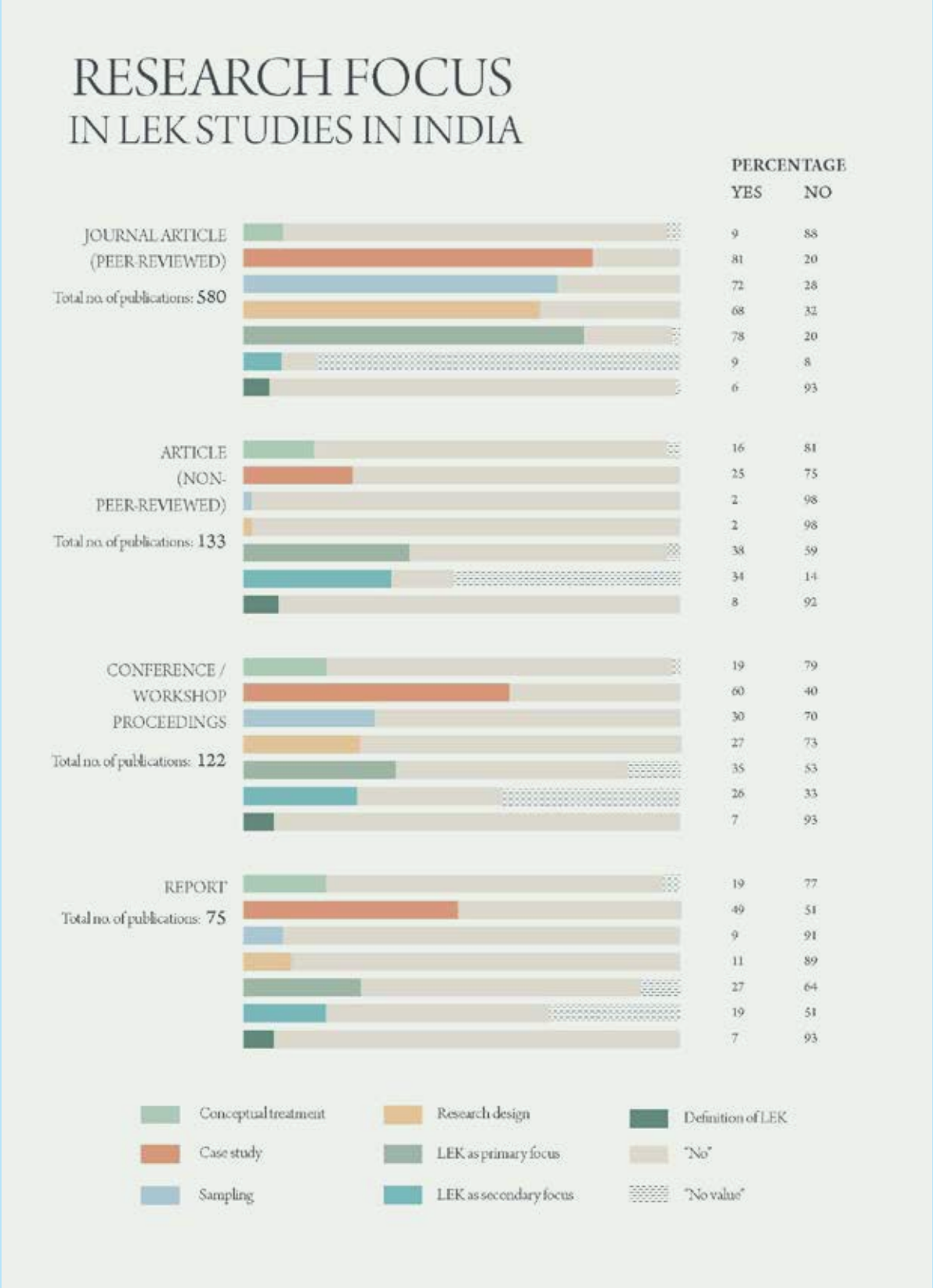


Figure 2 (*Cntd...*)
Research Focus in LEK Studies in India

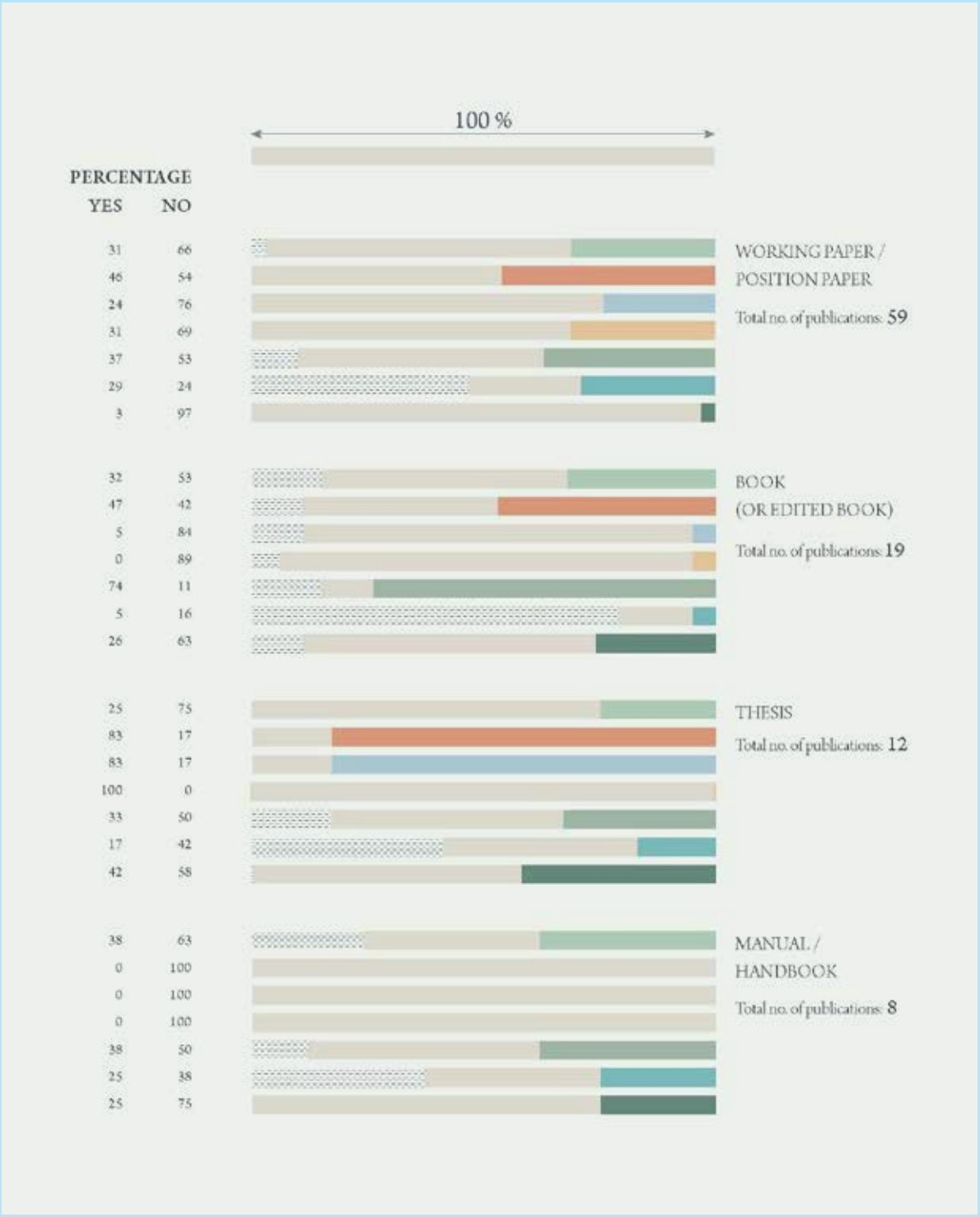


Figure 3
Spatial Unit of Study

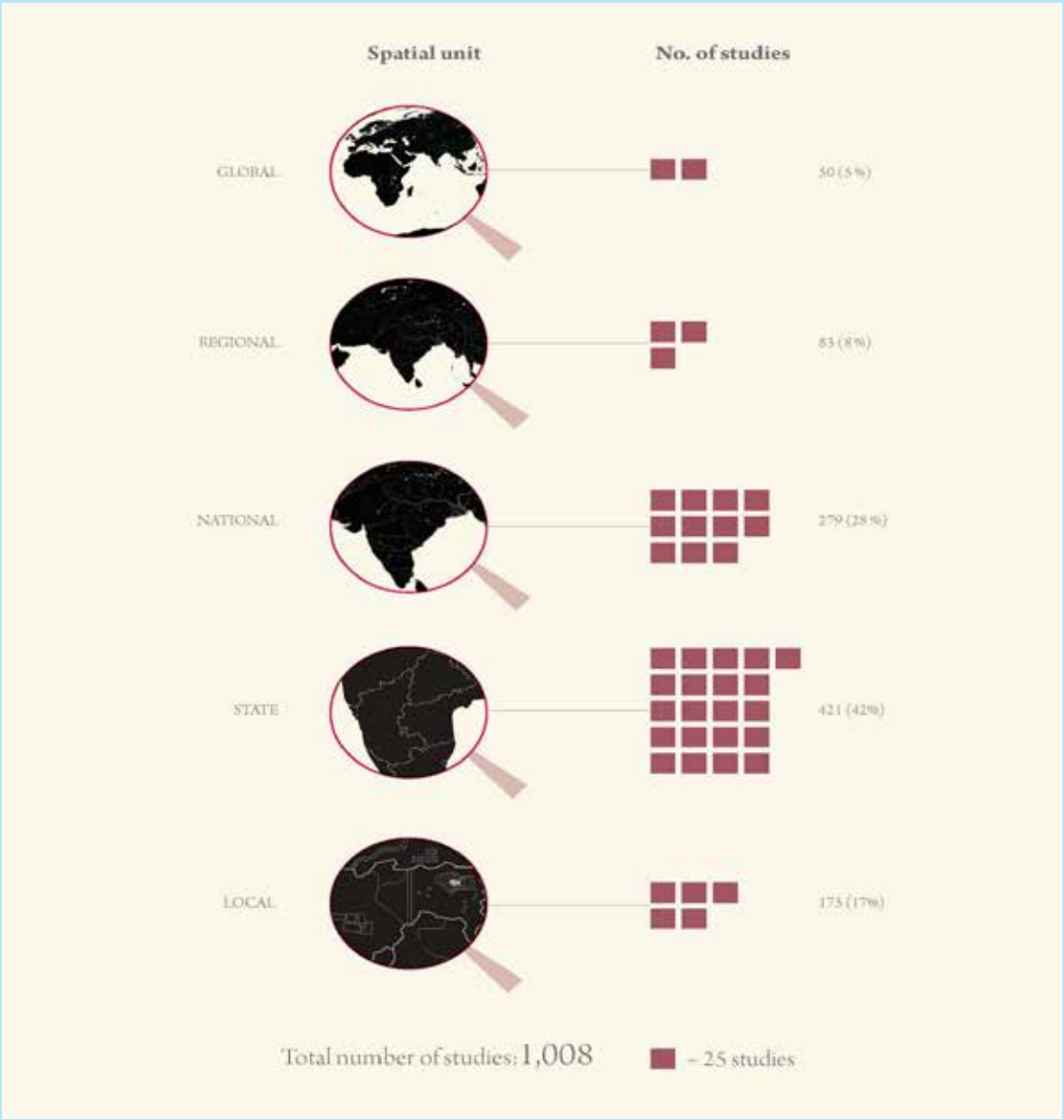


Figure 4
Legal Themes in LEK Publications

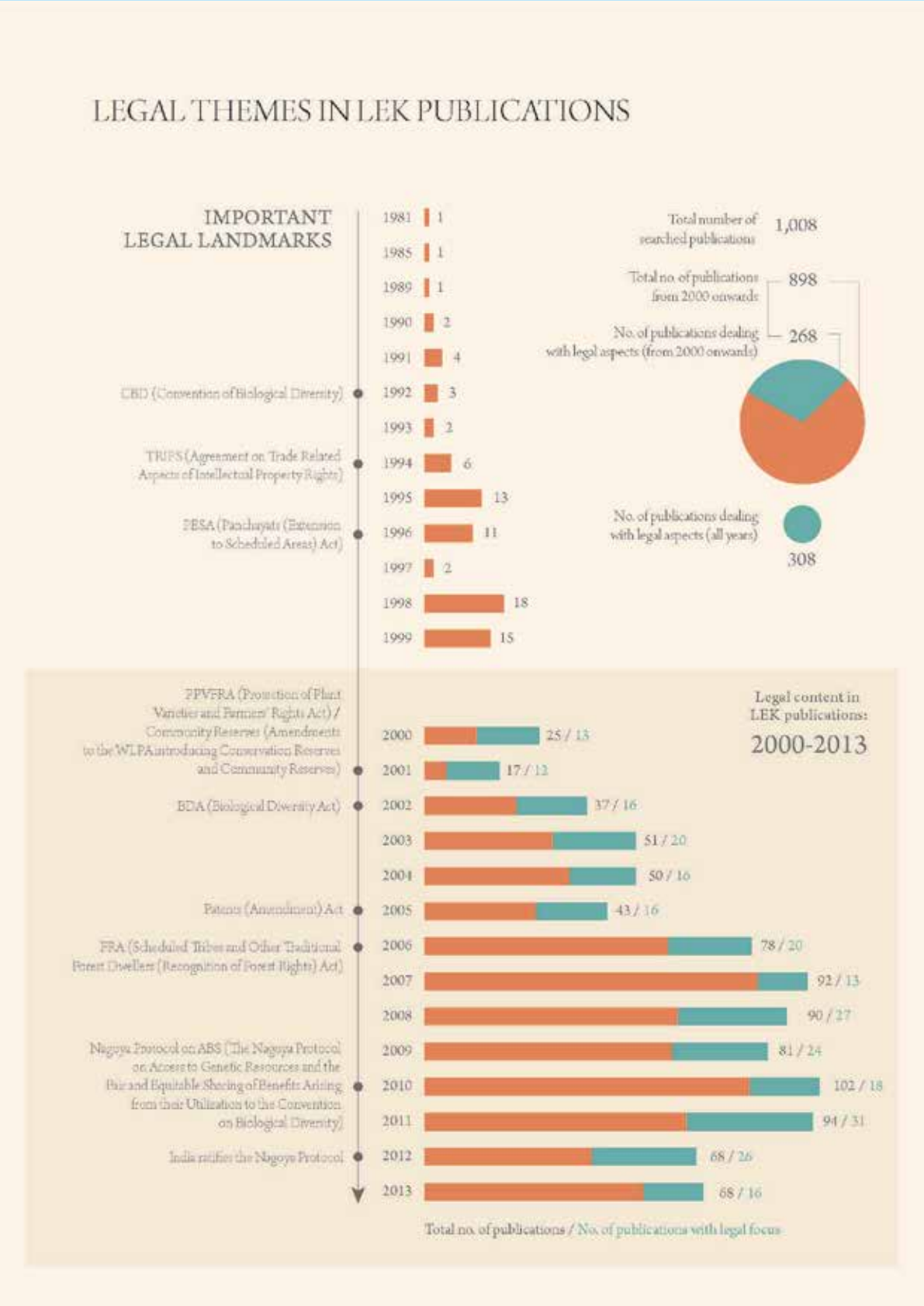
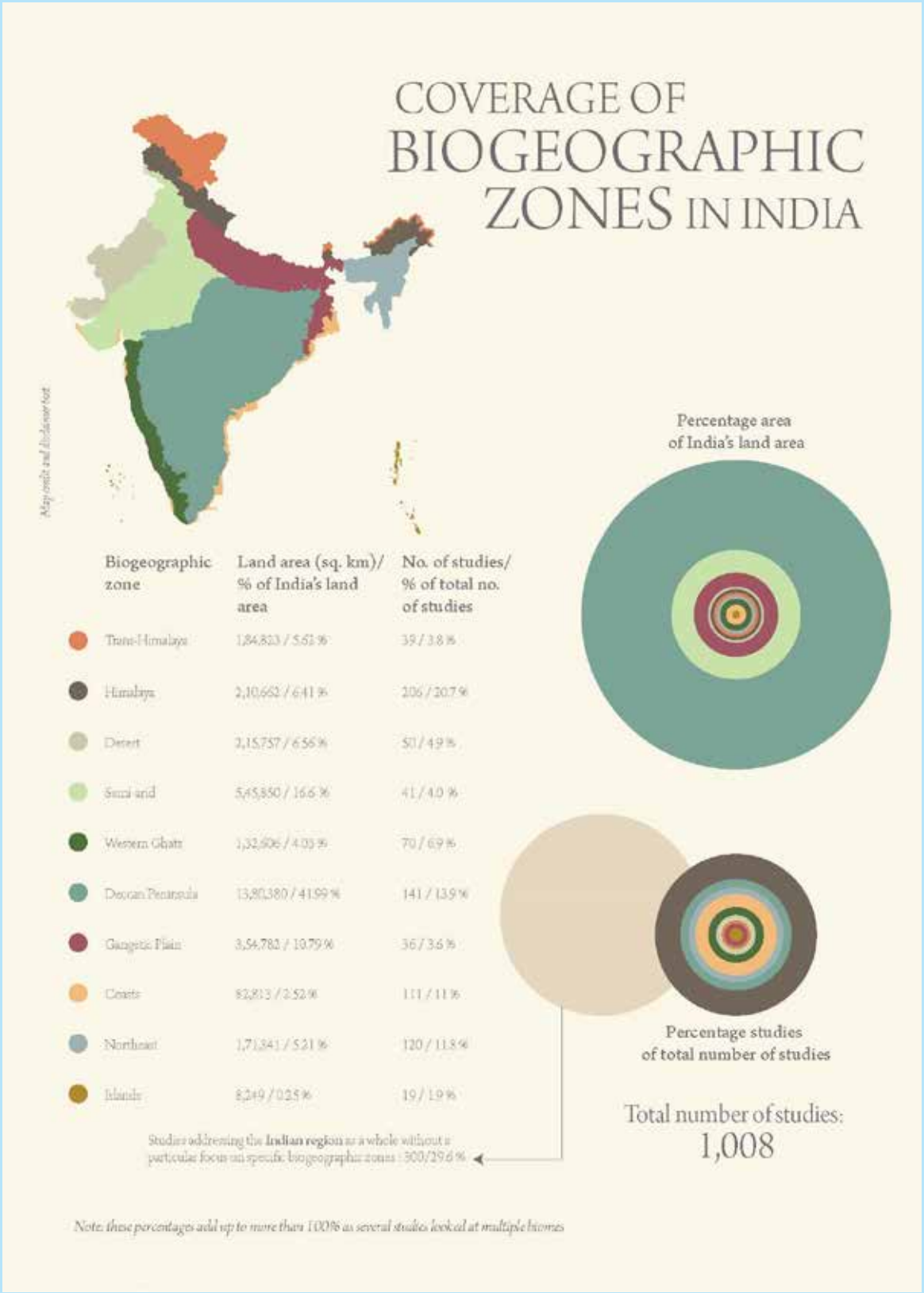


Figure 5
Coverage of Biogeographic Zones in India



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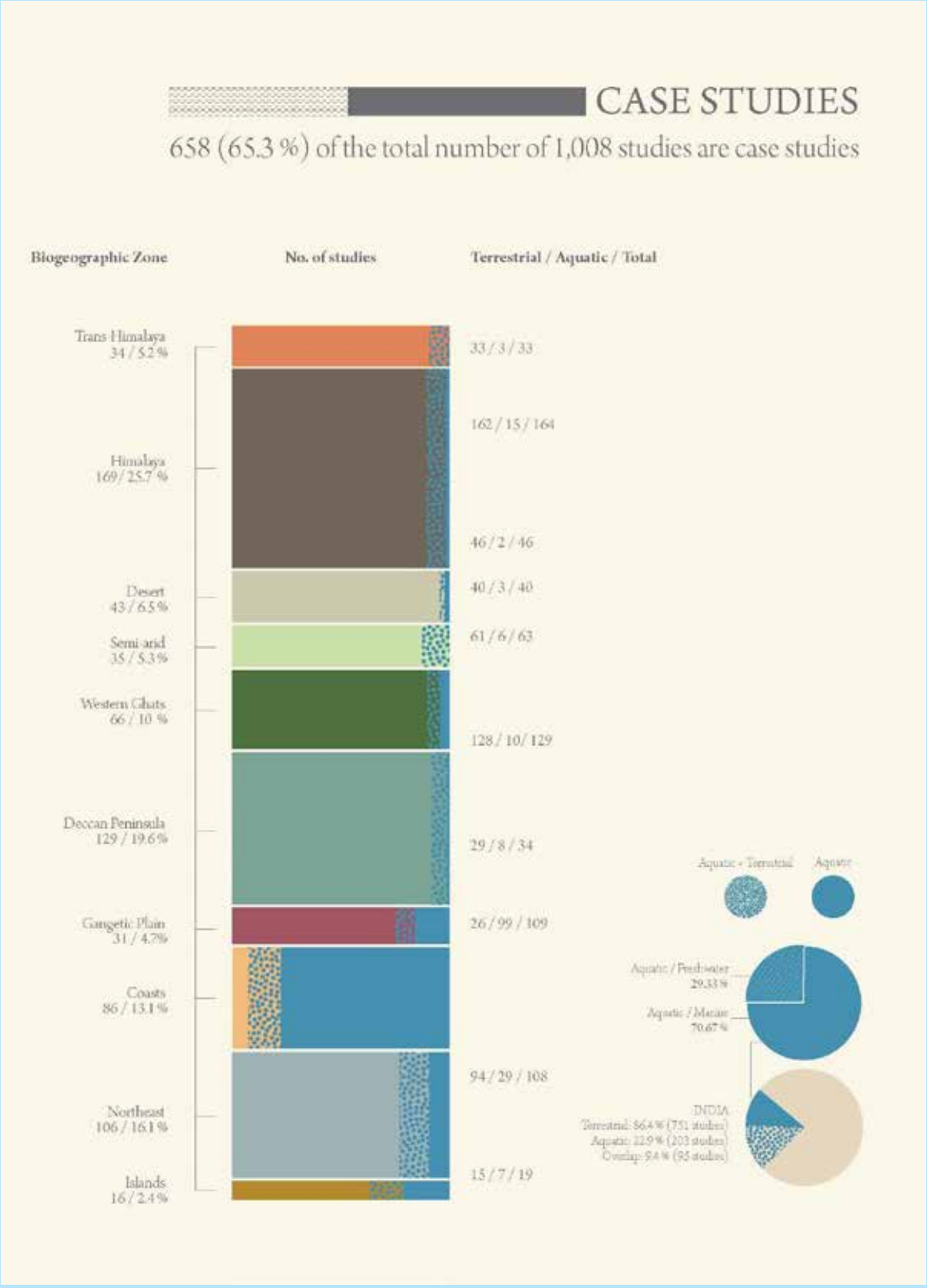

Figure 6
Major Focus Areas of LEK Research in India

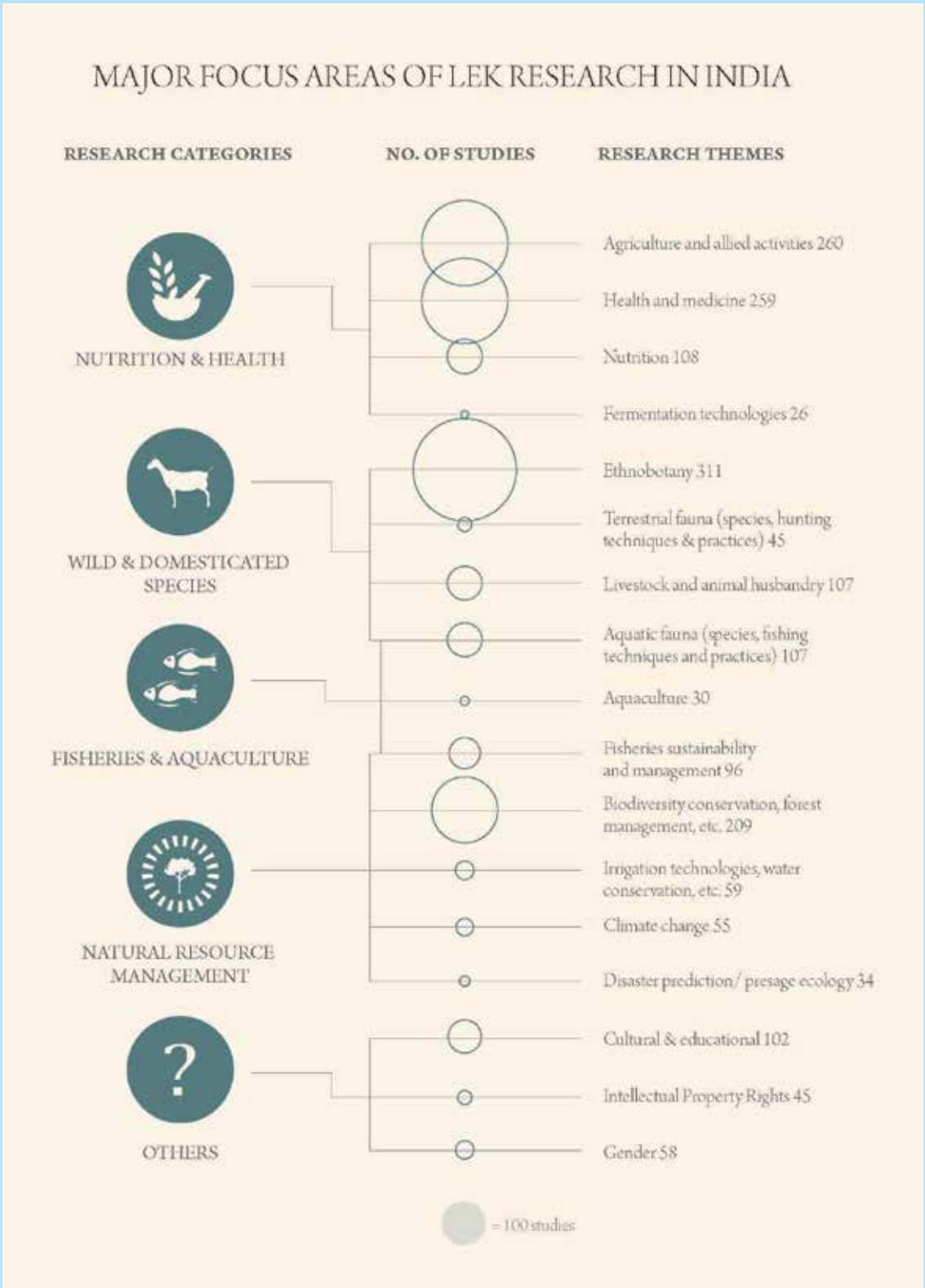

Figure 7
Focus Areas of Research within Biogeographic Units in India

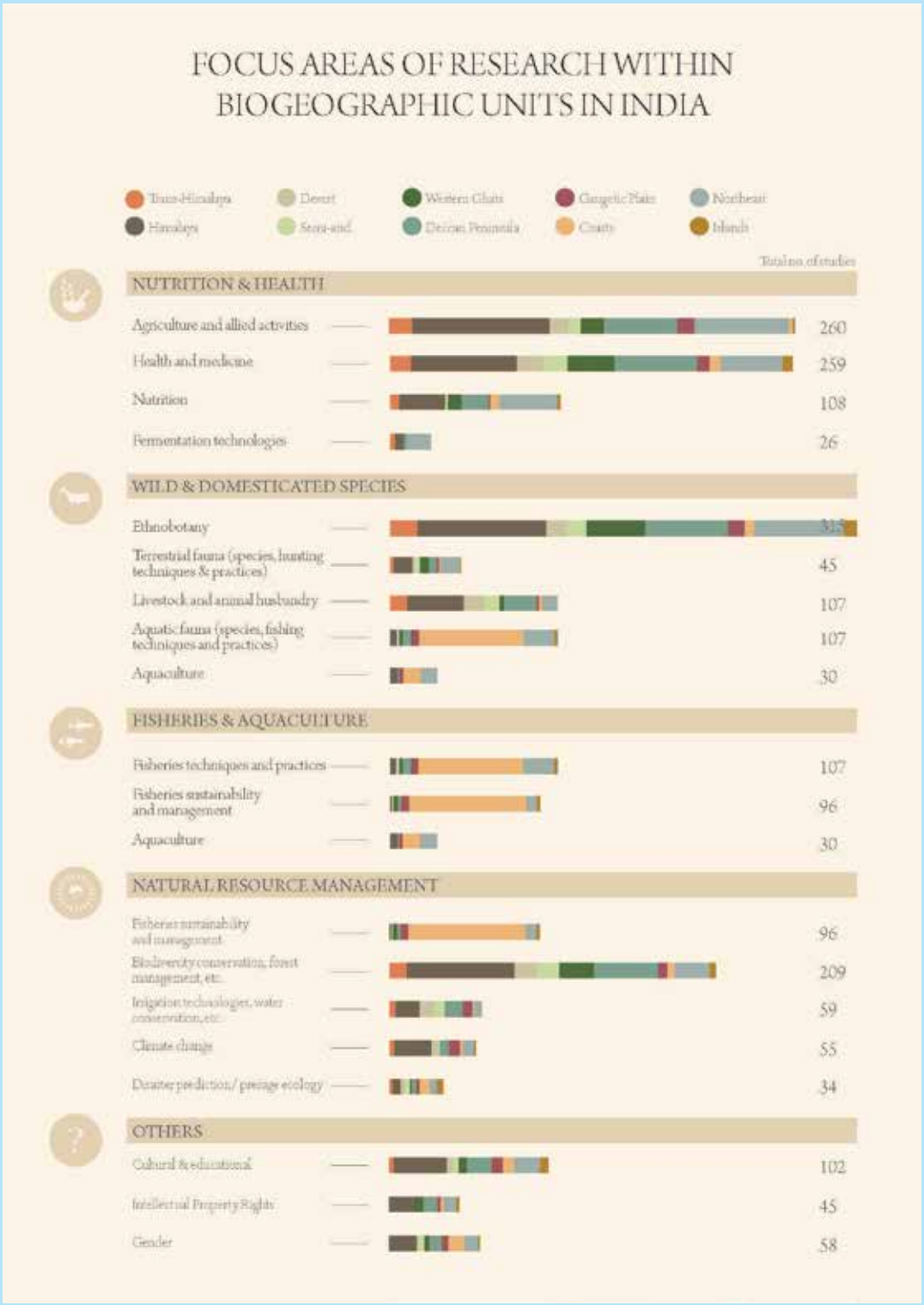

Figure 8
Coasts: Communities and Research Themes in Focus

Table 1
Community Focus/ Coasts 1 - 5 Studies

Coastal Area	Area km2		
Nolia	Soura	Mogaveera	Bovi
Pattinavars	Besta	Karvi	Bauri
Santal	Sundies	Harikantra	Araya
Khond	Oriya	Gangamathasta	Ambiga

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 Bramhaputra, 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 (1999) highlight, 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 (2012) work on institutions involved in stake net and lagoon fisheries and the Rajan (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.

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

Figure 9
Islands: Communities and Research Themes in Focus

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.

Lotika Varadarajan's 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'(Varadarajan 2000), 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, Anita 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 indepth 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.K. 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.

Chapter 3

A Place for Knowledge

Tracing Governance from the Late Colonial to Contemporary India

Natural resource governance can be viewed from multiple perspectives, ranging from the methods of governance, management rules and decision-making regarding use and access, fiscal and legal arrangements, etc. In developing countries in the 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 that can largely be attributed to colonial imperialistic and post-colonial encounters.

Two key points are worth mentioning in this context. Firstly, scholarship on environmental governance tends to treat scientific and traditional knowledge as separate entities, notwithstanding the lack of consensus on an acceptable set of distinctions between the two (Agrawal 1995). 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. Despite a clear difference between the two, 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 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 (Nandy 1989, Escobar 1995). This brings into focus a second perspective of a knowledge power nexus, whereby, knowledge not only relates to its explanatory potential, but is also employed politically by different interest groups to achieve their ends. An understanding of the knowledge-power nexus is critical to contemporary resource governance as it intersects most crucially with the politics of development in post colonial arenas such as India. Such a 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 1989; 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.

In the following pages, we trace the trajectory of knowledge politics in fisheries and maritime systems in India. The articulations of knowledge and its intersections with power and politics along a broad historical sequence is attempted in sequentially starting from the late colonial period to contemporary times. Relevant pre-colonial knowledge dynamics are also touched upon briefly to highlight specific instances.

When studying the knowledge systems that are embedded within the social, economic and political spheres of maritime communities at a site, it is pertinent to explore the region's histories in terms of commerce, technologies, politics and nature. 'Maritime communities' is a term that can be used to encompass coastal communities with a multiplicity of engagements with the sea. For example, the identities of fishers in many regions were shaped by their close association with the sea, but not restricted to single professions (such as fishing), but also with other maritime skills such as boat building, navigation, shipping, salt works and so on (Reeves et al. 1996a). Tracing the engagement of the colonial and postcolonial state over these key professions can help illustrate the complexity of knowledge-making, sharing, and transmission in these communities and spaces.

When compared to the voluminous range and depth of hinterland histories in India, historical work relating to maritime communities is sparse. The existing scholarship on the colonial period tends to focus largely on events in the Bengal, Bombay and Madras Presidencies with only minimal accounts of other coastal stretches. Existing literature also suggests that while coastal communities across India were largely homogenous units of specialists, 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 across varying scales and geographies. For instance, the Paravar of South India, who identify themselves as fisher people (meenavar makkal) were 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 bound under differing forms of colonial taxation and control on account of their occupational specialisation and economic worth. Reeves (2002) suggests that some of these groups (such as the Namasudras) shifted to agriculture in a bid to attain social mobility through occupational

change. 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 of 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 (1985) research on the Indian Ocean reveals a flourishing maritime trade scenario for the region well before the arrival of the Portuguese in the late 15th century, and the associated environmental change and maritime knowledge-exchange. Arunachalam (1952) 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, and involving numerous communities including Arab pearl divers. While these accounts establish the existence of communities and maritime practices in antiquity, at the same time they also illustrate the difficulties involved in establishing indigeneity in marine cultures. For instance, it appears that there may have been slight variations in skin diving techniques and skills among the pearl and chank divers such as the Moors of Ceylon, the Paravar of the Tuticorin coast and local groups in the Malabar and Kanyakumari region, with each group following distinct beliefs and understandings of harvesting times and ecological habits of animals, and holding differing world views of the marine space. The trade relations between the groups occupying a common space is likely to have allowed for knowledge-exchange and hybridisation between maritime communities. In addition to the differences between groups in operations such as pearl fisheries, there were also 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. The sources of historical information on these accounts lie in a range of colonial administrative documents, survey and exploration reports, financial, scientific, administrative reports of the colonial period.

In large part, the prevalence of particular types of maritime technologies such as 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. Though the British termed these as 'native' craft (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 (213) proposes a point of departure whom the conventional scholarship on maritime communities, suggesting that we 'look beyond nationalist histories, to see 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.

In the context of shifts in maritime knowledge, it is also pertinent to move away from the conventional assumption of viewing colonial interventions (in new practices and technologies) as precipitating dramatic ruptures in local ways of knowing. For example, though 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 to conduct 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 out-performed 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 (Pope1995) pointing to the dynamic relation between broad sectoral development (in this case transport) and the maintenance of knowledge systems and practices in related realms.

Boat design and technology were also shaped by prevailing ecological and social conditions. For instance, Hornell notes that the boats in Kathiawar doubled both as fishing vessels as well as coastal trade vessels in the off season (Pope 1995). In the Indian Ocean region, there existed a layered set of navigation technologies, each occupying a specific niche and powered by varying technological and scientific systems (Pope 1995). A modest scale of steamshipping operations at this time ensured operational space for a range of 'native' and 'traditional' European sail vessels. In Tuticorin, cotton traders developed the 'dhoni', a local rigged schooner design incorporating elements of the Arab baggala and the British liner (Pope 1995), whose versatile design enabled the craft to do brisk business at large ports as well as smaller inlets (Arasaratnam 1967). It's introduction in response to lighterage needs of the intense European shipping activity at the time precipitated social reorganization, acreating an elite class faction among the Paravar. (Roche 1984). 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 also 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. These insights also throw light on the knowledge-power nexus as well as subaltern responses to the same in the context of maritime knowledge.

Although fisheries have been under-explored (in comparison to other sectors), there has been some important historical work on marine fisheries in South Asia. Scholars of India's aquatic histories have focused largely on the influence of developmental policies in the post-Independence phase and only a limited amount of effort has been focused on the periods before. Peter Reeves suggests that though fishing as an activity existed in pre-Aryan times, it was considered to be a lowly profession and perhaps explains its poor literary representation, 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' (1995) exploration of inland and marine fisheries of the colonial period focuses on the significance of policy changes on local resource governance and practices. The Permanent Settlement Act of 1793 brought about significant changes in taxation and governance of community-based fisheries practices. In pre-colonial times, most waterways across the country were governed by the mirasi system with its unique arrangements of rights, entitlements and levies. When replaced by the Permanent Settlement Act, these systems underwent a radical shift towards privatisation with local zamindars being vested with these aquatic estates. Under the new 'Jalkar' system, colonial tax revenues were augmented through the hitherto alien idea that the produce of water (fish) could be owned privately (Reeves 1995). Benefits were also cornered by new classes of middlemen, wholesalers and retailers (Reeves 2002). Similarly, 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. By

introducing the taxation system through the brokerage of the Parsi Patels, the elaborate stake fisheries managed by the Kolis underwent vast changes, such as the taxation and coercion of individual fishers as well as their enslavement by company officials (Reeves et al. ibid). To summarise, colonial land revenue arrangements and the growth of colonial settlements (such as Calcutta) produced new classes of middlemen and wholesalers. New 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 the social classes engaged in allied activities prospered (Reeves 2002). Colonial revenue arrangements gradually marginalised fishers, with the latter being viewed as being incapable of engaging in sophisticated marketing or processing measures, and obligating further government or private investment in these areas.

During the post-independence period, India's interests and interventions in this sphere has been on fisheries development and 'improvement' projects undertaken through 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 (est. 1947). These survey explorations have their origins in the late 19th century and early 20th century. During this period, marine exploratory surveys became a common feature of a number of British colonies. However, the colonial governments were unable to finance and support these initiatives undertaken by their own staff despite their proven profitability (Reeves1996a). In this venture, the colonial administration demonstrated a degree of flexibility in its local operations and a diversity of approaches towards fisheries. In the debates surrounding the indigenous technological capabilities and knowledge, the colonial administration was by no means united in its view. Some fisheries officers clearly believed that fishers were primitive and backward, others such as Hornell believed that India was more suited to a smaller and diffuse approach to development, and even recognised some indigenous practices, craft and knowledge as superior (Hornell 1920).These discussions can be gleaned from 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). Actions undertaken include the intensification of pond-based pisciculture and stocking of a variety of fishes. 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 (Silas 2003).

A seamless transition from colonial administration to the post colonial Indian state took place in the management of fisheries. As with the agricultural sciences, fisheries too was considered a national primary production industry to be improved in terms of local capacity development and scientific management. The late 19th century and early 20th century saw the emergence of the concepts of Maximum Sustainable Yield and Maximum Economic Yield, and training efforts by institutions such as the Food and Agriculture Organization of the United Nations, to equip developing world fisheries with related knowledge-production capabilities. Contemporary fisheries inventorying practices of estimating fish stocks and maintaining catch statistics by state scientific organizations are grounded in this influential 'bioeconomic' view (St. Martin 2001). Early attempts of fisheries monitoring by the state 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 significant transformations of fisheries in the post-Independence period have been documented for states such as Kerala and Tamil Nadu. Subramanian's (2009) anthropological study remains an important contribution to understanding fishers' modernity through negotiations over fisheries development programmes. 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, were stigmatised as 'non-modern' or 'primitive'(Kurien 2002) and began to be seen by fishers as a means to secure social mobility and enhance self-identity. While the colonial concern with conservation of fish stocks was aimed largely at maximising revenue and maintaining steady supplies of fish for the market, it was also in equal measure about maintaining law and order among various social groups. Post-Independence fisheries legislations strengthened these agendas. Marine Fisheries Regulation Acts passed by various states created and reinforced divisions, and rarely envisaged a role for local communities in the management of fisheries. 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. The late 19th century, therefore, can be considered 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 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 (2009) makes a beginning arguing that fishers' activities related to fishing are central to 'active knowledge making' and to their conceptualisation of environmental change and encounters with modernity. The encounter between new and old 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) to 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 fishers' rights and identities.

Chapter 4

Knowledge at the Margins

LEK on Coastal and Marine Systems of India

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.

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 specific keywords related to knowledge and searched across specialised websites and digital repositories that are known to contain information on fisheries or coastal issues in India. However, we were only able to obtain a number of 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, several studies shed light on the cosmology, belief systems and relations that define these 'people in nature' to use a term employed by Silvius et al (2004)

referring to a range of epistemic communities engaged in nature. The detailed sociological investigations that examine fisher's institutions, governance systems or livelihood patterns in India provide us the social context 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 were exclusively concerned with coastal and marine ecosystems. 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.

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 (IJFT), 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 FT 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. 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, coastal and marine species nomenclature and use, local fishing craft design, coastal proverbs, coastal communities' abilities to interpret weather patterns and thus make adaptive strategies. Some studies also document particular fishing practices and technologies such as the use of traps, hooks, spears and in some cases plant based poisons.

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. One 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. Other studies tried to test fishers' knowledge regarding marine species and document their observations while also engaging in scientific verification of the same. 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 attributed to LEK by authors of publications from CMFRI is discerned 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 into 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.

LEK and Technology

Those publications that explore fishing technologies, especially publications in FT are concerned with the implications of fishing practices using a wide range of 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. For instance the use of the term 'technological gap', to describe the difference in usage of different types of fishing gear by fishermen is indicative of a technological normativity. Some studies suggest that greater capitalisation and technological sophistication displays a 'labour saving' character of fisheries and also 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 paper (2006) on the Pattinavar's history of regulating fishing net technologies and Gulati's paper (1984) on impacts of technology on women in fishing communities are exceptions but is 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.

Cross References and Citations: Contributions to Existing Knowledge

The global scholarship on TEK/IEK/LEK in coastal and marine systems is not just vast, but is also the outcome of a long engagement of scholars with these communities and ecosystems. 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 of coastal communities on aspects such as navigation, astronomy, animal behaviour, knowledge of medicinal properties of plants and animals, and prediction of weather conditions. 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, 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. 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.

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. Bavinck and Karunaharan's (2006) study of bans on fishing nets shows that 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. 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. 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 separated from culture. Research has shown that traditional governance institutions within fishing communities can be discriminatory, regressive and sectarian. 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.

Some of the studies on fisheries management point to the fact that belief systems change with changing practices in fishing. However, many questions remain unaddressed. How do fishers evaluate their knowledge systems when they are proved wrong? Does this process affect their self image? How do they accommodate changes within the knowledge systems? 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 (seenvariously 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. 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 spaces. 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 MFRAs 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 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 work examining the regulations of fishing nets, Bavinck shows that the principle behind fisher 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). 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 (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.

Knowledge Management and Documentation

The literature that dealt with knowledge management in coastal and marine issues, was mostly related to the World Bank supported FIMSUL project in Tamil Nadu. 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 new as far as policies on fisheries management in India are concerned. 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 attempt radical re-formulations of LEK. It seeks 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 ICTs 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 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.

Chapter 5

Engaging the Divide

Knowledge and Democracy in India

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 receives little scholarly attention. The problem of demarcation and 'boundary-making' in knowledge, the idea of 'legibility' of knowledge systems has been discussed by Christie (2008) 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 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 and exercises 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), "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 studies (1999) 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) in the context of North American fisheries 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 argument (2002) 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 (Vishvanathan 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.

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About the Study

Article 8(j) of the Convention on Biological Diversity 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 has emerged within the global literature. The study titled as *Representing Knowledge: Local Ecological Knowledge and Natural Resource Governance in India-A Summary Report* is a review of the literature on local ecological knowledge. This 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. This report is a summary of a long report by the same name. The long report is available upon request from Dakshin Foundation (Aarthi Sridhar, Programme Head, Dakshin Foundation; aarthi77@gmail.com).

The CMPA Project

The Project "Conservation and Sustainable Management of Coastal and Marine Protected Areas" (CMPA) is a project of the Indo-German technical cooperation. It is funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and implemented by the Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India, and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of BMUB.

Established to support the achievement of the Aichi targets of the Convention on Biological Diversity, the Project's overall goal is to contribute to conservation and sustainable use of biodiversity in selected areas along the coast of India. Taking into consideration the economic importance of the coastal zone for large segments of the population, the Project's approach is people-centered, thus ensuring the support for conservation by those depending on coastal ecosystems.

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Conservation and Sustainable Management of Coastal and Marine Protected Areas