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Coonoor
The Nilgiris

(sample pages)

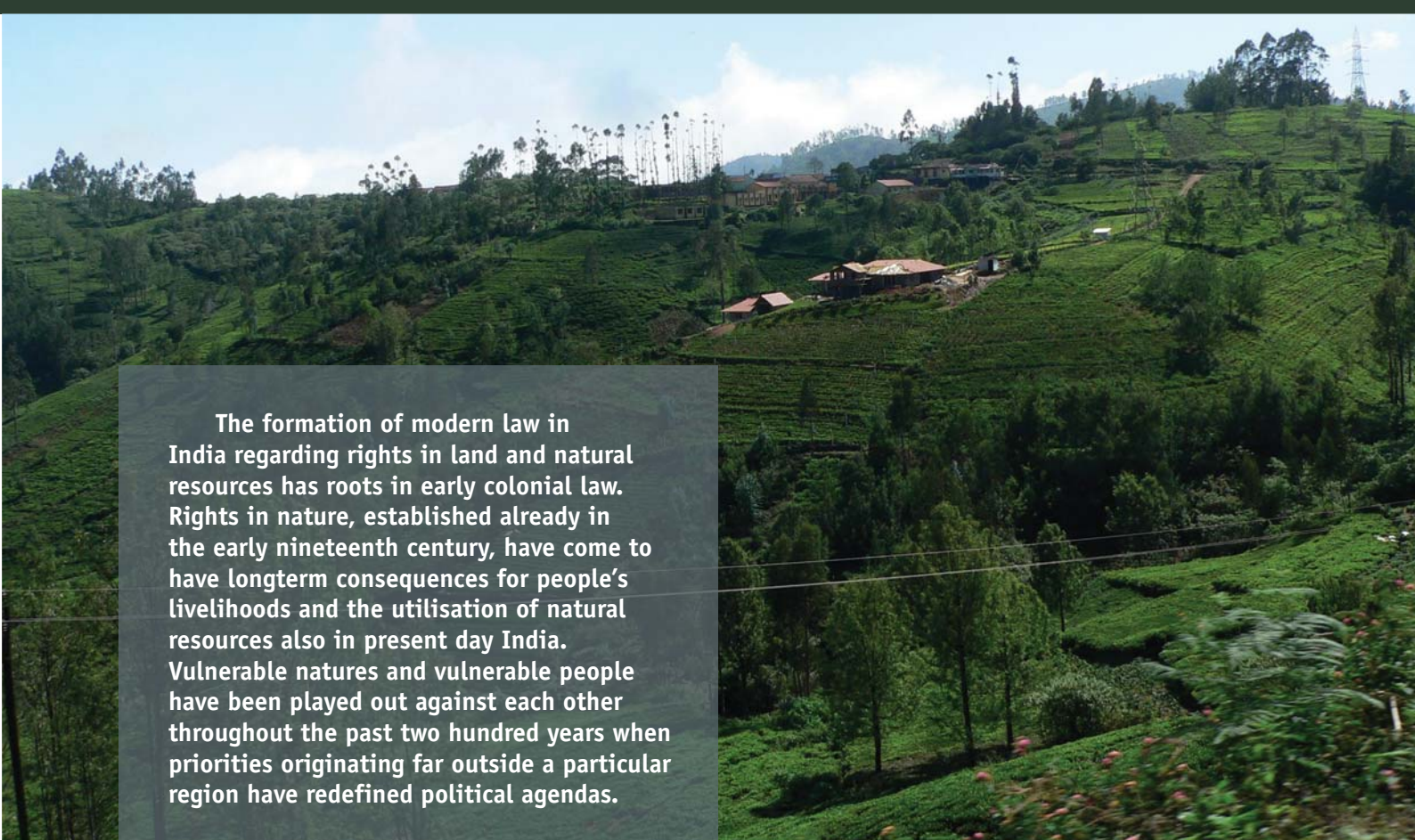


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NILGIRI BIODIVERSITY RESERVE - WIDE HISTORY AND CONTEXT

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(1A) Battles over Law: The (re-)formation of legal rights to nature in the Nilgiri Hills, early 19th century - Gunnel Cederlof



The formation of modern law in India regarding rights in land and natural resources has roots in early colonial law. Rights in nature, established already in the early nineteenth century, have come to have longterm consequences for people's livelihoods and the utilisation of natural resources also in present day India. Vulnerable natures and vulnerable people have been played out against each other throughout the past two hundred years when priorities originating far outside a particular region have redefined political agendas.

This article engages with the formation of legal regulations and codes for the right to access and control land and resources during the British East India Company's conquest and establishment of sovereign rule in the Nilgiri Hills in the early nineteenth century. The first settlement of right into codes in this limited region was a slow process over a quarter of a century and, in its initial phase, a delayed effect of the Anglo-Mysore War and the following establishment of British control of Malabar and Wynad. After a first period of arbitrary and personalised administration of the hills favouring individual interests, the Madras government stepped in and the land question turned highly sensitive. In the 1830s, different interests within the EIC collided, and existing conflicts within the region, both between

and within communities, dating long before European presence were played out in a battle over who had the right to determine land rights and what exactly those rights were.

The British East India Company (EIC) claimed all land in the Nilgiri Hills long before they entered into the territory itself. It was considered part of the Mysore State and, as such, it had fallen into the hands of the British when the Mysore State was conquered in 1799. But since all attention immediately after the war was on getting into actual control of the agrarian plains and setting up revenue administration there, it took two decades before small groups of British officers—one being the collector of Coimbatore, John Sullivan—began to explore the hills. What they saw made them

think of other landscapes, far from India. The Nilgiris looked like highlands in Europe and the people, the 'herders', were perceived as people being one with nature, majestic as the hills, free as the mountain deer, childlike and peaceful as simple peasants 'back home' in England. This would be the perfect place for a sanatorium and for experimenting with European crops. The place and its people were described as the complete opposite of the Hindus of the scorching Indian plains, where heat and Brahmin dominance were thought to have had a devastating effect on people's morals, work ethics, and social and economic life. Soon the watchwords of the time began to resound in the reports from the hills. In the Nilgiris, there was hope for improvement, entrepreneurship, and a healthy life.

Already in these first reports and letters from the hills, the region was described as ceiled off from the plains, as an enclave shielded from the civilisations of states and settled societies in the lowlands, and as a place where history long ago had come to a standstill. The perception of the place was that of a landscape which was totally different from the rest of India and the urge of finding a refuge from warfare and disease was so strong that, even though many observers in fact described strong links between hills and plains, and intersecting economies, their conclusions did not include those observations. When comparing the day to day correspondence in the Nilgiri administration with the generalised conclusions made in the larger reports and survey, this discrepancy comes out most clearly.

In addition, the general ideas of people held by the travellers to the hills were influenced by the scholarly knowledge of the time, which sought to find explanations for the origin of the human race. Influential scholars of medicine and natural history, like Johann Friedrich Blumenbach (1752–1840) and James Cowles Prichard (1786–1848), outlined in detail the evolution of the different human races, which in a significant way included the 'hill tribes'. Such tribes were often called 'mountaineers' to emphasise the importance of physical elevation and place, and centrally placed in the scheme were the Toda pastoralists of the Nilgiri Hills. Even if the EIC officers in India were not up to date with the latest

research, they conformed to views held in the common discussions which were highly influenced by the scholarly debates, argued also in fora like the Royal Asiatic Society and the Ethnological Society in London and in their journals. Ideas of hierarchies within the human race, wherein the Aryans were distinguished from the Dravidians, aboriginals and barbarians, were adopted also by the ethnographical surveyors in the Nilgiris. Prichard, more than Blumenbach, moved on to set up detailed ethnological schemes and to frame his findings in a classical Orientalist discourse. The 'mountaineers', he claimed, were 'all the tribes who live remote from cities and cultivated countries, and maintain a savage existence amidst woods and forests.' According to him, the people of south India constituted a distinct race, different from the Aryan and conquered by them. And just like they had fled from the Aryan race, also the mountaineers in the Nilgiris were claimed to have fled from the states in the south Indian plains and into the hills. Within this historical-cum-racial explanation of hill-plain and caste-tribe relations, non-sedentary societies were explained to be the antithesis of civilization.

Information was also passed in the other direction. There was a strong and mutual dependence between the scholars on the one hand and the 'barefoot' ethnographers in the Nilgiris on the other. Prichard depended exclusively on the reports of Henry Harkness and James Hough—the two most well-known authors of ethnographic reports in the 1820s and 30s—for his conclusions about the Toda, Badaga and Kota communities.

In an important way, such basic and preconceived understanding of the people and place came to have a decisive influence on the administration and bureaucratic rule set up in the Nilgiris during the 1820s–40s. These were the years when new settlements of Europeans and Indians from the plains began to emerge in the hills. The possibilities of setting up small scale workshops and agriculture in a cooler climate, and—not least—getting a freehold of their own attracted new settlers. When the Nilgiris were incorporated into the Coimbatore district administration, the collector John Sullivan together with the Commandant of the hills, Major Crewe, carried on a rather

lax procedure of allowing individuals to build houses and establish their enterprises. The influx of settlers in the centre-most part of the Nilgiri plateau was so significant that, in 1827, Sullivan asked for 'express sanction' for rules restricting the appropriation of land in the region. In a letter to government, he described how this pasture land was increasingly occupied by houses, woods were cut down and large herds of untaxed cattle grazed the land for which the Toda paid taxes. Sullivan wanted the government to ascertain that Malnad, the part of the hills where the Toda were in exclusive control, they should be given absolute proprietary rights.

Such correspondence certainly gives support to Sullivan's well established image of being the patron of the Toda and protector of their rights against an aggressive colonial regime. However, looking a little closer at the situation and, rather than making Sullivan into a lead character of Nilgiri history, placing him into the context of legal battles over land that broke out at this point in time will modify such an understanding of early colonial rule in the south Indian hills. Sullivan had private interests in land and shared these interests with many others.

During most of the 1820s, land administration had been in the hands of the Coimbatore district officers while the attention of the Madras government had been given to settling the vast lands in the conquered territories in the plains. Securing land and natural resources in the hills was given a much lower priority and only after members of the government themselves had begun to take a personal interest in the matter—not least by constructing their own houses in the hills—did they realise the consequences of the present administration. Therefore, both district and presidency administrations made claims on the land in the hills, but on very different grounds. Whereas the district administration argued that their expertise from having lived in the area almost a decade should give them the final say in legal matters, the presidency administration could not accept such a challenge to their sovereignty as rulers. Eventually, as conflicts developed, the highest board of the EIC, the Court of Directors in London, voiced concerns about the fundamentals of good governance and

undisputable principles of proprietary right in India. In these legal disputes, the ethnological classifications of people came to play a major role when rights in land were codified into law.

Land law based in custom

Founding the conquest of territory in legal justice and law codes was crucial for the legitimacy of the growing global empire. Law was seen as a neutral space and an evidence of civilisation, and the new subjects to British rule should be assured that they were treated with the same rights as any other subject within the empire. For the EIC governments in the British territories in India, law was aimed at securing trust among the propertied population while, for the subjects—not least the European subjects—it was a means of safeguarding positions and wealth. In the Nilgiris, Sullivan had been quick to secure nearly 2,000 acres for himself by a government grant. But most other Europeans had trusted Sullivan for his word and had struck deals with the local population when they set up houses and fields.

The disadvantage of lacking a valid document became apparent when conflicts emerged in the early 1830s when the government decided to resettle all land and thereafter put it up for public auction to be granted to the highest bidder. In this way, the government turned what the landholder thought to have secured as a freehold into leasehold. And, as a further disadvantage, the individual who had invested in improving the land could not be sure of reaping the fruits of the investment. Not all landholders were of the high social order representative of the members of the Madras government. Most European landholders in the hills were like Mr W Davis and Mr McNair, who had put their life's savings into small plots of land. The land was their only source of subsistence. They thought of themselves as original proprietors and had purchased the land from the Badaga shifting cultivators in Ketty by order of the Commandant of the Hills. This decision was now overruled by the government and, being made into leasehold, the land lost half its value and could no longer be inherited.

The wrestling between district and government administrations over European smallholdings reflects in a small way the larger conflicting interests that collided in the Nilgiris, which came to have severe consequences for the people native to the hills. Using law as a means of land encroachment was common for British conquest in many parts of the Indian subcontinent. But since the dividing lines in the Nilgiri Hills also cut through the European population, the different interests and principles argued received much attention far outside this limited region and were reported in great detail. This gives us an unusually good opportunity to study the logic and mechanisms of the making of law as it transformed man-land relations and people's livelihood during the establishment of British rule in India.

In spite of disagreements, there were certain legal principles that could never be questioned. The right to land and the freedom to hold property, together with personal security and liberty were indisputable ideological principles in the British debates. These rights were rooted in the legal frame of English common law, going back to Roman law on the British Isles. This custom based law protected both the lord's absolute right in land and the tenants' right to use the commons. As it had its fundamentals in the notion of custom, when applied in India, it fitted neatly into the principle of EIC governance in the British territories of respecting native custom in the application of law. As far as possible, local custom and law were to be respected and law codes under British rule were to be adjusted to these laws.

In academic debates, custom has often been seen as the epitome of aboriginal or tribal society, in contrast to British utilitarian and rational ideas of universally applicable law. However, the idea of custom was part and parcel of British land law and, therefore, the practice to adjust legal regulations to regionally specific conditions was not alien to them. The British officers might have misunderstood those conditions, but they were nevertheless keen on establishing native custom of a particular place. Not all agreed to the benefit of such policies but argued that custom would stand in the way for progressive legal reform. Yet in the Nilgiri Hills, to define native custom became a crucial

issue for arguing a position in the dispute on land rights.

Two major contradictions stood out: one emphasising the rights vested in land and natural resources, the other arguing for the utility of nature for the sake of the common good. According to common law principles, land belonged to those who were original proprietors, that means those who were the first to set foot on the land and by being aboriginal to the place also had birthright to this land. This implied absolute property in the land, the strongest rights anyone could have. For the district administration and all the private entrepreneurs entering the hills in the 1820s, to establish such rights for people in the Nilgiris became a way to make sure that there were owners from whom they could purchase the land and all the rights vested in it. Thus Sullivan argued at length that the Toda were the original inhabitants of the Nilgiri Hills.

The government's position brought forth the principles of government and sovereignty. It is important to remember that the EIC was first and foremost a global mercantile trading corporation that aimed at securing monopolies. The flip side of monopoly is sovereignty, which took centre stage when the Company began to conquer territory. Consequently, the Madras government argued that whatever rights a subject to their rule might have—and the existence of such rights were by no means denied—they were subordinate to the principle of sovereign rule. It was further the duty of any enlightened government to care for the common good of the subjects, but simultaneously the government kept for themselves the preferential right of defining who those subjects were and what was good for them. When the individuals securing private interests argued that the Toda were aboriginal to the Nilgiris, using ethnographical surveys to prove their point, the government used the same surveys and equally racial conceptions of people to prove the opposite. As the secretary to government, H J Chamier explained about the Toda:

These poor men are continually migrating from one part to another, have no fixed habitation, no settled rules of life, no written laws, no taste for agricultural pursuits, no population which presses on their means of subsistence, and no taxes which cannot be paid with the greatest ease; and if there

is any class of people to whom a more free and enlarged intercourse with the inhabitants of the adjoining countries, and with settlers in their own, can be beneficial, it is surely those who will receive knowledge, clothing, and [be] better supplied, in the place of ignorance, nakedness and discomfort.

In the secretary's view, shared by the members of government, absence of settled cultivation, lack of written codified law, and inability to use land efficiently proved a lack of civilisation among a particular group of people—in this case the Toda 'hill tribe'. Herding buffaloes over extensive grazing fields while lazily resting in the shade was evidence enough to prove their unwillingness to produce revenue for the government that could be converted into progressive reforms for the public. The productivity, not only of the people, but also of the landscape was aimed at improvement and progress. The low stature shola forests, significant because of their high biodiversity and well adjusted to the climate, were seen by the government as useless waste, to be replaced by eucalyptus, and the much 'unused' land that was claimed by the Toda was more than they needed for grazing, according to the government. As Chamier argued, they would not be hurt by losing it since the land was evidently not under any population pressure and their subsistence was not under threat. A truly utilitarian position that took note of an economic logic, while disregarding any political and social influence exercised by the Toda in the larger region, which was partly based on their influence over the Malnad lands.

Proving birthright to a particular piece of land followed strictly regulated procedures. In the first instance, this was to be substantiated in a written document—any document, not only pattas, was valid proof. If such a document could not be established, habit and usage could in the second instance prove a person's right. The over-riding principle was then that of equity. Not to disrupt people's trust in the government, the exercise of law had to be reasonable and just, also in the eyes of people to whom the law was to be applied. Immediately when the land question began to split the EIC administration, the establishment of the first regulation of the control and access to land in the Nilgiris turned into an elaborate exercise of extensive reinterpretations of the principles of proprietary right and of

negotiations on the land itself. This partly explains why it took up to a quarter of a century to establish the first regulation, 'Rights of the Todawars, and Rules for grants of land on the Nilgherries', which, in effect, was a regulation aimed at restricting land rights for a population which never counted higher than 600 individuals.

Two competing extensive production systems

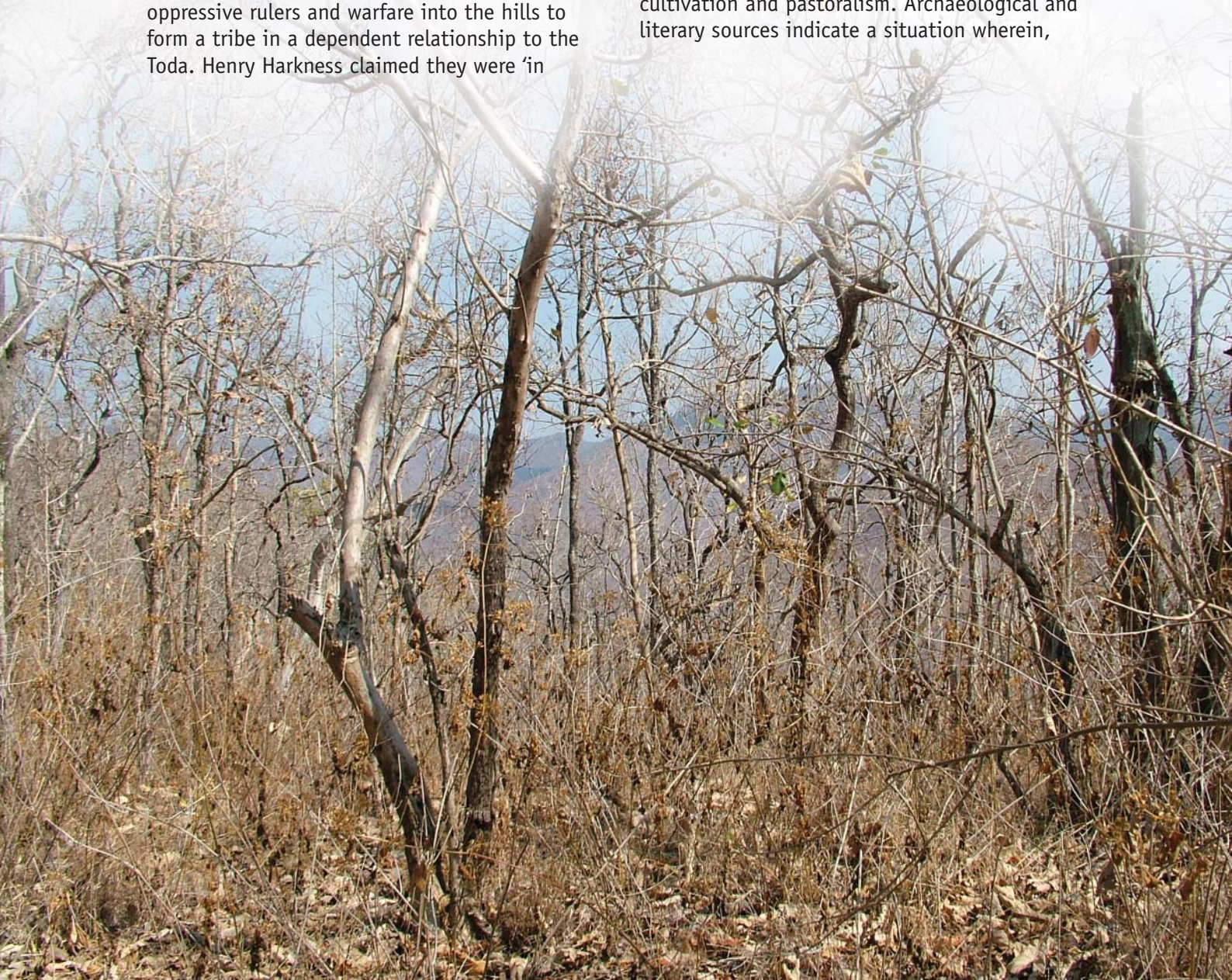
The socio-economic and ritual system of exchange among people native to the Nilgiris was already from the first reports in the 1820s, to be further emphasised in W H R Rivers' magnum opus *The Todas* (1906), described as a closed system of dependence and hierarchy. The Toda was described to have contributed dairy produce, while the Badaga produced agricultural crops, and the Kota, who were artisans, provided the necessary implements. The Toda occupied the dominant position in the social hierarchy, which gave them the right to determine access to usage of land. Their authority was partly manifested in rituals and the giving of gudu—a kind of social tribute or gift mostly given by Badaga shifting cultivators as a share of their produce to the Toda, who held authority over the particular piece of land they cultivated. Irula and Kurumba hunters and gatherers were described as not formally included in this social system, but as supplying honey, wax, and other small forest products to the local economy. The system tended to be portrayed as ancient and static.

In the case of Rivers, the lack of historical context is the most glaring. At the time of his study, in spite of being published after close to a century of colonial rule and immigration—an influence which had caused dramatic change to the life and livelihood of people in the Nilgiris—he does not make such historical transformation part of his enquiry or observe the fact that he himself also represented British presence in the Nilgiris. In contrast, he claimed that the information he found in the letters of an Italian Jesuit priest from 1603 was 'sufficient to show that there has probably been little change in the Todas and their surroundings in the three centuries which elapsed between his visit and mine'.

The colonial rulers' preference for cultivation over non-sedentary pastoralism is a well researched field in studies of various regions in India. Settled cultivation was the preferred form as it simultaneously implied an intensive use of land and more easily brought people under control by means of revenue settlement. Shifting cultivation, with a mobile population using extensive lands, was targeted for being wasteful and destructive. In the Nilgiris however, in the early nineteenth century, the conflict between cultivation and pastoralism appeared in a slightly different form. In contrast to generally held views, the British officers saw good prospects for improvement in these cultivators. They were the Badaga—a community constituted of people migrating into the hills over a long period of time. But the Europeans failed to observe their varied past. In the British narratives, the history of the Badaga rapidly turned into a singular and linear story of a cultivating caste from the plains, fleeing from oppressive rulers and warfare into the hills to form a tribe in a dependent relationship to the Toda. Henry Harkness claimed they were 'in

every respect the Sudra cultivator of Mysore, [who] ... migrated to these hills, together with the other classes of this tribe, about six generations ago'. True to the ideas held in classical Orientalism, they were portrayed as the entrepreneurial small farmers, representing a superior state of civilisation with dormant skills lacking in the hills, and a knowledge that would create economic improvements only if well guided and their skills utilised in a correct way. Significantly, in the revenue files they were almost never referred to as Badaga but as Burgher. Not until the 1840s are reports beginning to appear wherein this form of cultivation—not only in the Nilgiris but also in other parts of the Madras Presidency—is being targeted as wasteful and blamed for destroying valuable forest and contributing to a negative climate change.

Yet long before the British arrived there are signs of an emerging competition between the two as extensive production systems: shifting cultivation and pastoralism. Archaeological and literary sources indicate a situation wherein,



over time, the cultivators had encroached on grazing lands, thus beginning to limit the Toda's sphere of control over land. Most likely, this transformation began during the eighteenth century. In one of Sullivan's early reports, he claims that only the small region of Malnad and part of the neighbouring Todanad were exclusively under the Toda. He warned of the consequences of Badaga expansion: 'The cultivation and population in their nauds, are rapidly increasing, and in a few years, the Bergers if left undisturbed, will occupy all the best descriptions, and many of the inferior soils.'

When Sullivan sent this note to the Madras revenue board, the government had just begun to make restrictions for the procedures of land transfer and the requirement of a land grant was introduced. Simultaneously, the government argued that in spite of their 'custom' to graze cattle on the land, the Toda lost those rights when the land was enclosed. They were 'users' not 'proprietors' of land. The loss was a loss of a 'privilege' not of a 'right' and it should therefore be compensated in monetary terms. As is evident, cultivation of the soil held priority over grazing. Sullivan protested, arguing that the Toda certainly were proprietors equal to the mirasidars in Malabar.

The dispute between district and presidency administrations, more than once breaching the norms of appropriate speech, deepened into a conflict that involved many parties in the 1830s. Apart from the EIC administrators, private entrepreneurs, the Nilambur raja, and not least members of the Badaga and Toda settlements primarily in Malnad, were drawn into the legal battle. Seen over a longer period of time, three phases stand out. The first was characterized by strong individuals at the district and regional levels extending European settlement by crude means, the second by legal negotiations in the administrative offices as the presidency administrators took over the initiative on the question of land settlement, and the third by the final establishment of a legal code for rights in 1843 backed by a more powerful state bureaucracy. As the first European settlements appeared in Malnad, the Toda of those munds were also the first to respond to the intrusion. Later, when Europeans claimed lands that were under the

rotations of shifting cultivators, the Badaga, too, objected to the incoming settlers, while the British immediately mistook the Badaga for landholders.

The settling of land in Ketti in 1833 illustrates well the government logic in practice. In the Ketti valley, a government farm had been established in 1826 on 127 acres of land. Now, in the process of assigning grants to landholders, land used by the government also came up for scrutiny. Four years of investigation brought forth two valid claimants, both Badaga cultivators. Having lost access to this land due to the farm, they were eligible for compensation. When they turned down the new fertile lands offered them, elaborate calculations of the value of their loss were made so that the Badaga could be given monetary compensation instead of land. Each holder's land, its size, rate of revenue and assessment for the five years preceding the establishment of the farm were measured. The statistics resulting from this survey clearly show that these were small plots of land, cultivated under 2-3 years' rotation. Now, long after the fields were gone, no one could clearly establish the exact boundaries of each field any longer. In the end, the government calculated the loss of profit for the land that the Badaga cultivators were assumed to have used, had they had access to it. No land was compensated for more than three years.

At the same time, a similar situation was under investigation for land claimed by the Toda settlement Kandelmund, now used by government as a military cantonment. Since the government did not want to remove the cantonment, they sought an agreement with the Toda where they relinquished all claims. In contrast to the settlement with the Badaga at Ketti, here the government was careful to point out that the Toda were by no means to be considered equal to permanent cultivators:

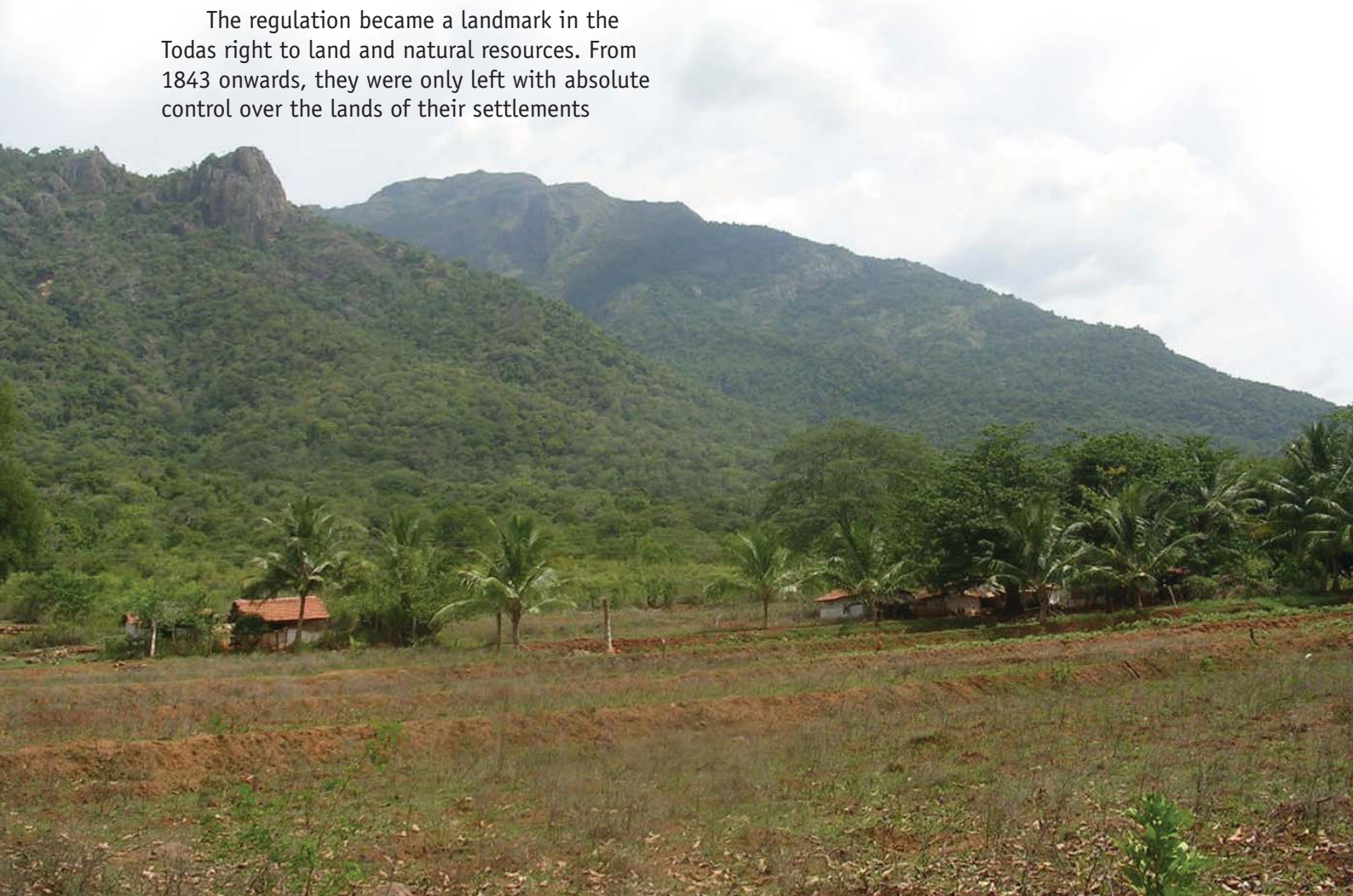
...it would appear that Government consider that lands so assumed are cultivated in perpetuity, but I beg to state that so far from this being the case, lands so taken up are commonly retained for a few months, a year or more as suits the convenience of the parties, but with few exceptions occupied for any considerable time so that such lands on being abandoned revert to the Todas who have the same enjoyment of them for pasturage as formerly.

It is important to note that, while this officer observed the fact that Toda still held authority over land and land reverted to the Toda after being used for shifting cultivation, he did not recognize any 'loss of profit' during the time when it had been occupied by the cantonment. In spite of both shifting cultivation and pastoralism being non-sedentary production systems, only cultivation was considered to produce a value which deserved compensation when lost.

From the late 1830s until the 1843 regulation, the legal settlement of rights had moved away from the Nilgiris and into the revenue department in Madras. It had become a bureaucratic issue to be solved at the officers' desks. In this regulation, the government made manifest the sovereign rights of government. 'From a consideration of the universally acknowledged rights of the Government in respect to uncultivated lands, as well as to the peculiar circumstances of the case under discussion, we cannot admit the existence of any such proprietary right in the soil on the part of the Todas, as can in any way interfere with the right of Government to permit parties willing to pay the full assessment to bring it under the plough.'

The regulation became a landmark in the Todas right to land and natural resources. From 1843 onwards, they were only left with absolute control over the lands of their settlements

and temple grounds. The government's vision for transforming livelihoods in the Nilgiris is also reflected in their decision to reserve the lands immediately surrounding the settlements from purchase. The intention was to influence these pastoralists and turn them away from non-sedentary pastoralism towards settled cultivation. Even the payment of compensation for Toda land was fixed accordingly. First of all, it was compensation for the loss of 'grazing privileges', something that did not account for more than the value of wasteland. Secondly, compensation was not to be given to the Toda directly but to the government that would set up a fund from which the Toda could withdraw money—but only if they were to undertake agricultural operations. Thus this regulation proves beyond doubt that the legal sphere was not a neutral space but an arena for strong and conflicting interests and was a means by which long term transformation of access, usage, livelihoods and rights took place.



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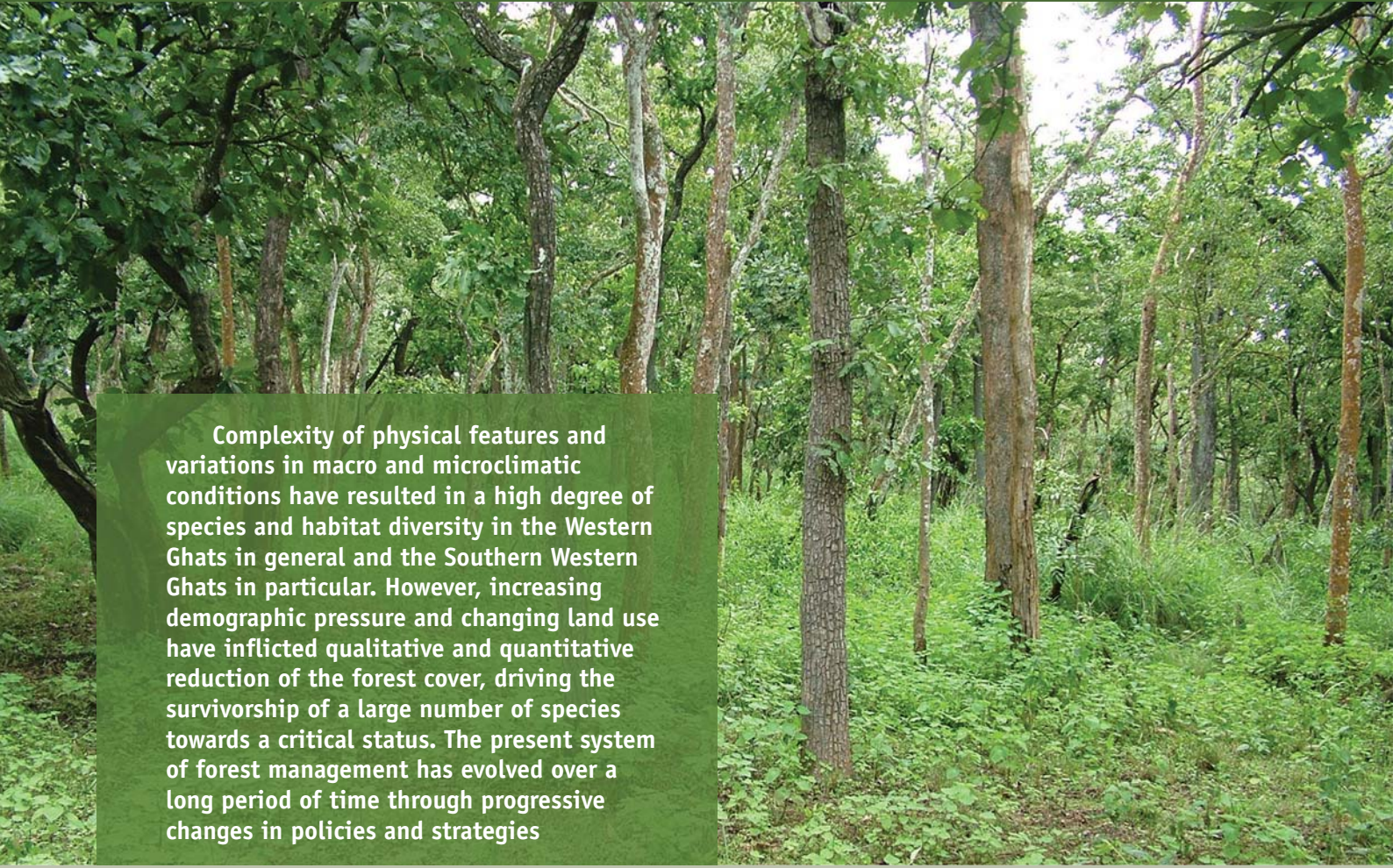
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(1B) Analysis of landscape elements for forest management in the southern western ghats, India

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Complexity of physical features and variations in macro and microclimatic conditions have resulted in a high degree of species and habitat diversity in the Western Ghats in general and the Southern Western Ghats in particular. However, increasing demographic pressure and changing land use have inflicted qualitative and quantitative reduction of the forest cover, driving the survivorship of a large number of species towards a critical status. The present system of forest management has evolved over a long period of time through progressive changes in policies and strategies

Until recently the thrust was on revenue generation with less importance given to the conservation of biodiversity and protection of the environment with people's participation. A radical shift in the policy was effected (inspired by international agreements like the Convention of Biological Diversity and the Johannesburg Summit) in the past two decades with participatory management as the key characteristic. The hallmark of these changes was the adoption of an integrated approach to biodiversity conservation with the emergence of new institutional arrangements with incentives for the local people for the joint management

of forests. However, some of the existing regulations (e.g. Wildlife Protection Act, 1972) are impeding the effective implementation of participatory forest management. In order to rectify these shortfalls and to address the challenges posed by the heterogeneity in land use and the dynamics fuelled by natural and anthropogenic factors on ecosystem processes, we seek a comprehensive management approach at the landscape level.

The changes in national forest policy and shortfalls in the present management system were highlighted through studies

on 'Biodiversity conservation strategy and action plans for Kerala' and 'Rationalization of protected area network' conducted by the French Institute of Pondicherry (FIP). The Kerala Forest Department (KFD) has thus entrusted FIP to develop an integrated management plan based on the landscape approach for selected landscape units.

Keeping in view the present management scenario, the overall aim of the landscape approach proposed was to promote conservation of biodiversity at the landscape level and sustainable use of natural resources by communities and other stakeholders, through the development of strategic landscape planning. In order to enhance the capacity of forest managers, the scientific underpinnings of landscape level management and the consequences of spatial heterogeneity on land-management decisions are elucidated.

The study has been designed under the principle of landscape ecology where a landscape is considered as a heterogeneous area composed of a cluster of interacting ecosystems. The structure (type, pattern and spatial arrangements) of ecosystem elements is primarily determined by physical factors (bioclimate, soil, topography, drainage) and modified by human activities. As a result, a complex environment, constrained by socio-economic and cultural factors among others, develops in a landscape. Considering this concept, the landscape approach includes three major parts: (1) division of Kerala, which includes the southern Western Ghats into different landscape units (2) spatial characterization and analysis of landscape elements, which includes biophysical and human ecological factors (3) strategies to manage the spatially derived management zones and for mitigating the threats that could be detrimental for biodiversity conservation and sustainable development.

Identification of landscape units:

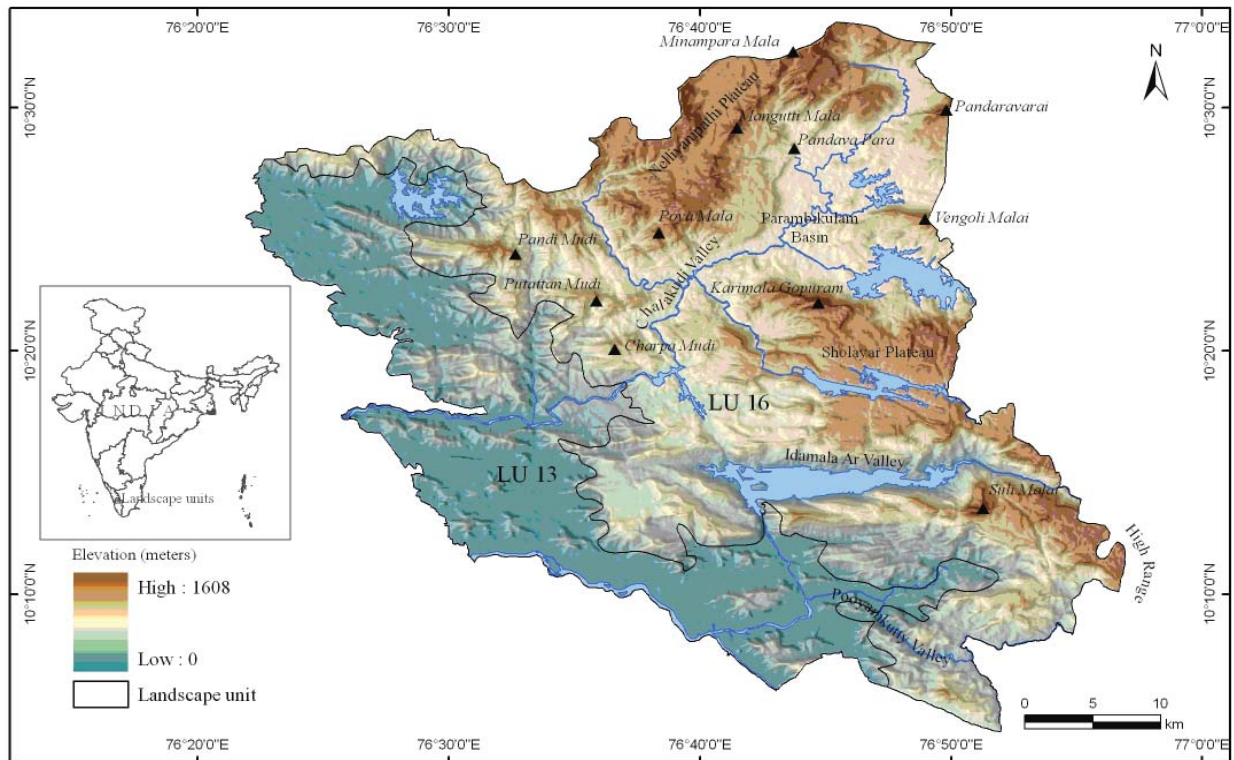
Delineation of the landscape units was carried out in the light of hierarchical theory in landscape ecology. A 'top down' approach starting from Peninsular India to

the geographical region was first adopted based on the work of R L Singh (India – a regional geography). These geographical units were further classified into geomorphological units based on landforms and soil (NBSS&LUP maps). The potential vegetation cover (using FIP's vegetation maps) was projected on this to derive the third scale classification, which represents the unique landscape units. In Kerala, 19 such units have been identified. Finally, two landscape units (13 and 16) in the western side of the Anamalai region (Nelliampathi Hills) were selected for the detailed study.

Characterization of biophysical factors in the selected landscapes:

The selected landscape units (Fig. 1) for the study lie between $76^{\circ} 21' 55'' - 76^{\circ} 56' 55''$ N and $10^{\circ} 04' 21'' - 10^{\circ} 33' 29''$ E and include an area of 1837 km² with seven forest administrative units (3 PA s and 4 non-PAs). Seven reservoirs spread out in the area highlight the water harness potential of the region. The climate is tropical in nature with a sharp variation in rainfall from northeastern (3,000 to 1,500mm) to southeastern (3,500 to 5,500mm) direction. The length of dry months varies from 2 to 5 months. The presence of young soils (Inceptisols) in association with





steep slopes and high rainfall indicates the vulnerability of the study area to soil erosion and siltation of rivers.

The analysis of the land cover and the biological and human ecological matrix reveals the habitat complexities, richness in biological repository and ethnic and cultural values of the area. The land cover and land use map prepared using GIS and satellite data indicates the presence of 72% of natural vegetation and the rest with forest plantations (mostly teak), commercial crops (coffee, tea, cardamom, rubber etc), water bodies and settlements. Among natural vegetation, three primary evergreen forest types (dipterocarp type at low elevation and, cullenia and dry fringe types at medium elevation) cover 22% and dense moist deciduous forests represent merely 3% of the study area. The presence of 47% highly disturbed evergreen to semi-evergreen forests in the form of small fragments and other degraded formations (woodlands, scrubs, thickets, tree savannas and fallows) indicates the prevalence of anthropogenic pressures especially in the fringe areas.

A total of 1,835 species of flowering plants (which account for 39% of the species found in Kerala) have been recorded from different

floristic works conducted around the study area. Most of these species have potential value as medicinal, NWFP, timber and industrial raw materials. Among these, 437 species are endemic to the Western Ghats. Out of the 60 endemic genera in the Western Ghats, 14 are found in the study area. According to IUCN categories 144 species are listed as rare, endangered and threatened.

The stand structural and floristic compositional diversities of vegetation types were studied using 146 sample plots of 0.1ha each. From the sampling plots, 436 woody species were recorded. The most dominant species are *Xylia xylocara* in deciduous forests and *Palaquium ellipticum* in evergreen forests. The multivariate and regression analyses of the database using parameters like density, basal area, species richness, diversity and endemism have showed the qualitative and quantitative changes particularly in phenological (primary and secondary evergreen species and deciduous species proportion) and stand structural (basal area and density) characteristics across different vegetation types as well as along the disturbance gradient of each type.

The vertebral faunal wealth of the landscape unit is evident from the 49 species

of mammals, 336 species of birds, 70 species of reptiles, 34 species of amphibians and 81 species of fishes recorded from the area. Among the vertebrate taxa, the maximum species richness is in birds (70% of the species found in Kerala). Among the endemic species of the Western Ghats occurring in the State, the study area possesses 6 (50%) species of mammals, 15 (94%) species of birds, 28 (41%) species of reptiles, 17 (27%) species of amphibians and 43 (71%) species of fishes. According to IUCN, out of the 49 mammals, 15 are among the rare, endangered and threatened categories. Similarly 6 species of birds, 16 species of reptiles, 10 species of amphibian and 28 species of fishes also belong to different IUCN categories.

The distribution and abundance of selected faunal species indicate that species such as elephant, gaur, sambar, Malabar giant squirrel and leopard are widely distributed, while tiger, sloth bear, lion tailed macaque, great Indian hornbill and Nilgiri langur are restricted in distribution either because of anthropogenic pressures or due to habitat alterations. Nilgiri tahr, another endangered species, which inhabit the unique montane grasslands are found to occur in 12 locations.

Human ecological appraisal and forest resource utilization:

Human ecological and stakeholder analysis includes an appraisal of the existing population, their history of settlement in the study area and the nature of their dependence on the forest for livelihood. The two distinct human ecological situations are the forest dwelling adivasi groups and fringe area non-adivasi settlers. The former is constituted of groups such as Kadar, Malasar, Malamalasar, Malayan, Mannan and Muthuvan (Fig. 2). About 90% of the adivasi population reside within the forest territory out of which 70% belong to Muthuvan, Kadar and Malayan tribes. Communities such as Kadar, Malasar, Malamalasar, and majority of the Malayan population are landless or nearly landless. The main sources of income of these communities are from collection and sale of NWFPs, agricultural products, and manual labour. Muthuvan and Mannan practice settled cultivation. The forced shift from slash and burn to settled cultivation has also changed the pattern of labour distribution at inter and intra household levels. The exposure of adivasi



population to non-advansi, influence of market and increasing control of the state on forests have marginalized and weakened the traditional institutions and forced them to access modern technology. Hence advansi like Mannan, Malayan, Malamalar, Malasar, and Kadar are in a disintegrated state with very limited remnants of tribal institutional and cultural ties.

The fringe area population is characterised by heterogeneous groups of in-migrant settler households and the market is the most influential factor that patterns their landuse. Their main source of income is either wage labour in corporate plantations or small-scale agriculture. Lemon grass, pepper, tapioca, paddy etc. were the prevalent crops during the early decades of the century. This was subsequently modified to rubber, pineapple and other cash crops. The three prominent landuse patterns in the fringe area are (i) contiguous forest tracts of adjacent forest divisions within and across the state borders, (ii) small to medium sized holdings cultivated with a mix of cash and food crops, and (iii) large plantations of coffee, tea, cardamom and rubber. Some of the fringe area settlements developed over time as a result of encroachment by in-migrant population and resettling of Second World War Army personnel. The increase of accessibility because of road and plantation development has brought encroachers into forested areas such as Injathotti, Thattekkad, Kuttampuzha, Urulanthanni, Pooyamkutty, Pinavoor, Elamblassy and Mamalakkandam. During 1920s, following a steep increase in the price of lemon grass oil, in-migration for cultivating the 'waste lands' with lemon grass caused deforestation and colonisation in the fringes of the Malayattoor forests.

The NWFP collection and marketing, one of the main economic activities of the tribal population is organised through cooperative societies and coordinated by the Federation of SC/STs. There are 49 items of forest produce, derived from 47 species of plants and 2 species of animals, collected and marketed from the forests of the landscape during the study period. Among these items, produce from 27 species of plants and 2 species of animals are marketed through cooperatives. The largest consumer of the forest produce is ayurvedic medicine manufacturing units which consume

about 33% of the total quantity collected from the area. Among the items marketed through cooperatives 10 are underground parts, 10 fruits or seeds, 2 barks of trees, and 2 are resin. The plants collected and marketed by the private vendors are medicinal herbs where either the entire plant or their tubers and roots are utilised. Among all the items collected only 14 are available throughout the year.

Approximately 236 tons of biomass worth rupees 6 million is extracted from the study area in the form of NWFP by the tribal cooperatives operating in the landscape. The 13 items such as cheenikka, kattupadavalam, kashurimanjal, thelli, pathiripoovu, padakkuzhangu, elakka, nannari, koova, marottikkuru, edanappoovu wild honey and wax contribute to approximately 98 % of the total revenue. Out of the 47 plant species of NWFP, 30 are either uprooted or subjected to fatal injuries during normal harvesting. Bark, fruits and resin are the major products obtained from the trees. In case of *Symplocos*, *Sterculia* and *Cinnamomum* the whole tree is debarked to collect the bark. In case of *Canarium strictum*, the resin is collected by inflicting injuries on the bark of the mature tree. The unsustainable harvesting practices, categorised by a complete removal of local population, destructive harvesting, and early harvesting has drastically reduced the availability of certain resources (e.g. black dammar).

The cooperatives, that are controlling the marketing of NWFP are a failure due to the following reasons (1) the members of the society (tribal collectors) are treated as wageworkers (2) conservation of the resource base and its regeneration is not a concern to the society (3) societies do not invest adequately to improve the quality and capabilities of their human resource (4) the prices offered by the private agents to the collectors are more than the prices offered by the cooperatives resulting in reduction in the market share of the cooperatives (5) underutilization of opportunities for semi processing and local value addition and (6) collection and marketing of only a limited number of items which are traded in larger quantities, because of a ready market.

Reed is another raw material collected by traditional and modern industries in large

quantities from the landscape unit. 82% of the total extraction is done by Hindustan Newsprint Ltd. (HNL) and the remaining is by the Kerala State Bamboo Corporation (KSBC). The average annual extraction of reeds by both these agencies during 2001-2002 to 2003-2004 from the landscape amounts to approximately 25,670 metric tons. The HNL organises their extraction through the contractors and the KSBC directly. From the year 1986 onwards a closure period of three months from July to September is observed in the reed collection. The reed extracted from the landscape unit divisions during the 2002-2003 and 2003-2004 accounted for 35 and 32% of the total annual requirement of the HNL in the respective years.

There are a total of 41 VSSs and EDCs belonging to the adivasis and non-adivasis. Nine of them are EDCs in the wildlife sanctuaries and 32 are VSSs in territorial divisions out of which 19 are NWFP based tribal VSSs and the remaining 12 are fringe area VSSs. These 41 institutions bring together a total of 9,867 individuals from 3,765 households under PFM, of which approximately 32% (3,125) belong to adivasi communities, 9% (913) to scheduled castes and the remaining 59% of the members are fringe area non-adivasi population.

The total area of forestland earmarked for joint management in the landscape unit is about 550 km². Out of this, 95% (520.61 km²) is allotted for tribal VSS and the remaining for non-tribal VSS, i.e. the tribal institutions while having only 31% of the total population under the PFM has nearly 95% of the total land under the programme. The per capita forestland allocated for fringe area VSS for joint management is strikingly small as compared to that of the tribal VSSs.

Landscape management plan and institutional mechanism:

A review of administrative infrastructures, tools and appraisal of management constraints were carried out after analysing the values of landscape units before delineating the management zones. The review of infrastructure indicated that PAs are better equipped in

terms of surveillance facilities such as vehicle, arms and ammunitions and other accessories compared to non-PAs. The overall analysis of management constraints (problems/threats) indicated that there are more than 30 issues that influence management of forests in this region. Some of the major issues identified are fire, poaching, cattle grazing, human-wildlife conflicts, illicit distillation, ganja cultivation, firewood collection, exotic weeds, etc. In addition to this there are logical issues like lack of funds, staff, political interference, etc. Because of these reasons the management activities are remarkably similar in both PAs and non-PAs.

A review of legal and policy environment pertaining to forests, natural resource management and environment protection was carried out. It could be concluded that even in the context of peoples' participation in the management of forests, instead of decentralisation, centralization is the theme of policy documents.

Taking into consideration the values, constraints, existing status of forest administrative units in the landscape and the overall objective of this management plan, i.e., biodiversity conservation and sustainable utilization of resources, two categories of management zones such as value based management zone and constraint based management zone were delineated. For each management zone, the prevailing threats and mitigatory measures were also suggested. The value based management zones are biodiversity conservation zone, resource zone (teak, bamboo, reed and non-wood forest produces) and soil and water conservation zone. In case of constraint based management zones, all the constraints or management issues hitherto identified have been described with strategies and actions. Spatially, zones have been identified for fire protection and restoration.

Since the landscape is part of one of the centres of species endemism in the Western Ghats, a zone of conservation was delineated so that whole range of biodiversity is represented and the habitats of critically endangered species are included. The main objective of the zone is to conserve and maintain biological richness with special emphasis on Rare, Endangered and Threatened species, unique

habitats such as marshes and swamps and to ensure habitat representativity, ecological integrity and connectivity. The area included in this zone is the primary evergreen and moist deciduous forests in existing PAs and non-PAs. The extent of habitat included under this zone from the non-PAs is more than that of PAs. The focus theme of the strategies and actions are participatory, involving PFM institutions in protection measures, restoration activities, eradication of weeds and monitoring programmes.

The resource (teak, bamboo, reeds and NWFP) zones are designed to extract the resources under the principle of sustainable forestry to meet the local and industrial requirements and to bring ownership in conservation and management among different stakeholders. Teak management zone represents the teak plantations and other zones are characterised by the preponderance of respective key species, for example, different species of bamboo in the bamboo management zone and *Ochlandra travancorica* in the reed management zone. It was emphasized while drawing out the strategies that the extraction of these resources should be carried out only through PFM institutions and a flawless monitoring protocol should be developed and implemented with the help of the local people. Moreover, periodic assessment of the resources should also be carried out by involving local PFM institutions. Regarding the strategies for NWFP management, thrust is on the need for training the local people in collection and value addition of the NWFP.

Soil and water conservation zone is demarcated based on the erosion proneness (slope, type of soil and land cover) of the area and vegetation around the streams. The strategies and actions include restoring the degraded land and avoiding forestry activities other than regeneration on the steep slopes (>200). Moreover a stream bank management policy is recommended.

The constraint based strategies and actions are meant for mitigating the general management problems that are present in other management zones also. However separate and theme based efforts should be taken in the case of illegal activities such as poaching, illicit felling, and ganja cultivation with the

assistance of PFM institutions. In the case of fire management zone, which is largely represented by degraded areas near the human habitation, a proper fire reporting system and utilization of modern fire alarm and detection tools have been suggested in addition to the traditional control methods.

The degraded forests in the landscape unit have been delineated as a restoration zone and the major strategy is to restore the area with the help of PFM institutions. Since most of these areas are adjacent to human habitations, the demands of the local people for small timber may also have to be met from these areas. Hence the focus is on restoring these areas to cater to the needs of the local people without compromising on the principles of restoration ecology.

These management prescriptions envisaged in the plan necessitates the involvement of all stakeholders apart from the forest department. Since there are multiple claimants for the same resources, conflicting interests exist. In order to resolve these conflicts, the implementation and monitoring mechanism involving all the departments and local level institutions is also suggested.



(1C) Biodiversity and livelihoods in the NBR - What is happening ? - P K Mulley and Snehlata Nath



Abstract

The Nilgiri Biosphere Reserve created in 1986 spurred a great deal of interest and greater concerns on the biodiversity of the region and the livelihoods of indigenous people, groups inhabiting this region. A tentative list of about twenty ethnolinguistically identified groups of people was drawn up. It has always been felt that these groups continued to be marginalized within the emerging socio-economic and political structures straddling across the states of Tamil Nadu, Kerala and Karnataka in South India. A bold initiative of those responsible

for the creation of this biosphere lay in the establishment of boundaries transcending politico-administrative units. Considering the large number of people groups and their habitats in this region it has been a challenge to bring about a new vision of environmental responsibility. The rights of the indigenous communities to manage and control the resources they depend on have their own historical sequence. In terms of sheer numbers these vulnerable groups are small. Except for communities like the Irulas, Paniyas and Kuruchiyars, the rest of the communities number less than 20,000 each. Many of them are food gatherers (if not hunter gatherers). Some small scale cultivation or agriculture

was familiar to many of these groups. But the onslaught of monetary economy in the region altered their strategies and degree of interaction with swarming immigrant population.

With the British Expansion came the extraction of forest resources and their commercial exploitation. Now the authenticity of the subsistence livelihoods of these people came to be challenged by an ambitious value system of a new kind of economy. This resulted in an overlap of several spheres of influence between their autonomy and what was propagated as their progress. The world view of these peoples, epitomized in their allegiance

to the biodiversity of their environments, has become exposed to new styles of management from a social, political and administrative point of view. The long time mutual knowledge of each other among these different groups sharing the same environment of biodiversity is therefore what needs to be analysed and applied in the Nilgiri Biosphere Reserve.

Introduction

The Nilgiri Biosphere Reserve created in 1986, spurred a great deal of interest and greater concerns on the biodiversity of the region and the livelihoods of indigenous people, groups inhabiting this region. This paper provides a socio-cultural background to the work undertaken by the 'Bees, Biodiversity and Livelihoods' project based in the Reserve. It also gives a glimpse of the historical changes in this region which essentially changed land, community and governance dimensions. This has in turn influenced biodiversity and livelihoods of indigenous people of the area. The sites selected in the project tried to capture contrasts of bio geography and the ethnic diversity in the region. Historically, the region has been acknowledged for its complex diversity in the natural regime as well as

the specific symbiotic relationship amongst different ethnic groups of the region. The sites selected for this project are represented in the following table and the subsequent text discusses the socio-cultural differences and similarities in this area.

Biodiversity, Land and Community

The Nilgiris, forming a part of the Nilgiris Biosphere Reserve (NBR) in the Western Ghats is home to moist, dry, evergreen and montane (shola) tropical forests. The Western Ghats, and the Nilgiris in particular, harbour a wealth of flora and fauna: mammals, birds, reptiles, amphibians, and fresh water fishes; most of which are endemic to the region. The NBR is 0.15% of India's land area and has 20% of all angiosperms, 15% of all butterflies and 23% of all vertebrates. Of the 285 endemics in the Western Ghats, 156 (55%) are in the NBR (Daniel 1993). The NBR is very rich in plant diversity. About 3,200 species of flowering plants can be seen here of which 132 are endemic to the reserve. Of the 175 species of orchids found here, 8 are endemic. The fauna of the NBR includes over 100 species of mammals, 350 species of birds, 80 species of reptiles

Management Divisions (State)	BBL Location Names	Elevation Range m.a.s.l	Forest Type	Indigenous communities
Chamrajnagar and Satyamanagalam (K&TN)	Chamrajnagar	1000 - 1200	DDF, MDF, Shola, SEG	Sholiga, Irula
Nilgiris North and Coimbatore (TN)	Coonoor	500 - 1400	MDF, DDF	Kurumba, Irula
Nilgiri North (TN)	Kotagiri	1800 - 2200	Shola	Badaga, Toda
Mudumalai and Nilgiri North (TN)	Mudumalai Sigur/	900	DDF, Scrub, MDF	Kattunaicken, Irula, Jenu Kurumba
Nilambur South and Nilambur South (K)	Nilambur	800 - 1200	SEG, MDF, DDF	Cholanaicken, Pathinaicken, Kattunaicken

and amphibians, 300 species of butterflies and innumerable invertebrates. 31 amphibians and 60 species of reptiles that are endemic to the Western Ghats also occur in the Nilgiri Biosphere Reserve (Daniel 1996).

The rich flora and fauna has resulted in declaring several areas as protected which include the Nagarhole, Bandipur, Muthanga, Mudumalai, Mukurthi and Silent Valley regions. Besides, areas like the New Amarambalam Reserve Forests are rich repositories of biodiversity (Daniel 1993). It is said that the Nilgiri shola and grassland vegetation complex has not changed significantly for the last 30,000 years (Prabhakar & Gadgil, 1995:153) but that does not mean that no land use changes have taken place. Over the years there have been commercially generated changes in land use practices, most of them altering the biodiversity of the region.

Before the advent of the British in 1819, land was used for grazing by the Todas and Badagas, who were pastoralists. Areas in

Kotagiri site of Bikkapathy and Kodithenumund were pasture lands for the people. Agriculture was done by the Badaga community who grew millets and a variety of cereals. Special importance was given to growing food crops like Ragi (*Eleusine coracana*) and Ganje (Barley), which were also exchanged for other goods and services from different communities. Other pre-agriculture communities like Kurumbas, Kathnaickens, Kasava, Jenu Kurumba etc. primarily depended on the lower forests for survival, though they were linked to upper areas for medicinal plants and other forest produce like thatching materials and bamboo.

The corridor zone below the northern slopes of the Nilgiris, along the Moyar river valley, presents a picture of fractured and fragile cultural linkages. This is an area where history, sort of, stood still. The Forest Department named this region Sigur, though, according to epigraphical sources it goes back to about 11th century AD. What happened in this region is not very well known. Despite its close proximity



to the Mysore dominion, the ecological and historical changes that have occurred in this buffer zone remain largely unknown. A big question is, did the indigenous people like Kasavas, Uralis, Solegas and Kurumbas have a relationship of mutual dependence with the Badagas and Toda of the uplands, as indicated in early British documentation? It is true that the Kasavas were looking after more than scores of Badaga pastoral camps in this region, but what determined this historical symbiosis largely remains untraced.

It should be noted that the present day Mudumalai, prior to its conversion into a sanctuary was inhabited by Mountaden Chettis who had fairly extensive cultivation practices. Now there has been an artificial change brought about in the landscape. Consequently not only these Chettis but also the Kurumbas and Kattunaickens, who had shared the same habitat have become refugees in their own land. Therefore the governance of such landscapes could offer more options for a different kind of bio-diversity

management. With the advent of the British, these relationships and structures changed due to imposed land use alterations and workings in the forests. There was teak, rosewood, other timber logging in the Mudumalai forests since 1857 to 1963 – removing an estimated 4,116,370 cft of timber (Sekar,2004). This also meant that many indigenous people became logging workers and shifted from their original villages. In 1977, Mudumalai was declared a sanctuary, however, removal of species stopped in 1980 (Sekar, 2004). This continued destruction of the forest and added restrictions of the protected area declaration has only led in further alienating people from the land. Similar situations happened in different parts of the NBR. In Nilambur, even today Mundakadavu Kattunaickens are logging workers, maybe earning more money but losing their socio-cultural and forests linkages. Even settlement names like Mel Koop and Kil Koop in Kotagiri area, were derived from a history of logging operations in that area.



With the extent of changes and destruction of the forests, movement of indigenous communities, alienation from land and traditional boundaries has taken place. The forest is not what it used to be – foraging and making a living out of it has become impossible. According to a Badaga proverb, “forest as a foster land has now become a barricaded domain”. Here, the changes and existing governance altered the equations of resource control - from a free access to a monitored, controlled and hierarchical one. Forest Governance played a big role in alienating people from their land and forests and making them part of the monetary economy.

Another policy of the then British Government that ruined biodiversity and changed once and for all the shola-grassland ecology was the introduction of exotics – wattle and eucalyptus. These covered the grassland and colonized large areas quickly which over time made it more and more difficult for the Todas and Badagas to graze herds of buffaloes.

Since then the Toda people adapted to a ‘settled’ life with land being ‘given’ by the government. Today they have agricultural land, which they have leased out to plains people and their buffaloes, which they have to maintain for religious/cultural reasons, graze on nearby lands and eat agriculture produce. Badagas adapted to the changes and took up agriculture of potato and other English vegetables and later to tea cultivation. They also became educated and later were absorbed into mainly government jobs – as can be ascertained from one of the field sites – Tuneri in Kotagiri location.

The introduction of other plantation crops like tea in 1839, and its spread after 1869, when it was only 200-300 acres spread, but by 1876 the extent rose to about 7000 acres (Grigg 1880: 513-4) and by 1940 the extent of tea in Nilgiris was 19,733 acres. After independence the extension really increased and by 1996 it was 63,746 acres (Sekar; 2004). These plantations also attracted labour from



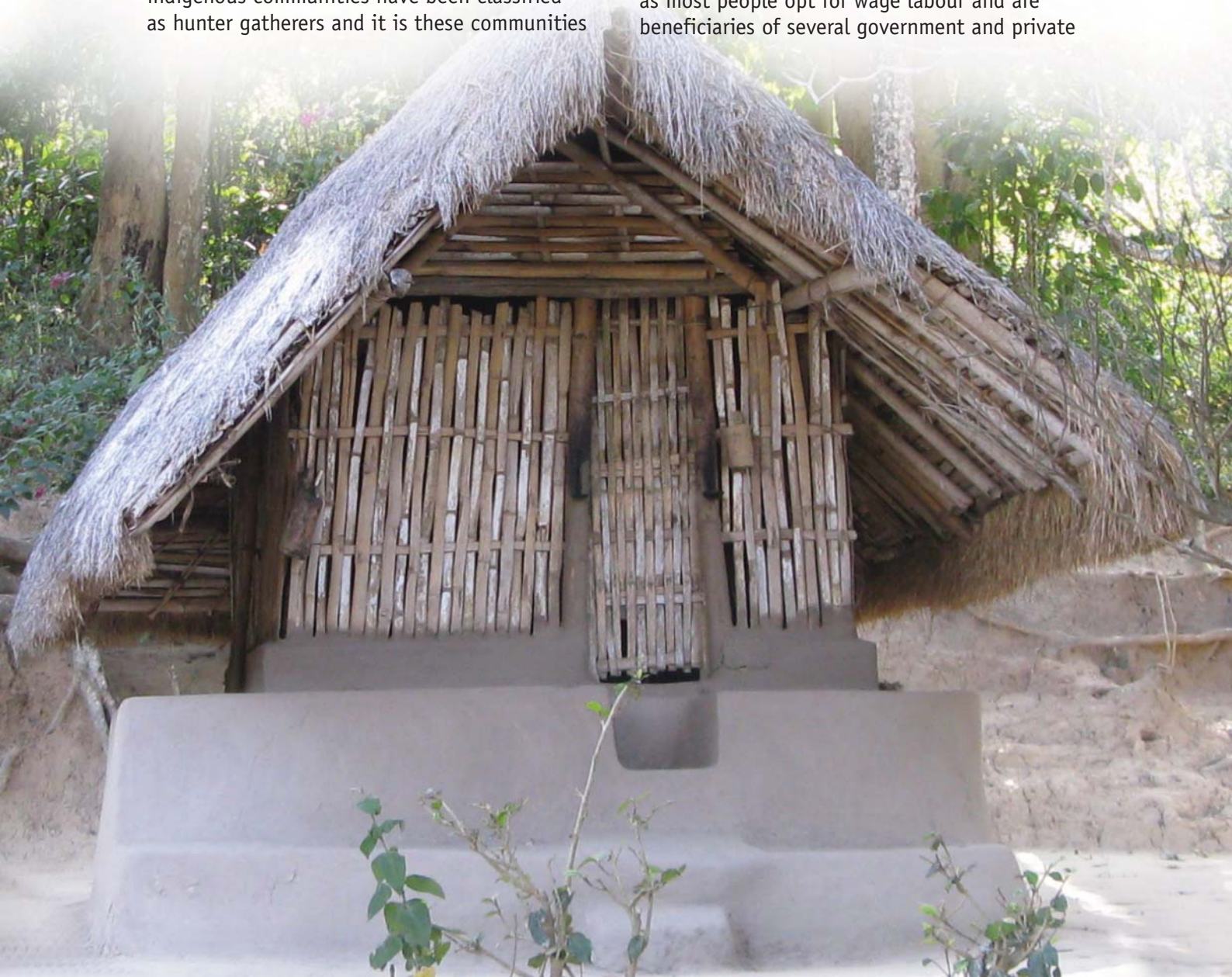
the plains and increased in-migration into the area. The establishment of TANTEA by the Forest Department to secure the livelihood of 2,455 repatriated families from Sri Lanka is an important landmark, as it covers a large 3,734 ha of land (Sekar; 2004). These erstwhile forest areas have been home to indigenous people and this influx of a different community also changed the socio-cultural environment forever in the hills.

Pre Agriculture Communities and Gathering

Of the 36 indigenous communities known to reside in NBR, about 14 have been assessed to have been traditionally involved in the collection of honey, although this is of varying significance in the livelihoods of these different communities. 12 of the 14 indigenous communities have been classified as hunter gatherers and it is these communities

that are particularly active in wild honey and NTFP collection. The other 2 communities, Todas and Paniyas, are respectively pastoralists and agricultural labourers under their Chetti overlords.

Of the sites selected in this project it is interesting to see the dominant presence of these people. They live in forested areas and have a cultural linkage to the forest, besides a direct livelihood benefit. In older times, even as late as the 1960s, these communities bartered forest produce for grain. The system has now changed and in some cases, like the Nilambur site of Mancheri, the Cholanaickens exchange their forest produce for rice, salt, oil, from the co-operative society. As some of the few hunter-gatherers still following their old way of life, these communities depend most of the time on forest produce both for the market and for their own food and medicine. In other adjacent communities like the Kattunaickens, forest dependence has now reduced significantly as most people opt for wage labour and are beneficiaries of several government and private



facilities like hospitals and schools. Likewise, variations exist amongst other communities, depending on location and surrounding environments. Of late, the expansion of estates, plantations and commercial forestry has increased the possibility of getting wage work amongst these communities.

Governance and Impacts

The history of bio-diversity management in the Nilgiri Biosphere Reserve has been chequered. Tamil Sangam texts of about two millennia ago refer to Wynaad and also mention that a Chera monarch sub divided lands for cultivation and granted a sort of tenancy rights to the aboriginals of the area. There is also an 8th Century AD copper plate grant issued by the Ganga ruler, Sri Purusha which mentions Gudalur and the environs as containing lands fit for cultivation of rice and grains, garden lands and forest lands fit for the cultivation of drugs and pepper and fourteen villages. Subsequently, the history of Malabar chiefdoms may also contain a lot of such information on biodiversity management.

A series of historical changes also reflect the governance of the NBR, which moved from a local indigenous system, which had self determination and rights, to a system of management and monetary emphasis which was unfamiliar to the local people of the hills. The current governance also continues to be moving on the premise that increased incomes and infrastructure equals development, whereas for these hill and forest systems new approaches maybe necessary. In conclusion, it may be said that the importance of the Nilgiri Biosphere Reserve is not only bio-geographical, but also socio-cultural and any intervention needs to take this into consideration. An ancient symbiosis and long time relationship that exists between these communities and their specific niche environments, needs to be kept in mind in the NBR. The drawing of the boundaries for the purpose of governance must be sensitive to socio-cultural dimensions and in this case, especially since it concerns a host of indigenous communities.

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(2)

BIODIVERSITY/BEES/ LIVELIHOOD LINKAGES

- (2A) Researching Livelihoods, Beesx
and Biodiversity Linkages
Adam Pain
- (2B) Pollination of cardamom and coffeex
in the Western Ghats of Karnataka –
Need for conserving bees and bee flora
V V Belavadi & C Parvathi
- (2C) Bees of NBRx
Bradbear N, Davidar P, Leo R,
Roberts SPM, Rehel S, Thomas S, Verghese A

(2A) Researching Livelihoods, Bees and Biodiversity Linkages

Adam Pain

Introduction

This research programme on Bees, Biodiversity and Forest Livelihoods (BBL) has set out to build understanding of the inter-relations between three dimensions of the Nilgiri Biosphere Reserve (NBR). First the indigenous people, their honey collection practices in particular and the effects of these on bee populations; second wild bees and their pollination activities, and third, the role and contribution of bee pollination activities to biodiversity. Listing them this way should not be taken to indicate a unidirectional relation – that is from people to bees to biodiversity – reverse causalities are equally plausible.



Previous studies (Keystone Foundation, 2007) have indicated that bees and non-timber forest products (NTFPs) are a resource for indigenous people of the NBR within which the research has been carried out. However the significance, both social and material, and role of these as resources has been far from clear. Equally the bee species from which the honey has been collected have not been scientifically identified or classified, their populations and distribution are unknown and the role in pollination and maintenance of forest biodiversity has not been studied. This research project has therefore attempted to combine participatory livelihood analysis with collection of scientific data about the status of these indigenous bees and their ecology, and

the links of this to biodiversity creation and maintenance.

Interdisciplinary research of this nature raises numerous conceptual and methodological challenges as well as practical ones. Part of the issue is the difficulties that interdisciplinary research faces in dealing with qualitative complexity – that is the enormous spatial and temporal variability of ecological systems in the NBR that are in dynamic flux, and the moving non-linear target of socially differentiated livelihood trajectories. Linked to this the knowledge frameworks that drive different disciplinary practices – from biology to ecology to social anthropology and sociology – are structured with almost mutually incompatible underlying theories, values and methods

that challenge, to put it mildly, cross- (let alone inter-) disciplinary research. Different knowledge frameworks lead to different research models in terms of the definition of the problem, understandings of realities and the research methods and data requirements that are used to investigate the issue, although normative science has a tendency to privilege certain knowledge frameworks over others. Even within disciplinary practice debates rage between methods and approach that draw more on normative scientific method (largely deductive in approach and method) and those that challenge or question the positivist tradition of certainty over facts and measurement. On the practical issues, given the resources and time frame of a research project of this nature - and in every sense they have been modest given the task - the question has been how best can one deploy resources and locate activities to even begin to build understanding of these dynamics and deal with the challenges of inter-disciplinary research?

This paper is a preliminary exploration of some of these issues of method and approach as a basis for explaining the case study approach that the research project has followed. It first briefly outlines some of the theoretical challenges, and then discusses some of the issues of working with different knowledge frameworks relevant to the project's research and the debates within them. This leads to a final section on the site selection processes and a discussion of the ways in which data and understanding generated from each of these sites may contribute towards more generalised statements about livelihoods, bees and biodiversity linkages.

Theoretical Challenges

This research project is fundamentally about the relations between poor people and natural resource management. It aims specifically to build understanding of the significance of biodiversity to the diversified livelihood activities of poor people and the potential effects of indigenous people's activities on the conservation of natural ecosystems. In this sense it is of direct relevance to the broader policy agenda of linking poverty alleviation with biodiversity

conservation. But as Agrawal and Redford (2006) have argued, much of the literature on programmatic interventions e.g. policy responses designed to jointly address poverty alleviation and biodiversity conservation have worked with very limited and simplified understanding of poverty and biodiversity. These assessments have been determined more by what can be measured rather than attempting to investigate the complexity of these dimensions as evidenced by the theoretical literature. Thus poverty has tended to be defined and measured simply in terms of its material dimensions while a focus on income and biodiversity has been characterised in terms of species diversity, often reflected in the presence or absence of indicator species or groups (Agrawal and Redford, op.cit: 29). In addition, these studies have generally paid little attention to history and context and accordingly have offered little scope for generalisation beyond the empirical case study.

As Agrawal and Redford (op.cit: p33) rightfully note, this requires a rethinking of the research agenda. They go on to say:

“What is even more troubling is that if the most widespread and frequently used analytical approaches to understand and document the relationship between poverty alleviation and biodiversity conservation continue to be used, it may not be possible to throw greater light on this relationship. Case study approaches based on



evidence that is collected from a single time period and without careful and systematic consideration of the causal mechanisms at play are ill suited to generate policy relevant insights into the tradeoffs between poverty alleviation and biodiversity conservation.”

They conclude that “new studies will need to focus on the dynamics of the relationships between various measures of poverty and biodiversity, and on how these dynamics are affected by macro-social and political variables such as education, demographic change, levels of unemployment and technological change among others. Without greater attention to change over time, the goal of policy relevant understanding of the relationship between biodiversity and conservation and poverty alleviation is likely to remain chimerical”.

Agrawal and Redford’s analysis relates to the assessment of project interventions designed to reconcile poverty and biodiversity objectives but their questions and research agenda are of direct relevance here. While this research has not specifically used instruments of intervention to explore livelihood-biodiversity interlinkages, it has worked within a context where multiple dynamics are at play,

including the effects of Keystone programmatic interventions.

This research is fundamentally concerned with exploring cause-effect relations and the interactions in a complex system but it also has to work with considerable theoretical challenges. At a general level there are questions of theory and method related to the question of “how you know what you think you know” (Sayer, 1992, 2000). Method is as driven by theory as theory is by method. If these are linked to the challenges generated by complexity theory and chaos in complex systems – and the NBR has to be recognised as an extremely complex system – then certainties about cause-effect relations that are stretched over time and space indicate how difficult it is to know what the variables are and how they interact since measurement at best is only partial.

Uncertainties over biodiversity

Consider for example general ecological theory. There has been a long tradition in ecology that has worked within a normative



framework of ideas of equilibrium and balance, functional order, linear change and homeostatic regulation of systems and stable equilibrium points. These have underpinned succession theory in vegetation, models of population dynamics with their assumptions of definable carrying capacities, maximum sustainable yields and ideal management regimes (Leach et al., 1999). But this normative framework, which still arguably drives much ecological research, is under challenge from an ecological perspective that is concerned more with micro-variability and dynamic changes over space and time, non-equilibrium systems and scale relationships in ecosystem analysis. It also emphasises the importance of history in understand the present status of ecosystem dynamics, a point that is deeply relevant to the NBR.

If one moves more specifically to defining and measuring biodiversity the issues can be explored more specifically. Following Redford and Richter (1998) and Agrawal and Redford (2006) biological diversity can be characterised in terms of its components, the three dimensions of which can be assessed by attributes of composition, structure and function as outlined in Table 1. This table helps identify how it might be possible to find

measures that might indicate potential effects of human activities and use of resources on biodiversity.

But as the table demonstrates and as Agrawal and Redford (op.cit:13) make clear there are multiple dimensions of biodiversity and no one indicator or even several taken together can possibly provide an assessment of biodiversity at even one scale, let alone at another or evidence what the inter-relations might be between different scales. Moreover by selecting and focusing on a single component of the biodiversity – in the case of this research, bee species – it is difficult to argue that this simplification is sufficient to capture the full complexity of biodiversity or be certain of its significance.

Of course there are arguments that can be made, which can less easily be made for more emblematic components of biodiversity such as tigers or other endemic species, about the link between bees and pollination that make the particular case for a critical functional role of bees in pollination and therefore biodiversity maintenance. But to complicate matters further, and as the table indicates, biodiversity in some cases may well be maintained or even encouraged by disturbance regimes that might

Table 1 - Indicators of Attributes and Components of Biodiversity

Attributes / Components	Composition	Structure	Function
Genetic	Allelic diversity	Heterozygosity , Heritability	Gene flow, genetic drift, mutation rate, selection intensity
Population / Species	Species abundance, biomass, density	Population Structure, dispersion, and range	Fertility, mortality, survivorship, life history, phenology
Community / Ecosystem	Relative abundance of life forms, proportions of exotic or endemic species	Spatial geometry and arrangement of patch types	Disturbance regimes, nutrient and energy flows, biomass productivity, patch dynamics

Source: Agrawal and Redford, 2006:13

reduce biodiversity locally but promote it more widely. Thus land clearance and agricultural cropping, both annual and perennial, may support bee populations in terms of pollen and nectar supplies even though it may be detrimental to other aspects of biodiversity.

If one moves one step further to explore the specifics of the ecology of *Apis dorsata* given the seasonal migratory behaviour of the species and its relaxed nesting behaviour in terms of nesting sites (at least outside the NBR) building understanding of cause-effect relations on its population dynamics even within the NBR is fraught with methodological and conceptual difficulties. While it is known that there are marked seasonal fluctuations in honey harvested as evidenced from Keystone experience which is probably indicative of fluctuations in production, the causal factors of this are unknown. Here is a case where long term systematic records of *A. dorsata* nest counts within the NBR could provide insights but such data does not exist.

At a relatively late stage in the research, when the question was asked, because it was identified as potentially a crucial link between honey harvesting and *A. dorsata* populations, 'what is the effect of harvesting on *A. dorsata* on nest survival, subsequent honey production and swarming?' it became clear that much of the basic detail on the direct action of harvesting honey on bees is not available. Much depends apparently on the timing of the harvesting in relation to the life cycle of the bees' nest and the method of harvesting, all of which will affect nest survival, recovery, subsequent swarming and so forth. One could assume the worst – that all honey harvesting is destructive but observational evidence does not support this and contextual factors (weather conditions, pollen supplies etc) might play an equally important role in nest survival and recovery after harvesting. It is conceivable that harvesting through promotion of rebuilding activities could be a stimulant to bee population expansion. In short there are multi-causal dimensions of which we have little understanding.

Uncertainties over livelihoods

Similar questions of method and theory apply to building understanding of livelihoods, and these are developed in a later paper in the conference on Conceptual Issues (Nath et al) and in part relate to the issues covered in the next section. Two points are made here.

The first relates to the use of livelihood frameworks and our understanding of livelihoods. There is much about the standardised sustainable livelihoods framework (SLF) and the way in which it has been applied that is entirely consistent with a neo-classical model of utility maximisation by households and assumes a pervasiveness and persistence of liberalised market relations. The idea that poor households having livelihood strategies carries with it assumptions that they have awareness, choice and freedom of movement, that is very far from the reality in which most poor rural households lead their lives (Johnson & Start, 2001). Many of the rural poor live in contexts



in which assets are far from fully commoditised and where access to assets depends not on 'free' market relations but much more on dependent social relations. As Whitehead (2002) has noted the whole livelihood framework in its neo classical language and its assumptions of market exchange strips context and relations out of people's lives. It is precisely these dimensions that provide the means by which people handle risk and maintain access to resources and institutions (de Haan & Zoomers, 2005). For many of the poor it is the maintenance of dependent patron-client relations that provide the means to their survival (Wood, 2003) in a context where the state fails to provide that security or may be the key source of risk.

Second, and linked to this, much of the discussion on poor people, particularly within biodiversity management has tended to treat collections of people as communities (and in the context of the NBR labelled them as 'tribals' or 'adivasis') with assumptions of them being socially undifferentiated and unchanging – the language of 'forest dependent communities' exemplifies this. Comparative field evidence and theory (and as will be seen in the empirical evidence from this research) points to as much social and economic differentiation within many of these groups of people as between them and others and how they have both shared and conflicting interests according to social and economic status. Further, the language and perspectives towards these indigenous groups has tended to see them as either victims or innocents in the face of wider processes of change and ignores their individual capacities to work against domination, challenge or subvert the processes that act on them to find room to manoeuvre. Thus despite the apparent strictness of Forest rules as to what may or may not be done with forest resources, everyday practices, and the studies on the honey market evidence this, indicate many ways around the formal rules. Thus attention to what people do and how they behave, either within, outside or against the rules of the game is essential.

Despite the widespread perspective of seeing these indigenous people as victims, much of the policy and programmatic response to their poverty has focussed more on the symptoms of their poverty – the lack of

education or health services – rather than focus on the underlying causes that have contributed to their poverty and marginalisation in the first place. While the origins of the marginalisation of indigenous groups are to be found in deeper history, and part of that is British colonial history and its settler culture in the Nilgiris, closely related to that has been Forest policy and the effect that Forest policy has had in reducing indigenous people's endowments (rights) and entitlements (benefits) from forest resources. In the light of this the recent 2006 Act on Recognition of Forest Rights (The Scheduled Tribes and Other Traditional Forest Dwellers Act 2006) represents an attempt to redress one structural dimension of the marginalisation of forest indigenous groups and their loss of endowments and rights through previous Forest Acts. What is far from clear though is how (or even if) and to what extent this Act will actually be implemented in practice. Thus the way the State behaves in practice – whether through the Laws of central government or the behaviour of State Forestry Departments has a critical bearing on the context in which indigenous people lead their lives and the ways in which they utilise forest resources.

This brings us back to the critical issues of risk and vulnerability. Vulnerability and risk within the standard livelihoods frameworks are largely seen as external factors. In part this is a result of the idea of risk being drawn from the natural resources literature and risks or threats being seen mainly in relation to the occurrence of natural resources disasters – of which the 2005 tsunami in South East Asia is a classic example – and therefore random events (to which some element of probability assessment can or cannot be attached) and external to households. Two issues should be stressed here.

First, it is often the poor who are susceptible to risk from threats associated with natural resource disasters because they tend to live in the most risk prone areas – in areas that can be flooded for example. Second, natural resource disasters (floods, frosts, droughts etc) are not the only sources of risks and for many of the poor a key source of risk and uncertainty is actually caused by markets (commodity and labour) in which they are relatively powerless actors. However in drawing its intellectual origins from the natural resources literature, the

idea of vulnerability within the SLF ignores the important factor of human agency or action by others as a significant threat to many. For the poor, risk is a daily feature of life. It is not only just to do with income but also with access to assets (including health) and the ability to deploy what capabilities they have. Uncertainty in the ability of the State to deliver services of health, education and protection is a key risk for many. There is also widespread evidence (see Ellis and Freeman, 2004 for example) that deliberate action by the government and local authorities can be as much a source of risk. As Geoff Wood has put it (2003):

“ the determining condition for poor people is uncertainty. Some societies perform better than others in mitigating this uncertainty. Elsewhere, destructive uncertainty is pervasive. Under these conditions the poor have less control over relationships and events around them. They are obliged to live more in the present and discount the future. Risk management in the present involves loyalty to institutions and organisations that presently work and deliver livelihoods, whatever the longer term cost. Strategic preparation for the future, in terms of personal investment and securing rights backed up by its correlative duties, is continuously postponed for survival and security in the present.”

What Wood is emphasising, and this echoes the point made by Whitehead, is that many of the poor are locked in dependent social relations in order to survive in the present. At the heart of these are unequal power relations and, as many have observed, the SLF is particularly weak in addressing issues of power structure.

There are other areas in the SLF that have brought critical comment including the notion of sustainability and the difficulties and value judgements over its assessment and determination. While sustainability may indeed be a desirable objective, the reality is that for many of the poor they lead lives in which “choices” can only be made for the short term and in many ways these are not choices at all. Such choices may well undermine longer-term welfare. In that sense there is no choice and what characterises their life is livelihood insecurity and emphasis in the SLF on emphasising the opportunities and strengths may lead to an underestimation of the constraints and difficulties under which many of the poor lead their daily lives.

The emphasis on history and time needs to be stressed in building understanding of the livelihoods of indigenous groups. Much of the livelihoods research has classically been cross sectional, based on random or stratified sampling, collecting metric data at one particular point in time and through quantitative and statistical manipulations attempting to infer causalities on what are often more arguably correlations around what can be measured. Such methods, based on large or small scale sample surveys have a role but they are also deeply limited and tell us little about the processes of change and differences between households. For these reasons Murray (2002) has argued strongly for the need for livelihoods research to include a retrospective approach – seeking to reconstruct change over time to be complemented with dispersed but intensive research methods of micro-level field investigation. This research has partly responded to this through investigations of household histories which are reported on later in the conference.

Indeed research on chronic poverty – that is poverty which persists over time and across generations (arguably the condition of many of the indigenous groups in the NBR) - has been built out of the quantitative analysis of household panel data which has followed individual and household economic dynamics over time. This has been linked systematically to qualitative data trying to identify the proximate causes or drivers of rising household prosperity or decline through detailed household recollection of sequenced actions and events that have induced change. As da Corta (2009) notes such studies have provided detailed understanding of the character of poverty or its experience but have provided little understanding on the constraints of poor people’s agency in constructing strategies, how poverty and vulnerability has been created in the first place or of the deeper processes of poverty creation based on unequal social relations generated through economic, social and political structures. In short there is a need to complement understanding of livelihood trajectories with the understanding of the dynamics of social structure and relations and concepts such as class. But it also requires, as with ecological research, attention to multiple levels. Not only is there a need for

both quantitative and qualitative analysis of livelihood change through panel studies but these have to be linked to broader changes in social relations and institutional setting along with their transformation in relation to broader policy and economic trends. Nothing less will do.

This scope of research method and analysis has been beyond the resources of this project and the absence of household panel data, an acute gap in general in the literature of indigenous people and forests, has been partly addressed through the reconstruction of household histories. Equally the attempt to link individual and household changes to broader changes in context – the dynamics of changes in social structures, economic relations and institutional context and how they affect household activities and choices – has been challenging. In part this will be built out of an environmental entitlements analysis (Leach et al, 1999) which will explore changing endowments (rights and resource of indigenous people) and entitlements (the range of benefits derived from environmental good and services) and how these have varied over time and by location. The analysis of the workings of the honey market in part contributes to this investigation as well as an exploration of the changing institutional context, specifically that of Forest Policy and its effects on legal endowments and entitlements of indigenous people.



In summary both the ecological and livelihood dimensions of this research have faced considerable theoretical and methodological challenges: but bringing them together into an interdisciplinary framework has been even more daunting.

Doing Interdisciplinary Research and negotiating Different Knowledge Frameworks

As Bevan (2007) noted with respect to multi-disciplinary collaboration on poverty research there are multiple barriers. These included the cultures of particular disciplines, the patterns of thought and behaviour of disciplines (disciplinary habitus), the histories of research disciplines and research funding policy and practice. Such barriers undoubtedly exist to an even greater extent in research on poverty-biodiversity linkages. However Bevan focussed specifically on the barrier of “conflicting intellectual assumptions which underpin different social science ‘paradigms’ or research models” (Bevan, op.cit: 284) arguing that these were “the most interesting and change relevant”.

This has not been a research project on building multi-disciplinary research in the project’s research area, although the need for such an investigation I think has been self evident from the process of the research. However the analytical framework that Bevan elaborated has been adapted here simply to point out the challenges that exist rather than an attempt to negotiate a way through it. The adaptation (see Table 2) extends to a comparison of social science with science disciplines in the research areas within which the project has been working. It does not cover the style of writing, or ‘rhetoric’ as Bevan calls it, that is particular to the way in which the disciplines write to analyse and persuade. The point to be made is that the way in which biology and ecological science might think about and characterise interlinkages between people and biodiversity are likely to be very different from those of social science. These are debates which the research has yet to engage in.

Table 2 - An Ideal-type depiction of some of the research models on poverty - biodiversity linkages

Question	From social anthropology	Social change	From ecological systems	From biology	From resource economics
Focus: What are we interested in?	Local cultures & meanings; use of resources	Unequal social structures, power, dynamics, access	System & biodiversity resilience	Robust biological models	Institutional Performance
Values: Why?	Agency of poor should be recognized & respected	Redress of inequality and exclusion		Need better knowledge of the biology to inform	Institutions can be made to work better
Ontology: What is the reality we are interested in?	There are different realities associated with different standpoints	Reality exists independent of thoughts but complex, multiply constituted & much unobservable	Reality exists independent of thoughts but complex	One reality exists independent of our thoughts & what is observable is real	One reality exists independent of our thoughts & what is observable is real
Epistemology: How can we know about reality?	Through interpretation of local meanings ..'abductive' research approach	Truth as practical adequacy.. models of mechanisms/ processes through iterative process of conceptualization / fieldwork	Observe through scientific methods (deductive/ inductive) & can establish truths	Observe through scientific methods (deductive/ inductive) & can establish truths	Use mathematical logic.. deductive & observe it.. surveys .. inductive
Theorising	Hermeneutic interpretation ... reflexive	Conceptual frameworks to guide exploratory research , middle range theories	Causal theories through measurement / stat technique	Causal theories through measurement / stat technique	Causal theorizing via mathematical modeling & stat techniques
Research Strategies: How can we establish what is really happening	Data: Ethnography, range of instruments Analysis: interpretation & comparison	Data: Integrated use of surveys, participant observation & protocols Analysis: multiple, discourse analysis	Data: empirical / measurement Analysis : statistical / spatial / multivariate	Data: empirical / measurement Analysis : statistical / spatial / multivariate	Data: secondary Analysis: econometric analysis
Theoretical & empirical conclusions: What kind of conclusions can we draw?	Understanding of people's actions & relationships in cultural context Focus: community?	Identify universal mechanisms / processes; show how they work in different local contexts Focus: interactive .. person, household, community, country	Relations between ecological variables / robust models Focus: the ecological system & its inter-relations	Relations between biological variables / robust models Focus: the biological subject & its inter-relations	Descriptive stats using economic variables Explanatory: identification through regression analysis Focus: Resource / Constitution

Site Selection Processes

The use of Case Study Sites

The research approach that the project has followed is essentially a case study one with cases selected as points of contrast between different social groups, potential importance of NTFPs in their livelihoods, linked to relative 'remoteness' and different agroecological settings. There is a tradition at least within the sciences of following random selection procedures with random or stratified sampling to avoid systematic bias in the sample and seeking appropriate sample sizes to enable generalisation. As noted in the previous section, data collected from such an approach is largely quantitative. Theorising about causalities is largely based on mathematical modelling and statistical techniques and explanation is provided through the detection of regularities derived through regression analysis. This is not the approach

that this project has followed, but and this is emphasised, this is also not a rejection of quantitative methods.

In part the reason for not following such an approach responds to the issues raised in the earlier part of the paper about qualitative complexity and uncertainty. There is so much variability, both social and ecological, within the NBR that the research specifically needed to maximise the information that it could gain in order to tease out deeper causalities. Further it needed to select study sites which would tell different stories about potential causal relations between livelihood, bee and biodiversity linkages. What was hoped was that the case study sites would capture the maximum variation that might exist in terms of the role of NTFPs in indigenous livelihoods, thus allowing the building of site specific stories around the potential interactions. Indeed the selection process of sites appears to have been successful – there is one site where indigenous livelihoods



are entirely dependent on NTFP income sources (NM – see Table 3) and there are two where NTFP contribute nothing to household incomes (ChB and KT).

A more general comment needs to be made about case study research. First it is not a rejection of large random surveys or questionnaire surveys and the use of quantitative analysis with these. Such research is important and is needed to understand the significance or presence of certain phenomena and how they vary across larger populations or scales. Such approaches provide breadth but they do not provide depth. Given a quantitative complexity and the theoretical uncertainties discussed above, the need for detailed case studies to build understanding and theory is essential and if we are to make any progress in building understanding of the links between indigenous people and biodiversity, this can only be built out of good case studies.

Site Selection Process

The project purposively selected case study research sites in order to capture contrasts of biogeography, the distribution and honey collection practices of the major tribal groups as well as respond to practical and strategic considerations of coverage across the three Indian states (Tamil Nadu, Karnataka and Kerala) that are contained within the NBR .

With respect to the biogeography, the selection process drew on available information on the distribution of the seven major vegetation types within the NBR, their distinctive distribution by state and recognition of considerable micro-level variability due to variation in altitude and localised water resources. In terms of biodiversity there appears to be little systematic data on comparative biodiversity richness by vegetation type within the NBR so vegetation type were used as a proxy, on the basis of the wetter regions might be expected to be more biodiversity rich although it is recognized that this is a very crude measure. This was complemented by field observations and assessments by Keystone staff on the indicative presence and relative abundance of bee species by vegetation type. This indicated some degree of association of bee species by vegetation type – for example *Apis cerana* with grassland and shola and

distinctive bee species mix by vegetation type – which field data should now be able to corroborate or challenge.

Drawing on the known distribution of indigenous groups and their reported honey collection practices (by species of collection) a mapping exercise, again largely drawing on observation and field experience of Keystone field staff allowed an identification of patterning of community by vegetation type by bee species. Finally a comparison was made of the management divisions operated by the three State Forest Departments across the NBR. Management divisions where National Parks are located are areas where in theory honey harvesting activities do not take place and where gaining research permission is also difficult. Logistical issues and questions of accessibility as well as of questions of balance across the states finally reduced the potential 13 divisions across the NBR to seven divisions and from these five research BBL locations, four of which cross the Forest Divisions were identified within which the research sites should be selected.

Finally, within the five locations a process of selection of research sites was initiated. Research sites are defined as places where the following activities were carried out:

- **Studies and sampling of bees and vegetation in one hectare plots;**
- **Livelihood studies in villages located near the plots including the assessment of honey collection practices;**
- **Additional studies on bee nest densities in the vicinity of the research plots.**

Sixteen research sites were selected in total across the five locations (see Table 3). Three ranked criteria were used in their selection. First the distribution of sites had to be proportional to the vegetation cover within the location, second indigenous communities who used the resource of the areas and contained honey collectors had to be located adjacent to the site area (but no closer than 500 m for reasons of disturbance) and third the research plot had to be close to a water source (for bees to visit these areas).

Table 3 - BBL Location, research sites, adjacent indigenous community and vegetation inside the research plots (vegetation surrounding the research plots)

BBL Locations (Forest Divisions & States)	Code	Indigenous Community	Altitude m.a.s.l	Vegetation
Chamrajnagar	ChB	Sholiga, Kannadiga	1304	SEG (DDF)1
Chamrajnagar & Satyamanagalam MD in Kerala & Tamil Nadu	ChG	Sholiga	1256	SEG (MDF)
	ChK	Irula	1250	SEG (MDF)
	ChP	Sholigas, Kannadiga 2, Badaga 3	1013	DDF (DDF)
Coonoor				
	CM	Kurumba	1094	SEG (DDF)
Nilgiri North & Coimbatore, Tamil Nadu	CP	Kurumba	890	SEG (MDF)
	CS	Irula	582	DDF (DDF)
Kotagiri				
	KB	Toda	1831	Shola (grasslands)
Nilgiri North, Tamil Nadu	KK	Toda, Others 4	1665	Shola (Cultivation)
	KT	Badaga, Others	1500	Cultivation
Mudumalai/Sigur				
	SB	Kattunaicken	936	MDF (MDF)
Mudumalai & Nilgiri North, Tamil Nadu	SC	Kasava/Irula	877	DDF (DDF)
	SS	Kasava/Irula/Jenu Kurumba	875	DDF, Riverine (Scrub)
Nilambur				
	NA	Kattunaicken, Paniyas	198	MDF (SEG)
Nilambur North & South, Kerala	NM	Cholanaicken	258	MDF (MDF)
	NMu	Padinaickens, Paniyas	96	DDF (MDF)

Legend

- 1 The vegetation type inside the plot is identified and vegetation adjacent to the plot is given in brackets. SEG - Semi-evergreen, MDF – Moist Deciduous Forest, DDF - Dry Deciduous Forest, EVG – Evergreen, Others – agricultural land;
- 2 Kannadigas are the residents of Karnataka state and have been living in the mentioned villages along with indigenous groups.
- 3 Badagas are the single largest ethno-linguistic population in the Nilgiri Biosphere Reserve and one site in which they are present has been selected for comparative purposes.
- 4 Others refer to those who were settled in the Nilgiri district since the coming of the British or those who have populated the district since the advent of the British. These would also include those who have been recently settled following the ethnic conflict in Sri Lanka.

Conclusion

As will be evident this is a paper in progress, written somewhat before the event in that the stories told by the biological and social data and analysis have yet to be put together. That in part is the purpose of this conference. But hopefully the issues that this paper has raised will inform that discussion and contribute to a more open inter-disciplinary discussion that recognises that there are many routes to knowledge and the task is to accept that different knowledge frameworks tell different stories about the same phenomena. We need to listen to them.



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(2B) Bees of NBR

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1. Introduction - Relating the bees of NBR to the wider Indian, Asian and global picture

In 1999 the Convention on Biological Diversity (CBD) identified the service provided by managed and wild populations of pollinators, of which bees are the most significant, to be threatened (<http://www.cbd.int/agro/pollinator.shtml>), with the increasing concern reflected by further special initiatives such as the recent International Initiative for the Conservation and Sustainable Use of Pollinators (CBD, 2008). Meanwhile, the world's beekeeping sector is in accelerating crisis, with significant declines in some honey bee populations (Cox-Foster, 2007). This has consequences for the pollination ecology

of natural habitat as well as the pollination of crops of which bees are key pollinators, with the total economic value of pollination estimated to be 153 billion, representing 9.5% of the value of the world agricultural production used for human food (Gallai, Salles, Settele, & Vaissière, 2009), with consequences also for honey and beeswax production. This Darwin Initiative Project in NBR is timely because the Asian honey bee species that are relatively little known beyond their localities may in the future play a much wider role within the apiculture sector. However, these indigenous honey bee populations are probably already threatened by

loss of habitat and excessive hunting pressure (Oldroyd & Wongsiri, 2006). This Project set out to determine basic understandings of the bee species and their populations in NBR.

The vital role of bees in maintaining biodiversity by pollinating flowering plants is rarely observed by non-specialists and not always understood by farmers. Produce such as honey and beeswax that are harvested from bees are valuable, yet the value of this produce is insignificant compared with the role of bees as pollinators. Nevertheless, throughout human history bees have been kept primarily for their produce. Significant volumes of harvestable





products are stored only by species of bees that live socially, and therefore it is bee species with greatest sociality, living in large, permanent colonies, that have been best known and utilised by us as sources of honey, beeswax and other products of bees' nests. (Where there were no species of honey bees or stingless bees, the very tiny stores of honey stored by bumble bees and honey ants have been harvested.) Bees with the necessary honey-storing characteristics belong either to the subfamily Meliponini that contains several genera of stingless bees, or to the single genus *Apis*, the honey bees, and these were the bees studied by the Project.

2. Diversity of *Apis* in Asia

Bees and flowering plants have evolved during a period of 130 million years to become increasingly dependent upon one another (Engel, 2001). Today there are 20,000 - 30,000 species of bees of which around 16,000 have been scientifically described (Michener, 2000).

Ancestors of honey bees emerged 40 million years ago, with a modern type of open nesting species appearing in south east Asia around 10 million years ago (Engel, 1999). Subsequently species that nested inside cavities appeared, eventually spreading throughout tropical and temperate Asia and into Europe. These European bees became isolated from the Asian species as desert developed in the Middle East, and evolved into the species that we know today as *Apis mellifera*, with an indigenous distribution stretching from the Arctic Circle to South Africa, and with eastern limits of the Ural Mountains in the north and the central deserts of Afghanistan in the south (Ruttner, 1988). The cavity-nesting bees in Asia evolved into *Apis cerana* and the several other cavity nesting species of *Apis* known today. The open nesting species gave rise to the several types of open nesting species existing today, with none of this type outside Asia. Thus, Asia has a diversity of *Apis* species, while Europe and Africa have just one species. However, it is this single species, *Apis mellifera*, upon which the world's industrialised beekeeping sector is based.

Table 1 - Apis species

Honey bee species whose nests consist of multiple combs (cavity nesting honey bees)	Natural distribution	Exotic distribution
<i>Apis cerana</i>	Asia	Solomon Islands
<i>Apis koschevnikovi</i>	Asia	
<i>Apis mellifera</i>	Europe, Middle East, Africa	Introduced throughout the Americas, Asia, Australasia and Pacific regions
<i>Apis nigrocincta</i>	Asia	
<i>Apis nuluensis</i>	Asia	
Honey bee species whose nests are single combs	Natural distribution	Exotic distribution
<i>Apis andreniformis</i>	Asia	
<i>Apis binghami</i>	Asia	
<i>Apis breviligula</i>	Asia	
<i>Apis dorsata</i>	Asia	
<i>Apis florea</i>	Asia	Sudan
<i>Apis laboriosa</i>	Asia	

3. Meliponini stingless bees

This subfamily contains genera of stingless bees found mainly in tropical areas of Africa, America, Asia and Australia. In all of these regions, people have traditionally harvested products from the nests of these highly social bees that live in perennial colonies. Before the introduction of *Apis mellifera* to the Americas and Australasia, stingless bees provided sources of honey, and are still kept and managed by beekeepers in many countries, notably in Central America.

4. Problems with global apiculture

The world beekeeping industry trades around 1.2 million tonnes of honey per annum, with about half of this exported on to the world market by countries such as Argentina, China and Mexico. This is a globalized industry, based on just a few races of just one species of honey bee (*Apis mellifera*), together with standardized technology that suits this bee. This sector is now in crisis in some countries as bees succumb to diseases, parasites and predators that man has spread around the world while transporting bees from one area to another. In 2007, the media highlighted news that beekeepers throughout the USA

were experiencing a dramatic spate of sudden honey bee colony losses. As often happens, this created media exaggeration ranging from 'Bee AIDS' to the extinction of mankind as a consequence of the loss of honey bees. The condition - now named Colony Collapse Disorder (CCD) has been familiar to beekeepers in Europe during the last ten years or so. No single cause has been identified; rather it is believed that the collapse of colonies arises as a result of the various honey bee pathogens that are now widely distributed (for example the predatory mite *Varroa destructor*), the viruses they carry, the use of neonicotinoid insecticides, combined with the stress caused to bees by intensive, industrialised beekeeping methods (Schacker, 2008).

The effect of this crisis has two outcomes that are relevant to the work of this Project. Firstly, that scientists are having to address concerns for pollination, with fresh research endeavours being made to assess the role of pollinatory bees other than *Apis mellifera* for world crop pollination (Kremen, 2007). Secondly, not only are global volumes of honey threatened by the loss of colonies, but also the quality of honey supplies are affected as world honey markets increasingly screen bee products, especially honey, for the presence of chemical residues. The residues most likely to be present in honey are due to the use of medicines to treat honey bee diseases, introduced during some form of honey bee management, or from environmental pollution. Residues detected in honey have included aminoglycosides, tetracycline, streptomycin, sulphonamides, chloramphenicol, naphthalene and many others. The presence of traces of any residue can have significant consequences, for example, in February 2002, the world honey market was strongly affected by an EU ban on Chinese honey, following the identification of antibiotics in samples of Chinese honey. Since China was Europe's largest supplier of honey, this immediately led to a shortage of honey meeting EU criteria, and world honey prices increased rapidly. This demand for residue-free honey opens opportunities for honey producers in the poorest countries, which also benefit from low labour costs, maybe have excellent resources of bees and habitat for their survival, and where it is often the more poor and remote people of these countries with few other

livelihood options, who practise beekeeping. It is in these parts of the world, such as shown well within NBR, that honey bees remain relatively disease free, environments are relatively unpolluted, and people have potential to harvest honey and beeswax that are of excellent quality. Because these products are residue-free, they could achieve good prices on developed markets, assuming they meet the import criteria necessary to gain access. However, these products are being harvested from wild populations of bees, and the sustainability of increased harvest is unknown.

5. The apiculture sector in Asia

5.1. Asian honey bee species

Little is known about the ecology of Asian honey bees, and indeed, it is only comparatively recently that there has been acceptance of the existence of more than three Asian honey bee species: authorities as late as 1988 (Ruttner, 1988) still described only three Asian species. Today at least eight Asian species are recognised, and may be identified according to bee size, nest architecture and known distribution patterns. Globally, little is known about the naturally occurring population densities of any honey bee species. While a number of studies have researched natural forest nesting of *Meliponini*, summarised in (Kajobe & Roubik, 2006) far less has been done, worldwide to determine the natural nesting density of *Apis* species. Asian honey bees nest in one of two distinct ways, described as open or cavity nesting, as shown in Table 1, and this has implications for the way they are utilised by humans.

Open nesting species

These species include the so-called giant honey bees (e.g. *Apis dorsata*, *Apis laboriosa*) that build a large, single comb in the open. This may be suspended down from a cliff (as commonly found in NBR), beneath a tree branch, or human made structures – *Apis dorsata* is commonly seen in urban and peri-urban areas nesting on office buildings, under bridges and water towers. (Whether such nesting on buildings reflects a lack of natural

nesting sites is unknown.) There are also so-called little honey bee species (e.g. *Apis florea*, *Apis andreniformis*) that also build a single comb, but build it enclosing the branch (rather than just suspended from underneath it).

Colonies of these open nesting species aggregate; for example it is possible to find more than 100 colonies of *Apis dorsata* nesting from the branches of a single tree (Saville, 2002). It has been shown that *Apis dorsata* colonies return annually to the same trees following their migrations (Oldroyd, Osborne, & Mardan, 2000), with the same colonies returning to the same sites (Neumann, Koeniger, Koeniger, Tingek, Kryger, & Moritz, 2000) (Paar, Oldroyd, & Kastberger, 2000). Other species of open nesting *Apis* have been shown also to nest in aggregations, for example *Apis florea* (Rinderer, Oldroyd, de Guzman, Wattanachaiyingchareon, & Wongsiri, 2002), and *Apis laboriosa* (Roubik, Sakagami, & Kudo, 1985).

Cavity nesting species

These bees (e.g. *Apis cerana*, *Apis koschevnikovi*) are individually intermediate in

size between the large and little honey bees, and nest with multiple combs inside a cavity, which may be a hollow tree, a cave, or a cavity in a wall or in the ground. The acceptance to live inside a closed space means that they can be kept inside a human-made container, otherwise known as a hive. The presence of multiple combs means that those combs containing honey can be removed without harming combs containing brood, and these features make these species (like *Apis mellifera*) appropriate for management, leading to the craft known as beekeeping.

5.2. Asian stingless bee species

Stingless bees are social insects living in large, permanent colonies that store honey to survive dearth periods, but generally in smaller volumes than *Apis*. World-wide there are around 50 times more species of stingless bees than *Apis*. While their biology and behaviour resembles honey bees to some extent, they differ in biologically significant ways. All stingless bee species are cavity nesting and therefore can be kept in human made containers.



5.3. Use of Asian honey bee species

Before the introduction of *Apis mellifera*, honey and beeswax in Asia were obtained from the indigenous species mentioned above. How bees are utilised by humans depends upon the bees' nesting behaviour: open nesting bee species can be exploited only by honey hunting, while cavity nesting species can be hunted as in honey hunting, or kept in a container owned by a human, i.e. beekeeping.

Honey hunting

Honey hunting is the taking of nest contents of any species of bees, from which are obtained honey, beeswax and maybe bee brood. It is an ancient tradition, providing early humans with a sweet food - honey. The oldest known rock paintings of honey hunting in Asia are in Uttar Pradesh, India (Gordon, 1960), and date from around 6,000 BC. These paintings depict easily recognisable *Apis dorsata* colonies being hunted from cliffs and trees, much as happens today. Mathpal writing in 1984 mentions that the paintings were in rock shelters where *Apis dorsata* were still nesting (Mathpal, 1984). This ancient practice has enabled traditions to develop such that honey, bees and honey hunting occupy a place in many Asian cultures, and these have been well described (Crane, 1997), (Crane, 1999). Honey hunting is not devoid of any management practices, as in some places honey hunters prepare nesting sites for incoming swarms, for example the 'rafter beekeeping' in the Melaleuca forests of Vietnam (Chinh, Minh, Thai, & Tan, 1995), beekeepers provide artificial nesting places for *Apis dorsata*: this makes harvesting of the combs convenient and easy. While the beekeeper has ownership and provides some care for the colony, the colony is still living entirely as it would in the wild. Other examples of keeping *Apis dorsata* on rafters have been described from Cambodia (Jump & Waring, 2004), Indonesia (Mulder V., 2001) and in India, in Little Andaman Island (Mahindre, 2000).

Today large volumes of honey are still obtained in Asia from honey hunting. Honey hunting of *Apis laboriosa*, a honey bee species that nests at high altitudes, is practised in the

Hindu Kush Himalaya region. Honey hunting of *Apis dorsata* is practised throughout its distribution range: from Pakistan in the West to the Philippines in the East. Honey hunting of cavity nesting *Apis cerana*, *Apis koschevnikovii*, *Apis nuluensis* and *Apis nigrocincta*, and the 'little' honey bee species *Apis florea* and *Apis andreniformis* is practised wherever they occur. Indeed, in Nepal and Malaysia tourism based on viewing traditional honey hunting has taken off.

Tending of nests in cavities

This practice describes the ownership by a human of a bee colony that is nesting inside a tree or another cavity, and represents a practice intermediate between honey hunting and beekeeping. It could be described as 'tree beekeeping' or 'bee having'.

Beekeeping

This means keeping bees inside human made containers and confers a number of advantages, such as the possibility for clear ownership, to harvest honey easily and conveniently, to manage the bees to some extent and feed them in dearth periods. All the Asian cavity nesting bee species listed in Table 1 are kept this way, and stingless bees are also kept in hives (variously made from logs, coconut shells, baskets or other local materials) throughout Asia. In temperate areas of Asia, the possibility to manage the temperate zone races of *Apis cerana* (that are much less prone to swarming and absconding than tropical races of the same species), and the lack of open nesting bee species in some of these areas, meant that beekeeping in hives became the most commonly practised form of beekeeping. In tropical areas, where open-nesting species are abundant, both honey hunting and beekeeping in hives are found, although the latter may be considered slightly less common.

5.4. Sustainability of apicultural practises

Witnessing honey hunting in many areas of Asia it is common to see large numbers of bees killed with burning brands (Valli, 1998), (Buchmann & Cohn, 2007) and whole colonies destroyed. There is no data available on the

population sizes of any Asian honey bee species, and we do not know the impact of honey hunting upon these populations. Efforts have been made to encourage honey hunters to harvest during day time and without destroying the whole colony: i.e. to harvest only comb containing honey and leave comb-containing brood intact, for example, (Mahindre, 1983). However, care in harvesting honey comb is easier to discuss in the classroom than it is to achieve in practice. In many areas, honey hunting has increased with increasing human population, and this combined with a loss of large trees for nesting of bees. The loss of large trees makes it more difficult for bees to find secure nesting places: when they nest in smaller trees, they are easier to locate and to take the combs. We do not know the effect of decreasing tree habitat and increasing human population pressure on honey bee populations, although other authors have concluded that honey hunting of *Apis dorsata* probably is not sustainable (Oldroyd & Wongsiri, 2006). We are not aware of any study to determine the sustainability of honey hunting.

5.5. Introduction of *Apis mellifera* to Asia

Until the 1980s, commercial honey and beeswax production in Asia was based exclusively on the honey bee and stingless bee species described above. Throughout the late 19th and 20th centuries, people had endeavoured to introduce European honey bees to various countries in Asia, without success. During the past 30 years or so, beekeeping industries based on *Apis mellifera* have developed in Asia, such that *Apis mellifera* is now present in every Asian country and industries are based on many millions of colonies. However, with *Apis mellifera* in crisis due to CCD in several world regions (and reportedly present in Taiwan), and with the difficulties of keeping these exotic bees in regions where there are several indigenous bee species with numerous associated predators, questions must surround the long term sustainability of industries based on exotic *Apis mellifera* in Asia.

The effect of this abundance of *Apis mellifera* colonies on the viability of Asian honey bee species is unknown, although some authors have speculated that there must be competition for forage resources (Verma, 1991).



Table 2 - Numbers of Apis mellifera colonies in Asia

	1984	1994	2004	2008
Afghanistan	20,000			75,000
Bangladesh	0		present	
Bhutan	0	50	present	
Brunei		0		
Burma	2,000	2,000+	5,000	
Cambodia	.		present	
China	4,000,000	6,800,000		20,000,000
Hong Kong		100+		
India	3000	80,000		1,750,000 (rough estimate)
Indonesia	1000	31,000		
Laos		present		
Japan	284,000	225,000		180,503
Malaysia	<500	present		
Nepal	2	1,000+	10,000	24,000
Pakistan	1,000	14,000		275,000
Philippines	2,000	6,000		20,000
Singapore		present		
South Korea	280,000	300,000	790,000	
Sri Lanka	4	not permitted		
Thailand	30,000	100,000	300,000	
Vietnam	16,000	70,000	470,000	

3 Paul Molga, *La mort des abeilles met la planète en danger*, Les Echos, 20 August 2007.

4 Honey bees in Jammu & Kashmir State have been infested by the Korean haplotype of Varroa. The impact has been devastating with 80% of the honey bee colonies in the State destroyed during October to December 2005, with irreparable loss to bee farmers. Colonies in the neighbouring States of Himachal Pradesh, Punjab, Rajasthan, Uttaranchal and Uttar Pradesh have also been infested (Khushu, 2006).

5 Data compiled from reports held at Bees for Development, UK.