

Chapter 1

Commodification of Nature on the Plantation Frontier



Noboru Ishikawa and Ryoji Soda

Abstract The studies in this volume provide an ethnography of a plantation frontier located in the Kemena and Tatau river basin catchment in central Sarawak, Malaysian Borneo. Using a transdisciplinary approach that draws on the expertise of both natural scientists and social scientists, the key focus is on the commodification of nature that has turned the local landscape into anthropogenic forests. Looking into the interfaces between capitalism and the natural system, we document and analyse the transformation of a space of mixed landscapes and multiethnic and multispecies communities, for the most part driven by trade in forest products, logging and the cultivation of oil palm. How have new commodity chains emerged while older ones disappeared? What changes are associated with such shifts? How are material cycles and food webs altered as a result of large-scale land-use change? What are the relationships among these three elements—commodity chains, material cycles and food webs? Attempts to answer these questions lead us to go beyond the dichotomy of society and nature, and enable us to uncover complex relational entanglements of the two worlds abruptly and forcibly connected by human-induced changes.

Keywords Sarawak · Plantation frontier · Tropical biomass society · Commodification · Anthropogenic forests

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N. Ishikawa (✉)

Center for Southeast Asian Studies, Kyoto University, Kyoto, Japan
e-mail: ishikawa@cseas.kyoto-u.ac.jp

R. Soda

Graduate School of Literature and Human Sciences, Osaka City University, Osaka, Japan
e-mail: soda@lit.osaka-cu.ac.jp

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1.1 An Ethnography of the Plantation Frontier

This volume is a multidisciplinary ethnography of a plantation frontier. We document and analyse the commodification of nature that has turned the local landscape into anthropogenic forests in central Sarawak, Malaysian Borneo. The primary catalysts transforming the web of life in this part of the tropics are forest produce trade, logging and, more recently, the cultivation of oil palm in plantations and by small-holders. We formed a multidisciplinary team of researchers that was able to transcend the boundary between the social and natural worlds, as well as the human and non-human. With our strength in empirical fieldwork and capacity to collectively uncover complex relational entanglements, we present a study of an emergent and compelling resource frontier landscape in maritime Southeast Asia.

The project that has resulted in this book involved the collaboration of researchers specialising in anthropology, geography, Southeast Asian history, global history, area studies, political ecology, environmental economics, plant ecology, animal ecology, forest ecology, hydrology, ichthyology, geomorphology and life-cycle assessment. From 2010 to 2014 researchers engaged in individual fieldwork as well as collaborative sub-projects in a basin catchment composed of two riverine systems, the Kemena and the Tatau in Bintulu Division, central Sarawak.

The basin catchment represents a space of mixed landscapes and multiethnic and multispecies communities. Our research conceptualises the riverine basin as a unitary social field. The space constitutes an organic whole—penetrated, connected and structured by a major stream axis as well as a number of its tributaries. These tributaries function as corridors for two-way traffic, for instance for the downward movement of labour and commodities to coastal and international markets and the upward movement of state development policies into the interior. By conducting multisited fieldwork in this unitary yet inherently heterogeneous socio-ecological space, we explore a microcosm of Sarawak society along three broad trajectories: the changing nature of the environment; multispecies interactions; and multiple socialities based on both industrial capitalism and the natural economy such as hunting and gathering and swidden cultivation.¹

The project examines multifarious dimensions of change in a tropical region that has historically been deeply connected to both local marketplaces and international markets. They are the interfaces between capitalism and the natural system. We investigate a number of pressing questions. How have new commodity chains emerged while older ones disappeared? What changes are associated with such shifts? How are material cycles and food webs altered as a result of large-scale land-use change? What are the relationships among these three elements—commodity chains, material cycles and food webs?

¹ Scant attention has been given to such locales in the ethnography of Borneo, as researchers have been more concerned with the study of a single village community, an ethnic group, or a specific ecological niche. This study is thus an attempt to reformulate the unit of analysis to better comprehend the socio-ecological dynamic by shifting its reference away from closed units and expand it in time and space.

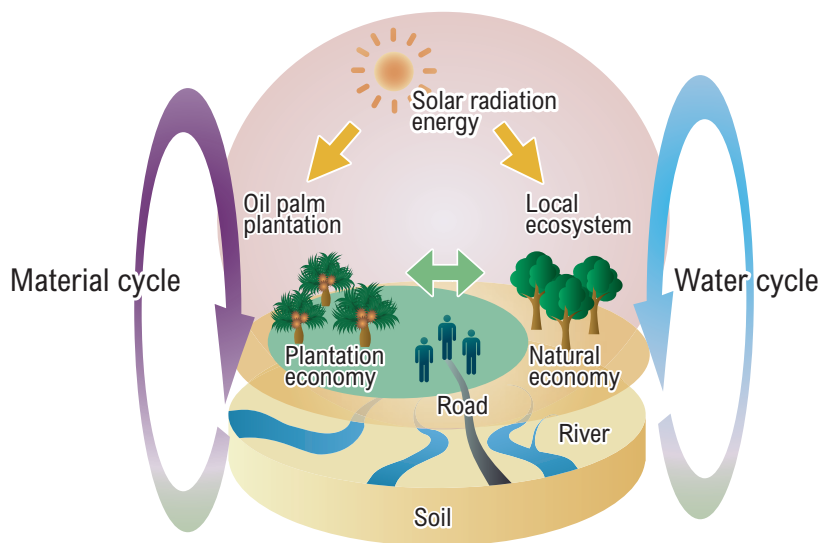


Fig. 1.1 Social and natural systems

Attempts to answer these questions lead us to go beyond the dichotomy of society and nature (see Fig. 1.1). The relations between the two worlds that have been abruptly and forcibly connected by human-induced change are the mainstay of our empirical inquiry. We look into multifaceted agents and drivers of change. We then track their flows and movements across social and natural systems, which are located within a local ecology yet part of a larger social milieu. In addition to humans, the focus of conventional ethnography, we attend to such mobile factors as energy, stream water, chemical components, mammals, birds, commodities, labour and capital.² Our attention to movements and flows also takes us to the interfaces of social space and the physical landscape. We scale up and down the units of analysis—from household, longhouse community, region, nation state and to the Global North, as well as from patches, landscapes and to spheres. This enables us to comprehend how the constituent parts of a system are related and distant places linked.³

Natural scientists deal with moving thresholds among mosaic landscapes, such as peat swamp forests, secondary forests, culturally preserved communal forests, swidden fields, reduced-impact logging sites and oil palm plantations. Social scientists look into changing boundaries between plains and hills, maritime and terrestrial domains, and urban and rural social formations in order to unveil the fundamental reconfigurations, adaptations and casualties at a plantation frontier. In

²For studies of transnational flows and movements of various social agents of change, see Ishikawa (2011).

³The diverse nature of our field research is closely related to our research agenda where we intend to cover *shinra banshō* (森羅万象)—*all things in nature*, literally meaning ‘all-covering forests and ten thousand things’.

the field sites, we asked a series of questions for closing the nature/society divide. Some questions are addressed so as to envision the ways in which local communities, both human and non-human, are connected to the outside world.

- How do animals choose migration routes in and outside anthropogenic forests?
- How do biodiversity hotspots connect communities beyond their local ecology?
- How do new systems of agrarian production affect hydrologic cycles?
- How does the terrestrial road network change the movement of people?
- How does a rural–urban continuum emerge out of new flows of labour and capital?
- How are food webs articulated with regional and global commodity chains?
- In what ways do the plantation and local peasantry influence climate change?

In order to integrate such broad fields of inquiries and their findings, we seek a strategic combination of field sciences. The natural sciences deal with material flows, such as water, gases and minerals, that are physical and biological processes at work, in and out of anthropogenic forests. Meanwhile, the social sciences look into the articulations and disarticulations between the natural economy and plantation economy, the effects of road networks linking the interior land to cities as well as hills and plains. Attention to commodity chains also uncovers the reconfiguration of local–global relationships. All of us have made a deliberate attempt to work outside our own disciplinary comfort zones. In so doing, social scientists seek perspectives that go beyond the conventional human and non-human divide, while natural scientists go beyond *in situ* analyses of ecosystems and embrace historical perspectives.

1.2 River, Forest and Trade

We situate our research site in a riverine basin consisting of two river systems—the Kemena and the Tatau (Figs. 1.2 and 1.3). The basin is formulated in a triangular area carved out by the South China Sea, and the Rejang and Baram rivers.⁴ The Kemena is the fourth largest basin with an area of 6105 km² and the Tatau is the fifth largest with an area of 5260 km² among the 21 river basins in Sarawak. We place special focus on the two tributary systems, where a variety of ethnic groups and diverse fauna and flora occupy a niche peculiar to their webs of life. The majority of social groups officially acknowledged by the state government of Sarawak can be found in the Kemena and Tatau basin catchment, making it a microcosm of Sarawak and widely representative of its ethnic composition and society at large. The basin is also one of the few remaining biodiversity hotspots in maritime Southeast Asia.

Historically, the Kemena and Tatau rivers have functioned as important social hubs for local communities (Langub and Ishikawa 2017). The river basin is the locus of economic exchange, information networks and kinship ties. Despite cultural

⁴For a social history of Rejang basin, see Fong (1996).

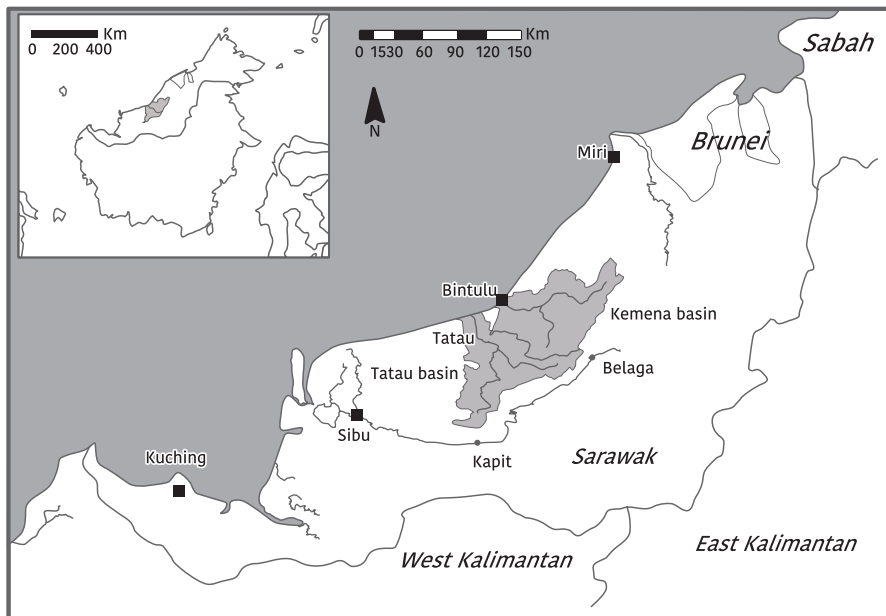


Fig. 1.2 Central Sarawak, Malaysia

differences, members of these river-based groups have a shared awareness of the strength and value of these interactions. River-based commons not only constitute a spatially specific geo-ecological unit but also a historically inscribed space where people's memories, social interactions, and conjugal and consanguineal ties accumulate to construct a historical memory and consciousness.

Contrary to the popular image of an out-of-reach hinterland in a dense tropical jungle, the riverine society under study has been connected to world commodity markets for generations. Under Brooke colonial rule (1841–1946), as a British Crown colony (1946–1963) and within the modern Malaysian nation state since 1963, local communities have been closely articulated with trading networks that derived from the extensive Chinese cultural complex in Asia as well as the West-cum-Global North. Abundant forest produce has been highly valued in both regional and international commodity markets (Ishikawa and Ishikawa, Chap. 6). The linkages to transnational commodity chains have long provided diverse income sources for local people (Ishikawa et al. 2013). The need to produce and store resources through settled agriculture has never been acute. Local communities have maintained multifaceted livelihood strategies, combining various modes of subsistence rather than solely depending on perennial cropping regimes with land ownership. People have, at different points in time, engaged in swidden cultivation, foraging, forest produce extraction and trade, crop cultivation during boom periods, wage labour (at logging camps and offshore oil fields) and so on (Soda 2007; Ishikawa 2010). By maintaining diversified economic portfolios, communities have upheld a

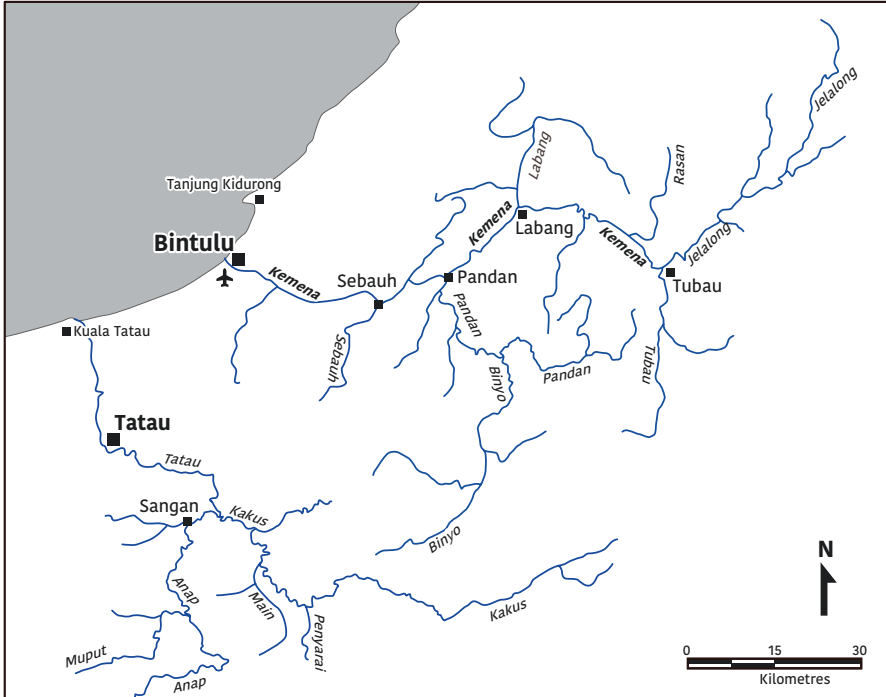


Fig. 1.3 Kemena and Tatau basins

distinctive non-sedentary character. People periodically move to access richer forests and rivers, where usufruct rather than land ownership functions as a basic mode of resource management (Langub and Ishikawa 2017).

The riverine basin in central Sarawak under study has a number of characteristics that have resulted in a peculiar riverine social formation. The first feature is the high level of biodiversity. Recent studies show that the research site in central Sarawak is located in one of the hotspots that possesses the highest level of plant biodiversity in the Sundaic region and records the existence of 639 plant species in seven families: Dipterocarpaceae, Ericaceae, Fagaceae, Lauraceae, Moraceae, Myristicaceae and Sapindaceae (Raes et al. 2013).⁵ In addition to flora, the region has the highest terrestrial vertebrate endemism (Fitzherbert et al. 2008: 540).

The richness of fauna and flora has supported the trading of forest produce by local communities with Malay and Chinese merchants at bazaars established at river confluences and inland trading spots (Langub and Ishikawa 2017). River tributaries and confluences in the basin have long functioned as an interface between the interior peoples and traders, and connected distant peoples and landscapes. The tropical forests have yielded numerous commodities for regional and international con-

⁵The Sundaic region comprises the Malay Peninsula, Borneo, Java, Sumatra and their surrounding islands.

sumption, such as natural rubber for submarine cable insulation, latex used in foods as a clouding or glazing agent, ironwood for roofing and construction materials, edible birds' nests and bezoar stones as highly valued Chinese medicinal ingredients, rattan for furniture, handicrafts and even grenade basket cases during the First World War, to name just a few. Take rattan as an example. Rattan is part of species-rich taxa representing a high level of biodiversity. As our study shows, the highest species diversity of rattan is found in Borneo, where an estimated 150 species exist out of approximately 600 species belonging to 13 genera of the *Palmae* family. Sarawak alone contains the highest species diversity, with a record of 107 species. However, it is not only biodiversity that has supported local trade but also high biomass. Brooke colonial officers stationed in Bintulu district recorded some activities associated with the brisk rattan trade in 1909.

These people are exceedingly busy carrying rattan sega overland from Belaga and while I was at Tubau some 10,000 bundles of this rattan were either in Tubau or on their way from Belaga. I found Tubau very badly in want of supplies the Bintulu Chinese keeping their agents there short of rice and other food stuffs. The whole of Tubau trade is with Belaga and thousands of dollars (silver) go over to Belaga as the price of rattan during the year and the consequence is a shortage of silver here. Dayaks keep large quantities of silver in their houses and always refuse copper in payment of rattan. (Owen 1909: 7)

This basin society with high biodiversity and biomass is also ethnically diverse. More than a dozen ethnic groups migrated into the river basin, living along the rivers. With the exception of multiethnic Bintulu town where all ethnic groups live side by side, particular ethnic groups occupy specific segments of the riverine settlements as if forming an ethnic gradation from the coast upriver to the interior. The Iban, the largest ethnic group in Sarawak, who now occupy almost all segments of the Kemena, are exceptions (Kato et al., Chap. 5; see Fig. 1.4).

It is important to note that such a riverine space with a mixed landscape and multiethnic communities is morphologically homogenous. The landform of northern Borneo mainly consists of soft mudstone, and the bedrock of the mudstone is well weathered. Despite the extremely high uplift rate, Borneo has remarkable physical weathering because of the large amount of rainfall and chemical weathering due to high temperatures and humidity, so that steep topography is uncommon and the stream gradient is relatively small.

In addition, most stretches of the major rivers in central Sarawak are parallel to the seam of the geological strata, and it is difficult for rapids and waterfalls to develop. Hardly any gravel exists in the beds of many large rivers. Therefore the erosion of rivers is weak, and the river channels and the terrain around them have been relatively stable over thousands of years.⁶ Relatively sluggish streams with few rapids and waterfalls have become the most suitable communication corridors in the environment of thick forests where a lack of road networks made long-distance ter-

⁶On a timescale of decades, however, lateral erosion of major rivers has been progressing, which leads to a crisis of the collapse of riverside longhouses into the water (Soda 2017).

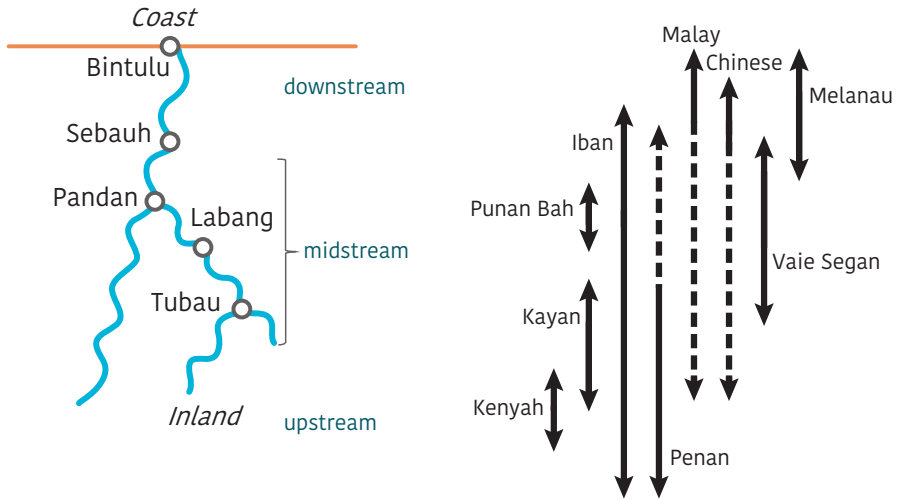


Fig. 1.4 Ethnic groups in the Kemena basin

restrial movement difficult. These features also mean, for the peoples living in the basin society, that there are similar geomorphological environments wherever they move. In addition to these geophysical features, vegetative and floral variations are not noticeable, so there is little change in geo-ecological settings in the riverine landscape. Local people settled and resettled anywhere without a fundamental change in their style of living and livelihoods (Mokudai et al., Chap. 2).

In such a morphologically homogenous basin, a web of riverine networks has long been established, connecting people with distant kin and traders from afar. As our expedition team found, there are currently eight major connecting points in central Sarawak, where different river systems divided by a mountain range are linked with small but well-travelled paths (Langub and Ishikawa 2017). They are one of the means by which people have maintained close contact with kin and traders. Our literature survey and field interviews identify other watershed connecting points that functioned in the past as trade and migration routes. These places were frequented for the purpose of social visits as well. They are usually located along district boundaries such as Belaga–Baram, Belaga–Bintulu, Belaga–Tatau, Kapit–Tatau, Bintulu–Baram and Bintulu–Miri (Langub and Ishikawa 2017). From these local connecting points, people could reach trading spots and bazaars with trader intermediaries who navigated up and down the rivers handling commodities. The proximity of Sarawak to Singapore as well as Brunei has enabled a synergy between Chinese *taukay* traders and Malay *nakodah* maritime traders who eventually connected the inland regions with coastal and international trade networks.

1.3 Tropical Biomass Society

The characteristics of the basin society in central Sarawak have led to the formation of what we propose to call a tropical biomass society.⁷ Heuristically, a tropical biomass society is defined as a social formation typically found in a geo-ecological niche located in an equatorial zone classified as having a tropical rainforest climate. An equatorial zone possesses the most concentrated biome on the surface of the Earth due to a combination of abundant solar energy and high precipitation. Active hydrothermal circulation makes tropical rainforests fertile ground for the regeneration of biome. High biomass societies with high levels of biodiversity are generally found between the northern and southern tropics. In maritime Southeast Asia, tropical biomass societies are located in Borneo, the Malay Peninsula, Sumatra and the Philippines. They are social formations with a number of general characteristics.

First, a tropical biomass society is not an isolated frontier. It is a mercantile and capitalist space connected to global commodity chains. Due to the rapid pace of regeneration and the abundance of biomass, tropical biomass societies have historically engaged with various modes of biomass commodification. High biomass and high biodiversity have led to the (continuous or intermittent) extraction of forest produce for export, leading to the formation of commodity chains.

Second, a tropical biomass society is a multi-livelihood space whose inhabitants are capable of practising combined modes of subsistence. Local people are engaged in swidden cultivation, foraging, forest produce trade and off-farm wage labour (Cramb and Dian 1979; Morrison 1993). Livelihoods have been secured through diversified economic portfolios.⁸

Third, a tropical biomass society is non-agrarian. With low population pressure, both biodiversity and biomass are retained. As a result, the requirement for producing and securing stocks of resources by settled agriculture remains low. A tropical biomass society is essentially a society based on flow and exchange rather than stock derived from agricultural production. Agriculture, when practised, is supplementary and not the sole or major means of livelihood. While people may engage in subsistence farming, their access to commodity chains and off-farm labour markets enable diversified strategies of living.

Fourth, a tropical biomass society values biomass cover more than land itself. Rather than ownership, the usufruct operation of land and the maintenance of commons provide the foundations for its sustainability. As the chapters in this volume discuss in detail, the absence of private land ownership coupled with usufruct opera-

⁷A tropical biomass society is an ecosystem type of tropical rainforest with the richest forest cover formulated between the northern and southern tropics. In addition to Southeast Asia, similar geo-ecological formations with high biomass and biodiversity can also be found in New Guinea, Africa, South America, Central America and in many Pacific, Caribbean and Indian Ocean islands.

⁸There is a danger of equating a 'high biomass society' to the 'original affluent society' (Sahlins 1968). The notions of 'self-sufficiency' and 'affluence' can be considered as constructs made by colonialism and developmental autocracy.

tions and the maintenance of commons have inadvertently created the necessary conditions for inviting drastic and large-scale land-use change.

Fifth, a tropical biomass society exhibits a high degree of flexibility to accommodate and respond to changes brought about by outsiders. When such a flexible response generates too drastic a change, or moves beyond a certain tipping point, a regime shift may take place. As we shall see, many tropical biomass societies have been exposed to large-scale anthropogenic land-use change, and have entered a phase of massive transformation or regime shift. In these instances, an environment-dependent subsistence economy has been replaced by commodity production and rural–urban migration (see Ishikawa et al. 2013).

1.4 A Human-Induced Inflection Point of Succession

In the history of the resource frontier under study, there are two plants—one native and one imported—that have played a distinctive role in transforming local communities, both human and non-human. They are Dipterocarpaceae and oil palm. The individual characteristics of the two plants have contingent effects on the transformation of tropical biomass societies.

The Dipterocarpaceae (literally ‘two-winged fruits’) family of rainforest trees plays a dominant role in the ecology and economics of Asian forests in a way that no comparable family plays in other regions. Dipterocarp trees dominate forests in Borneo, Sumatra, Java, the Malay Peninsula and the wetter parts of the Philippines, where the majority of large trees are members of this one family and account for the majority of biomass. Outside this core area, dipterocarps gradually decline in diversity and abundance. In total, there are at least 500 Asian species. Since the 1960s, due to their ecological dominance, large diameter at breast height and excellent knot-free quality, dipterocarps have been marketed internationally as plywood and sawn timber. Philippine timber excelled in quality and long supported the production of thin plywood mainly for interior woodwork, while Sarawak has provided plywood for construction materials such as concrete-forming panels and floor base. Southeast Asia first became a site of logging operations for the Japanese market. Round log exports to Japan gradually shifted away from the Philippines, Indonesia and Sabah, and Sarawak has become the last frontier for logging operations (Samejima, Chap. 25; Taylor et al. 1994; Bevis 1995; King 1996; Parnwell and Taylor 1996).

At the beginning of the century, oil palm plantations arrived in a major way in the Kemena and Tatau river basin. The shift from selective tree cutting to oil palm cultivation marked a fundamental change in commodification, from a system based on the regeneration of biomass to one that depends on expansive production of planted vegetation on clear-cut land. In the history of the basin, we have witnessed a new inflection point of succession, where biome transformation goes beyond primary as well as secondary succession. In the process of the construction of oil palm plantations, pre-existing above-ground biome has gone and been replaced by a single

domesticated crop.⁹ We do not see interspecies competition but only intraspecies competition.

The quintessential nature of the plantation system also lies in the principles of economies of scale and scalability. When the organisational practice of making goods cheaper because more are being produced is applied to oil palm plantations, at least 3000–5000 ha of cultivation land are necessary for the efficient and economic operation of a single mill (Okamoto and Hayashida 2018). The expansive nature of plantations is based on the principle of scalability. A plantation is ‘a scalable project where small projects can become big without changing the nature of the project’. Scalable projects are those that can expand without changing, where diversity is banished (Tsing 2012: 507; cf. Scott 1998). The effects of plantations on the ecology and landscape include the enclosure of space, the replacement and singularisation of the biomes, the fragmentation of the landscape and the emergence of a mosaic landscape.

We have seen precisely the emergence of such a highly fragmented, mosaic-like landscape in the Kemena and Tatau riverine basin (cf. Taylor et al. 1994). Using high-resolution satellite imagery, we analyse the land cover types and classify them into the following land uses:

- Good standing forests: 2.59%
- Degraded forests or forest clearings: 52.74%
- *Temuda* swidden agricultural practice: 21.85%
- Oil palm plantations: 15.92%
- Acacia plantations: 1.35%
- Log ponds: 0.4%
- Others: 5.12%

Forest covers most of the 62,133.8 ha project area, followed by fallow or secondary forest used for swidden agricultural practice (*temuda*), oil palm plantations and industrial tree plantations. The large extent of degraded forests implies that logging is the main economic activity in this region. Areas planted with oil palm have increased, especially along roads. Our results suggest there will be an increase in the area covered by oil palm plantations and this may soon surpass the extent of land currently categorised as *temuda* (Hon and Samejima, Chap. 3).

With the advent of inflection points of nature where heterogeneous landscapes are observable in sequence, and nature and non-nature or first nature and capitalist nature exist side by side,¹⁰ we inquired into issues such as how new systems of agrarian production affect the hydrologic cycle, the ways plantations and the local peasantry influence material cycles, and how animals choose migration routes in and outside of anthropogenic forests (see Figs. 1.5 and 1.6).

⁹For a comparison between the impacts of selective logging and forest conversion to oil palm plantations, see Edwards et al. (2014).

¹⁰Anna Tsing defines ‘first nature’ as ecological relations (including human) and ‘second nature’ as capitalist transformations of the environment (Tsing 2015: viii).

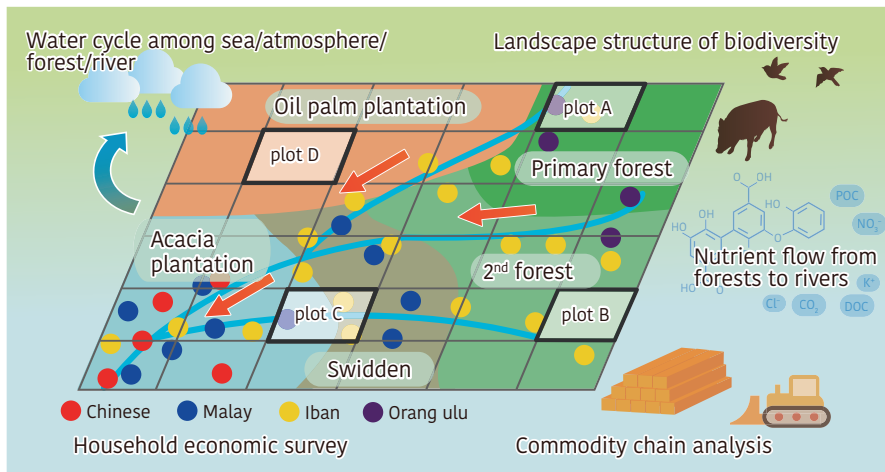


Fig. 1.5 Multidisciplinary research

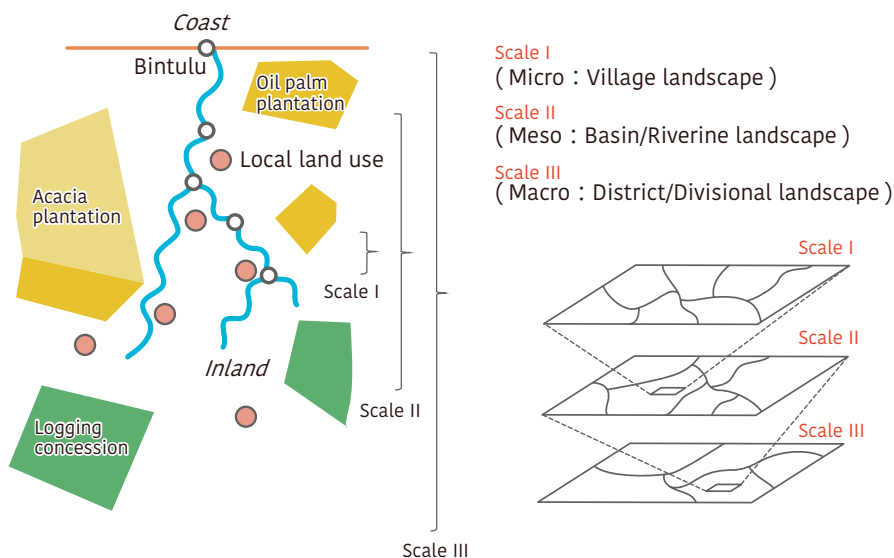


Fig. 1.6 Multiscale research

Our ecological research team analysed the ecosystems of natural and planted forests. For instance, multiple research plots were selected by animal ecologists in order to map the spatial structure of biodiversity. Hundreds of camera traps were set to monitor the movements of animals in and out of plantations as well as timber concessions for the purpose of examining habitat range and changes in the mixed landscape (Samejima et al., Chap. 10).

While a hydrologist looked into the water cycle in the ocean and atmosphere, and the forests and rivers at a mesoscale (Kozan, Chap. 4), ecosystem ecologists focused on the flows of nitrogen and particulate organic matter in the forests and rivers. They examined material cycles of nature, where the transfer of chemicals from biological to geological systems is observable in mixed landscapes. Rivers run through the fragmented mosaic landscapes, transporting chemical components derived from plantation agriculture. Forest ecologists examined the effects of agroindustrial operations on the forest ecosystem by taking numerous water samples along the rivers, while ichthyologists conducted a taxonomic evaluation of the freshwater community at each water sampling spot. The sampling points covered the whole river system including the landscapes of natural and logged-over forests, fallow land, and oil palm and acacia plantations (Tokuchi et al., Chap. 11; Fukushima et al., Chap. 12; Kano et al., Chap. 13).

The landscape being modified with the advent of plantations produces new food webs and commodity chains. With the expansion of planted forests, human relationships to other animals have changed, albeit in rather unexpected ways. After oil palm plantations are developed in the vicinity of longhouses, for example, it has become easier to hunt wild boar (*Sus barbatus*), because they eat oil palm seeds inside the plantations. By combining ecological data with anthropological information on local hunting practices, we examined how wild animals and local people have developed a new interface in the changing environs (Samejima and Hon, Chap. 8; Kato and Samejima, Chap. 14). Our research also confirmed that older logged-over forests in a forest concession that practises sustainable forest management contain greater numbers of carnivore species. As carnivores sit on top of the food chain, their presence indicates the general health of the forest, the importance of sustainable forest management and some of the roles logging companies can engage in towards the conservation of wildlife in a production forest environment (Hon et al., Chap. 9).

1.5 The Plantation as a Social Complex and Infrastructure

Just like the Dipterocarpaceae family, the very peculiar nature of oil palm also has a contingent effect on the social formation of the riverine society. As an industrial commodity, fresh fruit bunches need to be processed within 24 h so as to avoid oxidation which lowers the quality of the product. It is therefore essential that oil palm fruits are sterilised by heat treatment immediately after harvest and before oil extraction in order to deactivate the lipase, an enzyme naturally present in the seed. The oxidation process triggered by the lipase, a micro-change at the molecular level, is in fact a driving force of considerable social change in our research site. Traditional maritime and riverine society is being transformed to a landbound one with road networks for transportation of fruit bunches to processing mills. The advent of oil palm plantations stands not only for the introduction of a new mode of

corporate production but also the establishment of spatial linkages between upriver cultivation sites with downriver production sites.¹¹

Oil palm production requires an industrial complex comprising road networks and mills, and local people in the vicinity of plantations are simultaneously incorporated into the system. Our research witnessed and documented the very initial moment of the emergence of oil palm smallholders in the basin society. With the advent of road connections, many residents moved to the roadside, at some distance from their longhouses that are traditionally built along rivers. Now a long stretch of temporary huts (*langkau* in the Iban language) can be found, and oil palm seeds harvested by local people are brought to the refinery mills attached to plantation companies (Soda et al., Chap. 15).¹²

The emergence of the plantation as a social complex not only leads to the spatial reconfiguration of the basin society but also brings local communities into a profoundly contested situation. With the advent of the plantation complex, the object of appropriation has shifted from the extraction of biomass on land to land itself. As already noted, in the Kemena–Tatau basin catchment natural resources on the land surface, both timber and non-timber, have been valued for subsistence and trade activities for generations. Today the land and soil have become devices for production, where new biomass is cultivated through the domestication of plants.¹³ This new mode of biomass generation, both in plantations as well as by smallholders, requires an operational condition in which labour mobilisation, capital investment and land as a commodity become essential for continued operations (Soda et al., Chap. 15). What we observe now in the basin society is the rapid development of plantations leading to so-called ‘accumulation by dispossession’, with indigenous communities having compromised access to land.¹⁴

¹¹ The notion of the plantation as a social complex is not new. A pioneering study of Puerto Rico by Julian Steward focuses on ‘the levels of social integration’ brought about by the plantation system (Steward and others 1956). The plantation is also seen as ‘a socio-cultural type’ (Mintz 1959: 42). Plantations always function as a corridor connecting local communities to national and international markets through labour mobilisation and commodity chains.

¹² Concerning the spatial configuration of plantation society in Puerto Rico, Eric R. Wolf notes: ‘This class structure finds expression not only in the social terms but also in spatial relationships. Invariably the plantation creates new communities. In the highland areas of the New World it drew the Indians from their communities into life near the hacienda and made them *acasillados*. In the lowlands of the New World, it ringed the big house with the huts of African slaves. When population grew to a point where labor became plentiful, cheap and readily available, new settlements of laborers grew up in the vicinity of the fields, inhabited by men eager to find employment in cultivation and harvest’ (Wolf 2001: 217).

¹³ The Meratus Dayak of South Kalimantan have a notion of *bulu gumi*, which literally means ‘the body hair of the earth’. ‘It is all the living things, in the water, in the air, and on the surface of the earth: they are the body hair of the earth’ (Tsing 2005; Haraway et al. 2016).

¹⁴ This includes the commodification and privatisation of land, displacement of local peasants, turning various modes of ownership into exclusive private ownership, suppression of communal rights, commodification of labour, and suppression of non-capitalistic mode of production and consumption (Harvey 2003). For a discussion of land tenure and large-scale land acquisitions in Sarawak, see Bulan with Locklear (2009) and Cramb and McCarthy (2016). For an analysis of the political economy of oil palm production in Indonesia, see Pye and Bhattacharya (2013), Mizuno et al. (2016) and Okamoto and Hayashida (2018).

Looking at the emergence of a production site for an industrial commodity in the midst of a riverine landscape raises a number of urgent inquiries into the kinds of change new terrestrial connectivity brings to traditional riverine social formation, and how the terrestrial road network alters the movement of people, labour and capital. The sociocultural research team thus focused on transformations from a traditional natural economy (swidden cultivation, hunting and gathering of forest produce) to off-farm wage labour (in timber camps and urban areas) and to agricultural income generation (oil palm smallholdings). We conducted a series of household interviews on topics such as functionally and spatially extended kin networks, circular labour migration and flows of remittances (Soda et al., Chap. 15).

Road networks necessary for oil palm production have expanded into interior Dayak communities, where it is now possible for weekend returners from the city to join household oil palm smallholding operations. Rural villages have been depopulated and are now dependent on the urban economy, undergoing a structural transformation. However, the diffusion of oil palm smallholdings in accordance with plantation development in the interior has sparked a return migration from urban to rural areas for weekend oil palm farming. This return has revitalised longhouse communities (Soda and Kato, Chap. 17). The strengthened relations between urban areas and longhouses have brought about a new kind of rural–urban continuum where functionally as well as spatially extended local households play a key role (Soda et al., Chap. 15; Soda et al. 2015).

1.6 Commodification and Local Processes

The plantation system brings about changes to biodiversity and social organisation and also affects the way the local community, both ecological and social, is connected to the wider political economy. In the course of our research, we came to question whether the analysis of local processes is sufficient to explain ‘community’ and even whether the local ecological and social community is a realistic construct. These issues still remain controversial to us as social and natural scientists, but a consensus has gradually emerged that local community dynamics cannot be understood without attention beyond the local community per se.

One of the focal points of our study was thus to examine the changing nature of commodity chains, with a starting point in the interior river basin and an end point in the international market as well as with cross-continent consumers. To better understand the dynamics surrounding regional, national and transoceanic commodity chains, our attention has expanded to include the micro–macro nexus and its change over time, which has, during the course of fieldwork, translated to the following research foci: the interaction between the local ecological process and the commodification process; interfaces between local food webs and the commodification process; the emergence and disappearance of commodity chains; and the changing threshold between nature and non-nature through international certification systems instituted by corporations and civil society (Naito and Ishikawa, Chap. 26).

In the course of our fieldwork, several kinds of natural resources-cum-commodities became contact points for the collaboration between researchers with different disciplinary specialisms. We paid special attention to such commodities as the Dipterocarpaceae family, oil palm, birds' nests, rattan and bezoar stones to document the newly emerging and fast disappearing commodity chains. They function as academic ecotones, where disciplinary boundaries get blurred and interdisciplinary inquiries are fostered.

1.6.1 Rattan

Both forest ecologists and economic historians worked together on rattan as an important indicator species for biodiversity as well as a commercial agent that historically connected local communities with regional and international markets. In the midst of anthropogenic forests, the collaborative team examined the ecological, economic and cultural functions of *pulau*, literally the 'green island' communally managed by local people, and its location in global supply chains.

Rattan, for instance, has long been an important forest resource for communities in rural Sarawak and is still widely traded today. The ability to collect and weave rattan to sell for cash is closely related to the conservation of natural forests in the vicinity of local communities. A plant ecologist, a human geographer and a global historian conducted collaborative research in villages under pressure from logging and plantation development to elucidate the communal forest conservation system and its relation with the diversity of plant species (Takeuchi et al., Chap. 21; Takeuchi and Kobayashi 2016; Takeuchi et al. 2017). Researchers also investigated how forest plant resources have been extracted and traded within local and regional markets, both historically and in the present (Takeuchi et al., Chap. 22). By clarifying the significance of the communal forest in terms of the surrounding environment, rural economy and trade patterns, the research provides practical suggestions for forest management policy.

1.6.2 Swiftlets

Edible nests (*sarang burung*) of swiftlets (*Aerodramus fuciphagus*) are one of the most valued forest products in the area. The nests constitute an important meeting ground for cultural anthropologists, historians and bird ecologists to observe how commodity chains and food webs are being reconfigured. The diffusion of swiftlet farming—a new method of semi-domestication of the birds—also affects both habitat changes and birds' nest trading customs. In the lower reaches of the Kemena, we

constructed a swiftlet farmhouse to collect basic information on the feeding ecology of the birds in the transformed landscape. The supply chains of birds' nests have been both economic and cultural linkages connecting the riverine basin to Chinese culinary and medicinal communities. To follow the chains and examine the interfaces where various cultural and economic linkages are generated, we organised multidisciplinary teams composed of ethnic Chinese specialists, anthropologists, ecologists and historians. For instance, tracing long chains of *guanxi* (personalised relationships) crossing over ethnic and national boundaries, the birds' nest study team revealed the strength of Chinese networks connecting the interior of Sarawak with regional and international markets. They traced the commodity chains that link Bintulu to the region and beyond. These lead to the busy streets of Sheung Wan in Hong Kong, Kobe in Japan, and even Chinatown in New York City (Chew et al., Chap. 18).

The study of swiftlet farming examined how the feeding ecology of domesticated swiftlets has been transforming itself in the midst of a landscape dominated by oil palm plantation (Fujita and Leh, Chap. 19). With reference to the newly emerging commodity chain of edible birds' nests, the feasibility of farmhouse management in rural Sarawak was also examined (Suzuki et al., Chap. 20).

1.6.3 Porcupines

The subsistence (natural) economy of the upriver areas has long been connected with regional and global markets. Although many non-timber forest products are now minor commodities, they are still important forest resources when considering relations between village natural environments, the plantation-based economy and international markets. Our research examined how high-value forest products such as porcupine bezoar stones and edible birds' nests connect basin societies in central Sarawak with the wider world. With the advent of oil palm plantation, bezoar stone-producing porcupines have become a kind of windfall for local hunters in the basin society. According to informants, because of their habit of eating very hard oil palm seeds, porcupines started producing bezoar stones in their stomachs, which fetch extremely high prices in the market. Porcupines and the bezoar stones they produce are a case where the change in food webs leads to the re-emergence of Chinese commodity chains (Okuno and Ichikawa, Chap. 23). Specialists of cultural anthropology and overseas Chinese studies adopted multisited ethnographic methods to trace the commodity chain from hunting sites to consuming cities such as Kuala Lumpur, Penang and Singapore.

1.6.4 *Timber, Oil Palm, Acacia mangium and Fossil Fuels*

Taking as a case in point the reduced impact of logging activities and oil palm plantations endorsed by the international system of certification and governance, we examine a dynamic process of negotiation within an increasingly complex nature/non-nature threshold for the betterment of social and environmental conditions. Through the construction of a road network by which the interior is connected to processing mills and further down to international markets, the local community is now a producer of industrial commodities and emitters of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). With the data provided by a plantation company and a local Dayak community, we compare the peasantry and industrial sector in the wider milieu of climate change (Ubukata and Sadamichi, Chap. 24).

Unlike traditional forest products, modern global commodities such as oil and natural gas play important roles in the state economy. Chap. 27 describes the changing patterns of export trade, discusses its implications for the fate of a high biomass society, with detailed analysis of trade statistics in and beyond Sarawak, and identifies the long-term trends and changes from the perspective of global economic history (Kobayashi and Sugihara, Chap. 27).

1.7 Beyond Exceptionalism

Because of the consequences of large-scale land-use change taking place in a heterogeneous, transitional riverine landscape, the research assumes that only multi-sited transdisciplinary fieldwork can capture and understand the nature of the frontier. The distinction between the social and natural domains continues to make communication between researchers in these two categories an uneasy task. Our research agenda required us to overcome two kinds of exceptionalism: human exceptionalism in the natural sciences as well as nature exceptionalism in the social sciences. In the course of planning this research, we attempted to create new scales and units of analysis that enable an integrated understanding of the human–nature relationship in the hope that we include sociality in the natural sciences and a multispecies perspective in the social sciences.

We found the best way was simply doing things together. We visited the research sites together, stayed overnight in Dayak longhouses, ate rice from the same bowl, and saw what others do and interrogated the intention of the research. We gradually started to pay attention to the entanglements, or relational encounters, located at the interfaces between previously separated realms of the natural and social sciences. The multilingual assets of the transdisciplinary team also helped us conduct better research in terms of data collection. Scholars from Kyoto University and graduates who had been trained in the strong tradition of interdisciplinary field sciences there

formed the core of the research team.¹⁵ The majority of the team have also had years of fieldwork experience in Southeast Asia. Most, including the natural scientists, have a good command of vernacular languages and dialects (Iban, Kayan, Kenyah, Bukitan, Melanau, Penan, Sihan, Mandarin, Hokkien, Teochew, Sarawak Malay and Indonesian, in addition to standard Malay) and bring with them solid knowledge of local culture and society.

In the course of the fieldwork, we encountered multifocal windows for investigation for both natural and social scientists. Rattan, wild animals, birds' nests, culturally preserved forests and rivers became these windows and compelled us to facilitate our research with a multidisciplinary as well as a multiscalar perspective.

Our research was also meant to be transdisciplinary in the sense that we sought cooperation and assistance from various non-academic stakeholders before, during and after the fieldwork. The cooperation among multistakeholders enabled us to conduct research in newly created interface among the government, the business community and academics.¹⁶

1.8 Structure of the Book

The structure of this volume reflects our research design which was geared to examining new interfaces and connections emerging on the plantation frontier. The first section 'Landscape, Culture and History' provides basic information on the geomorphology, land use and human society of the basin catchments of the Kemena and Tatau rivers, including the history of forests and history of communities (Chaps. 2, 3, 4, 5, 6 and 7). The second section 'Inflection Points of Nature' is concerned with the interfaces among fauna, flora and the human community in the Kemena–Tatau basin. This includes an analysis of species composition, biomass and tree biodiversity in a transitional landscape and the influence of large-scale land-use change on the environment (Chaps. 8, 9, 10, 11, 12, and 13). The third section titled 'Plantations as Social Complexes and Infrastructure' focuses on the changing relationship between the plantation economy, the traditional natural economy based on

¹⁵For interdisciplinary scholarship at Kyoto University, see Heather Anne Swanson et al. (2015).

¹⁶Our field study was made possible by the permission, endorsement and logistical support of multiple stakeholders in Sarawak. The State Planning Unit Sarawak granted a five-year research permit, while numerous government agencies provided support for fieldwork. In particular, academic collaboration with the Sarawak Forestry Department, Sarawak Forestry Corporation (SFC) and Universiti Malaysia Sarawak (UNIMAS) was indispensable. We also received endorsement from private companies engaged in plantation and logging activities. They allowed us to conduct research inside their operation sites, providing personnel, transportation, accommodation (in the case of interior research sites) and information on their business operations. Zedtee Sdn Bhd, Sarawak Planted Forest Sdn Bhd and Keresa Plantations Sdn Bhd allowed us to conduct on-site research by both social and natural scientists (Hon et al., Chap. 9; Samejima et al., Chap. 10; Tokuchi et al., Chap. 11; Ubukata and Sadamichi, Chap. 24). We held two seminars in Kuching, Sarawak, to share research outcomes with local academics, government officials and business communities (*Borneo Post* 2012).

hunting and gathering and swidden agriculture, and oil palm smallholdings. It focuses on the changes in social formations of local communities (Chaps. 14, 15, 16, and 17). The final section ‘Commodification and Local Processes’ examines the social and ecological dynamics connecting the Kemena–Tatau basin catchment to the outside world, where new commodity chains are emerging. The case studies concentrate on products such as birds’ nests, rattan, bezoar stones and timber and oil palm, and conclude with an overview of the changing patterns of Sarawak exports over a period of nearly a century and a half (Chaps. 18, 19, 20, 21, 22, 23, 24, 25, 26, and 27).

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