

Table 2.1 Landscape elements recognized by a Karen community example in the upper Mae Chaem watershed, N. Thailand (James R. Peters, *pers. comm.*); NTFP = non timber forest product (van Noordwijk et al., *in press*)

Landscape element	Location	Function	Accessible to:	Resource use
Watershed (ridge) forest	On the mountain ridge separating the village territory from the next one	Providing main irrigable water source and clean drinking water (piped to the village)	All	cattle grazing and collection of food, and medicinal plants, hunting area, NTFP collection
Conservation forest	(new category)	Conserving wild animals and plants	No hunting	Cattle grazing
Open access forest	Hills surrounding village	Providing forest products	All, with permission	Construction wood (for house, not for sale), grazing and NTFP collection
Community forest	<i>idem</i> , but closer to the village than previous category	<i>idem</i> , for community activities	Community groups	Wood for community structures, grazing and NTFP collection
Bush fallow ('revolving forest')	Closer to the village than previous category	Crop production, grazing land	Privately controlled in cropping years, open access grazing in fallow years	Crop yields, fodder, manure transferred to home gardens, grazing and NTFP collection
Riparian forest	Along the streams and rivers	Providing clean and cool water for irrigation, maintaining the spirit owners (e.g. crabs, fish and frogs) in the paddy fields	All	NTFP's
'Forest above paddy field'	Forest land adjacent to a landowner's paddy field	Reserved for the exclusive use of the paddy owner.	Private	Commercial or subsistence gardens or useful tree species
'Paddy field'	Between streams and previous forest category	Rice production (+ dry season vegetable crop)	Private	Rice and dry season crops; cattle/ buffalo grazing in dry season
Burial forest	Close to village	Cemetery	All	-
Birth forest	Close to village	Burial of umbilical cords for spiritual security	All	-
Home garden	Around house in village	Household needs	Private	Fruit, vegetables, fodder, medicine (human and animal)

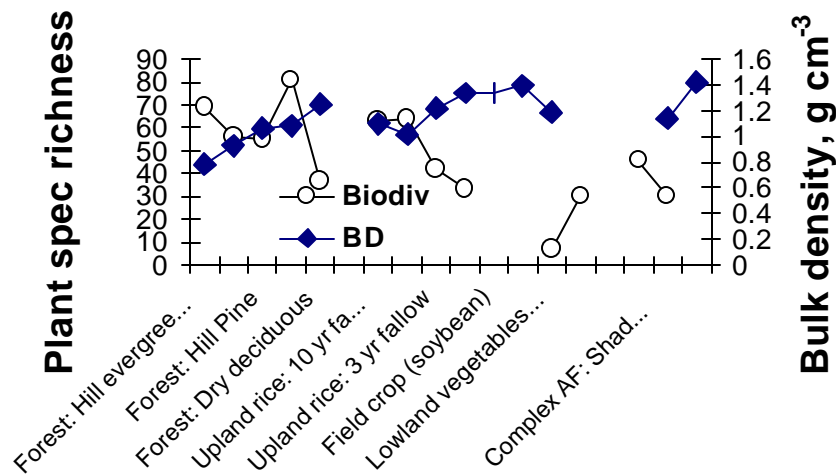


Figure 2.17. Plant species richness at plot level and soil bulk density for a rich of land cover and land use types in the Mae Chaem catchment (data: ASB Thailand)

Land use

The natural forest types differ both in plot-level plant species richness and in bulk density, with the dry deciduous the lowest in richness and the highest in bulk density. An ‘agricultural intensification’ series that starts with 10-year fallow upland rice and ends with intensively managed lowland vegetables and paddy rice shows a decrease in plant species richness and an increase in soil bulk density. The sparse data on agroforestry indicate relatively high bulk density for the fruit orchard and medium values for shade coffee.

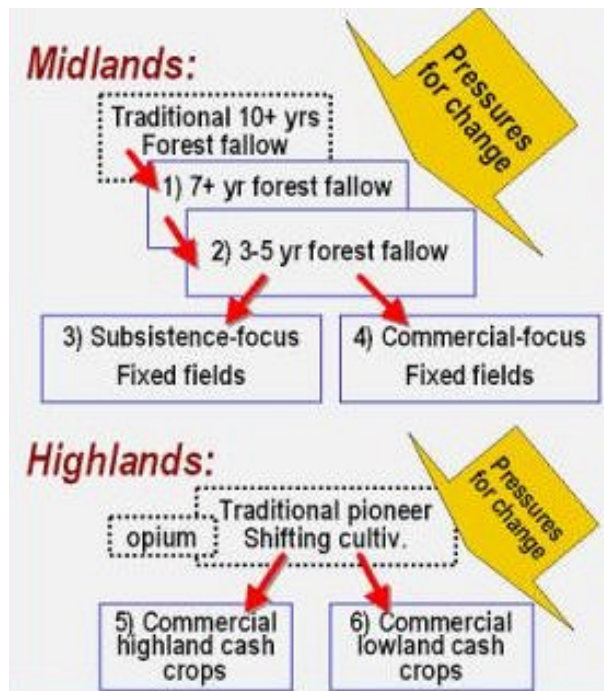


Figure 2.18. Pressures on the current land use systems in Mae Chaem

As described by Thomas et al. (2003), current landscape mosaic patterns of land cover in Northern Thailand can be seen as resulting from adaptation of traditional agricultural systems over time. During the 1950s, little influence from the lowlands had yet imposed

itself on traditional systems in higher elevation zones. Subsequent outside influences, such as markets for new crops associated with both opium crop replacement programs and expansion of lowland agro-industry, led to extensive clearance of forest in mountainous areas. Increasing clearing size changed the land-use patterns from those formerly based on small clearings substantially impacting forest regeneration and watersheds in general. Land-use constraints imposed by the Royal Thai Government (RTG) on highland areas, such as accompanying national parks, wildlife sanctuaries, and a watershed classification system, combined with political tensions, fears for national security in border areas, and foreign pressure to stop opium production, further influenced agricultural development. In response, a series of crop substitution-oriented projects were implemented during the 1980s, linked with RTG efforts to improve health service, education, infrastructure, and market access in the highlands. Population growth and in-migration further increased land-use pressure, and by the late 1980s projects like CARE Thailand and the Sam Mun Highland Development Project (SMHDP) began developing integrated approaches including participatory land-use planning (PLP) to address the multitude of problems and develop strategies and solutions in partnership with highland communities. These efforts also significantly affected agricultural systems in transition. During the 1990s, concern with environmental issues grew rapidly. Initial concern focused on criticism of dam projects and state management of forest lands, leading to proposals for a community forestry law that would allow local participation in management of forest resources. But growing environmental awareness in lowland and urban populations was also associated with realization of the importance of upper watershed forests in the northern region for future livelihoods. The regular supply of clean water long taken for granted was now becoming an issue of concern. This set the stage for a growing debate and tension between upstream and downstream interests, which has intensified with recent flash-flood and landslide disasters. Meanwhile, governance reform efforts led to a new national constitution and strengthening of local governance institutions. Additional projects initiated by the Royal Family, the RTG and various NGOs to work closely with highland villagers have been responding to challenges presented by these developments. As a result, locally-negotiated land-use planning, combined with new tools ranging from methods for local monitoring of watershed services to GIS and remote sensing technology, are coming together in a promising approach for addressing both local and societal needs. ICRAF Chiang Mai, working together with the Royal Forest Department, Chiang Mai University, the Queen Sirikit Forest Development Project, Care-Thailand, and other ASB-Thailand partners, are conducting research on these issues and processes at their benchmark research site in the Mae Chaem district of Chiang Mai province in northern Thailand. This research targets development and pilot testing of a comprehensive spatial information system to support participatory management of natural resources in upper tributary areas where national conservation concerns seek to constrain local land-use practices. The system consists of four major components:

- 1) Negotiation and articulation of local land-use plans and agreements that incorporate local needs as well as concerns of downstream communities and national society.
- 2) Spatial information tools that provide: a basis for formal recognition of local land-use agreements transparency and accountability in monitoring compliance, and

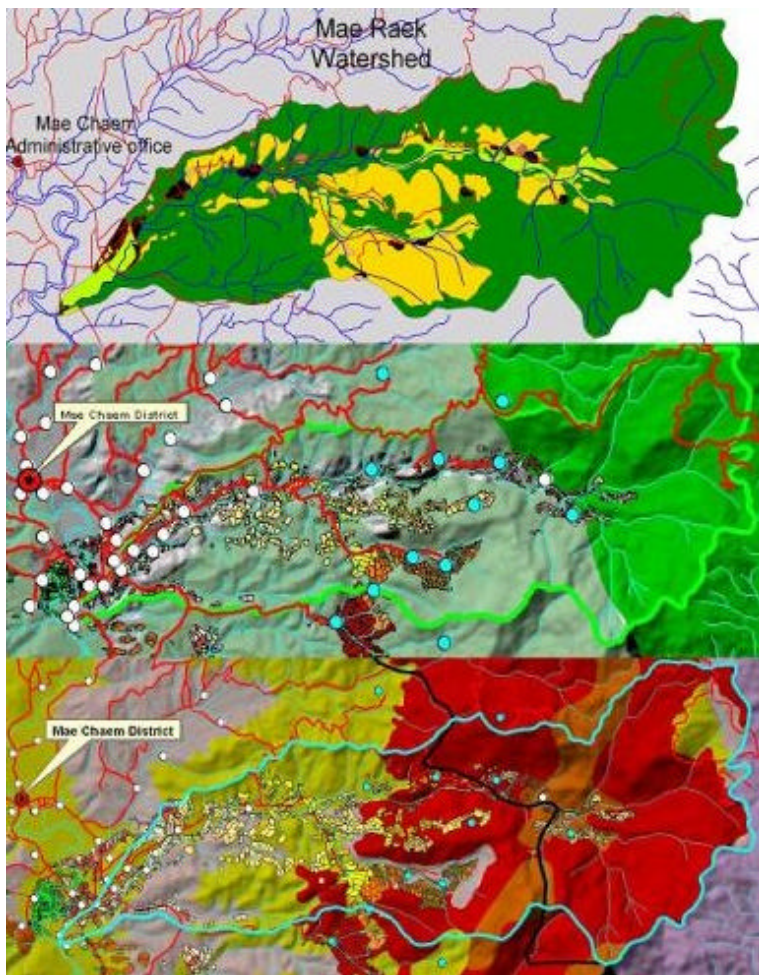
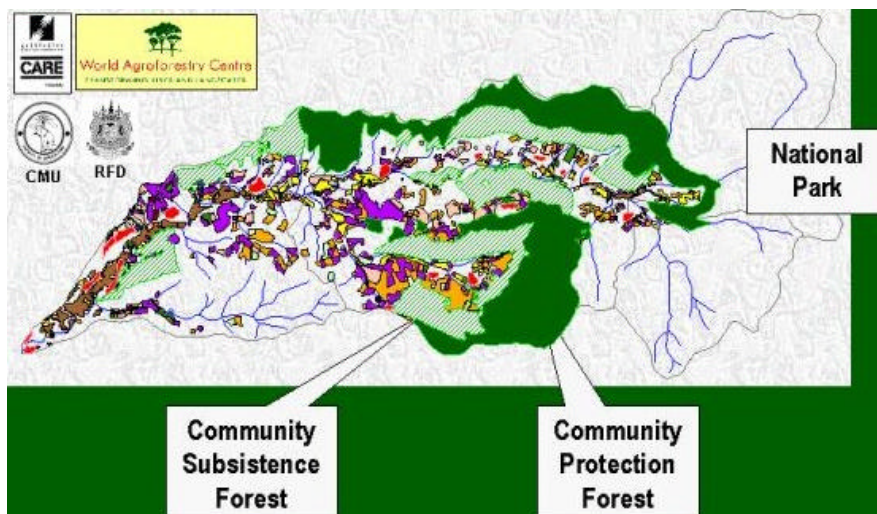


Figure 2.19. Land use in the Mae Raek subcatchment, with the official watershed categorization and (lower panel) the result of an intensive participatory land use planning exercise



additional information to enhance the capacity of local institutions to manage land use in a manner that can improve local livelihoods while sustaining environmental services.

- 3) Continuous monitoring and assessment of watershed services by local communities and water-shed management networks.

- 4) Analytical modeling to provide assistance for both local managers and the general public in interpreting information related to natural resource management issues.

Field-testing of the overall system includes additional detailed information on land-use history, local land-use patterns, and other factors that will assist in assessing the effectiveness of the system and its various components. Initial pilot implementation of these efforts began in 2001 in four sub-watersheds of Mae Chaem, selected to represent a range of current land-use conditions found in upper tributary watershed areas. The long standing debate on a possible relationship between forest conversion and rainfall tends to focus on large continental land masses (such as the Amazon basin) versus insular areas with strong influences from oceans and seas. Mainland Southeast Asia may be intermediate between these two, so an analysis of historical rainfall records may throw some light on the issue.

Walker (2002) analysed long-term rainfall data for numerous sites in Chiang Mai and Mae Hong Son province compiled by the Royal Irrigation Department (www.rid.go.th) for 10 locations where relatively complete data series dating from the 1920s are available (Fig. 2.20). The data show substantial short-term variation. The data from Mae Rim suggest a long-term decline in rainfall, while there is a minor downward trend in the data from Doi Saket, Chiang Mai and Samoeng. However, the data from other locations such as Chom Thong, Fang, Khun Yuam and Mae Hong Son suggest a long-term increase. Taken as a whole the data suggest long-term stability in levels of precipitation, despite very substantial reductions in forest cover. Only a very selective reading of the data could support the claim that deforestation has led to reductions in levels of rainfall.

Enters (1995: 95) similarly concluded from similar data that there were “no statistically significant changes [in precipitation] between 1927 and 1989.” Nipon (1994) cited a study conducted in northeast Thailand to the effect that “yearly statistical analyses showed an insignificant relationship between monthly, seasonal and annual rainfall patterns and the remaining forest areas. In other words there was no correlation between rainfall parameter and the percentage of remaining forest area.”

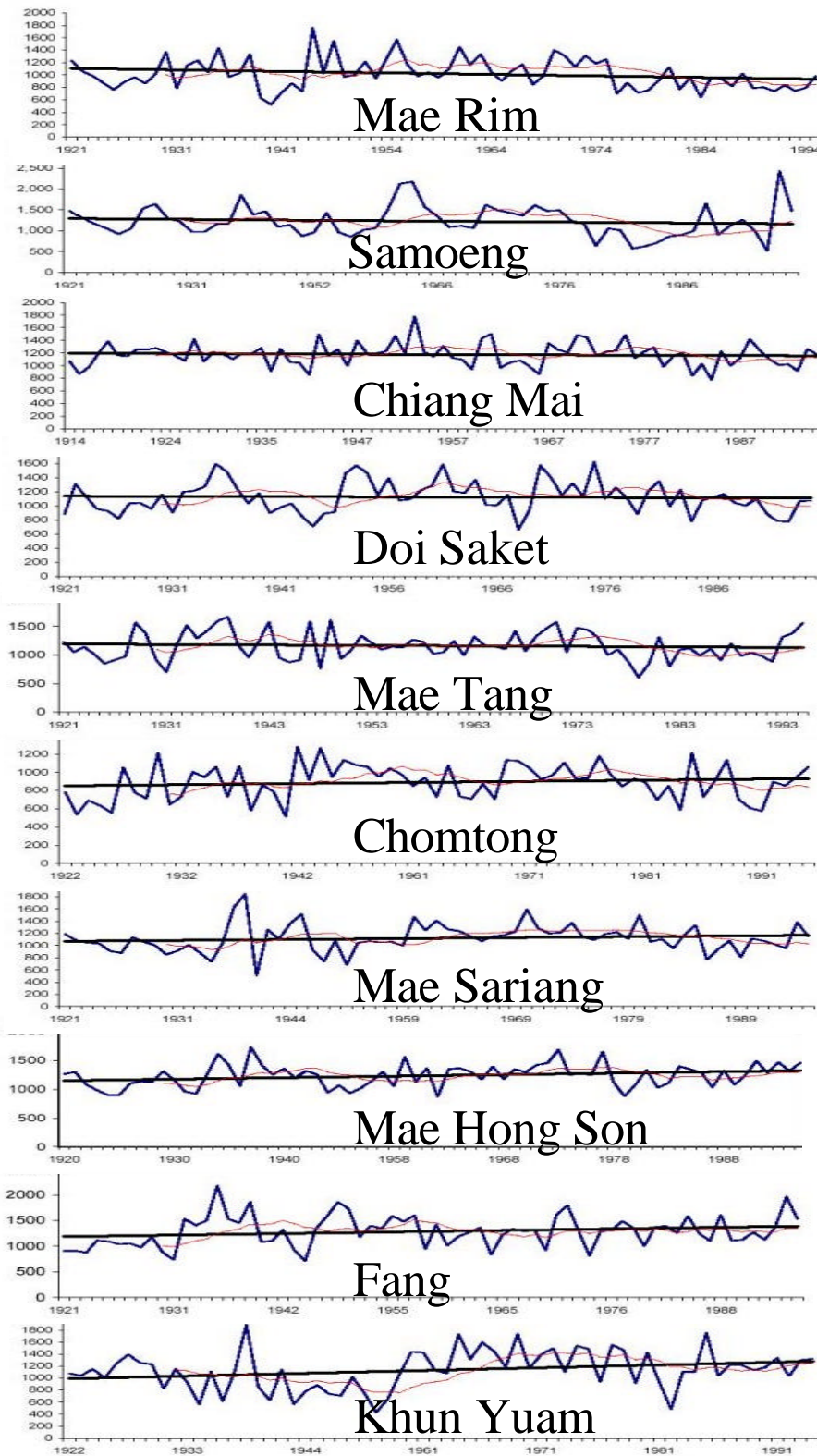


Figure 2.20. Long term records (since 1921) for rainfall stations in northern Thailand with their long term linear trends (data from the Royal Irrigation Department, derived from Walker, 2003)

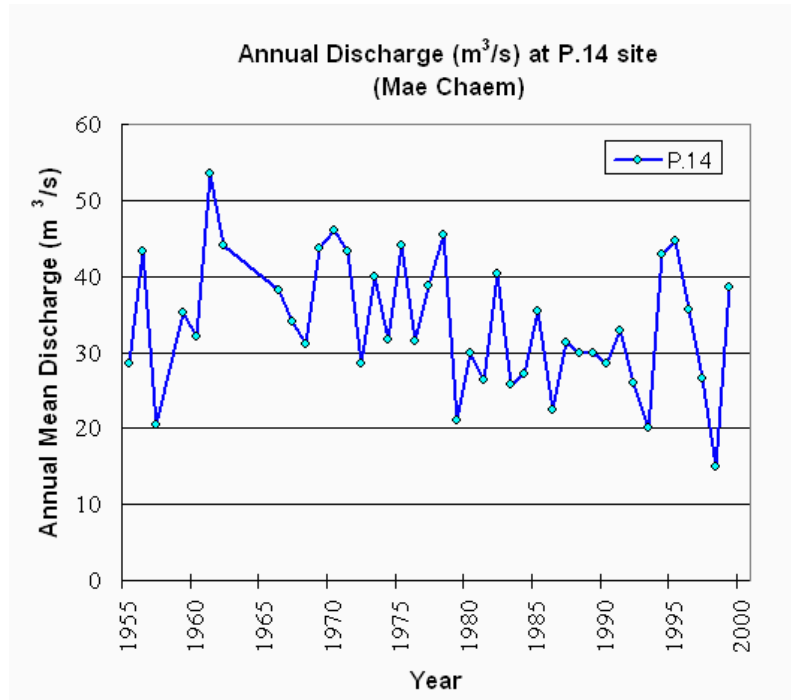


Figure 2.21. Long term record of the discharge of the Mae Chaem river

The data on rainfall and river discharge will be analyzed in section 3.1

2.1.8 Insular Southeast Asia-Sumatra- Tulang Bawang–Way Besai–Way Ringkih

Within insular Southeast Asia (with Indonesian and the Philippines as major countries and the Sabah/Sarawak part of Malaysia, Brunei and Timor Lorosae as smaller entities), substantial differences in population density occur between the islands with Java as the densest populated part, matched only by parts of Luzon (the Philippines) and the southern tip of Sumatra (Fig. 2.22). Recent forest conversion with substantial numbers of people living downstream points us to Sumatra for further analysis Indonesia has recognized the urgent need to undertake forest and land rehabilitation programs.

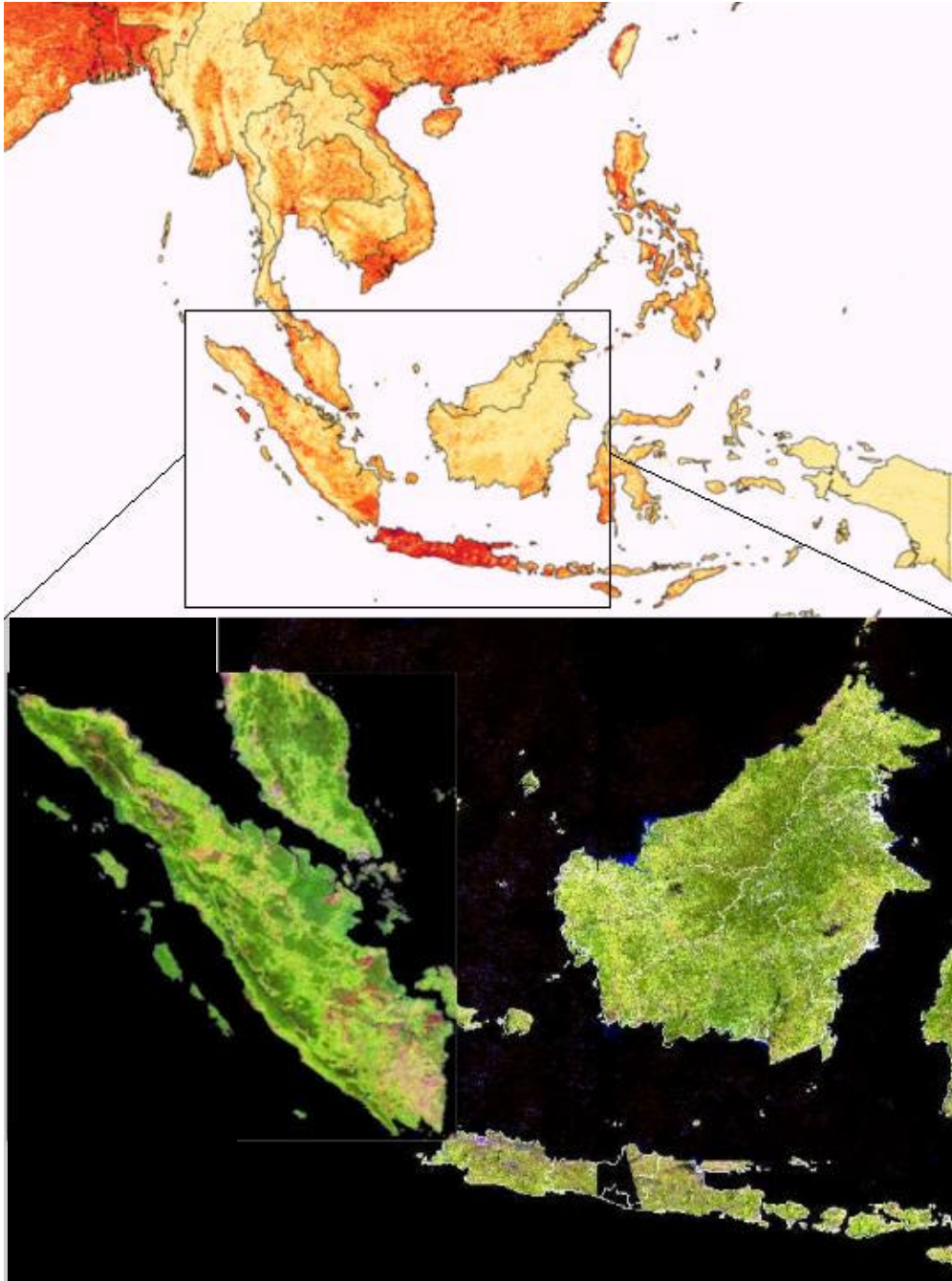


Figure 2.22. Human population density in Southeast Asia (upper panel) and a composite of 2003 Modis imagery (lower panel) showing closed forest (dark green), agroforestry mosaics (lighter green) and agricultural crop land (reddish)

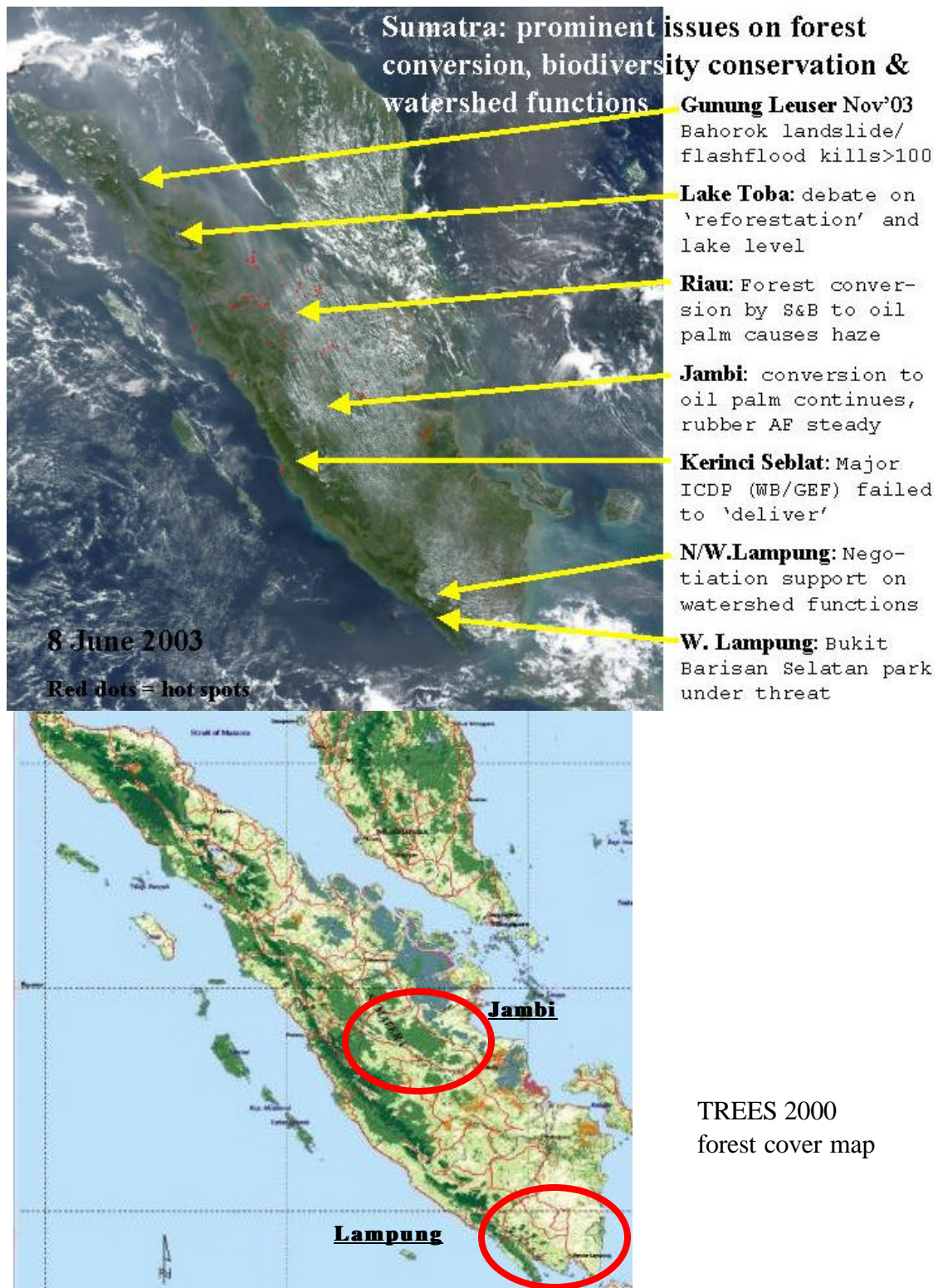


Figure 2.23. Some of the recent 'issues' on forest conversion and watershed functions in Sumatra

In a recent ministerial decree (09/KEP/MENKO/KESRA/III/2003) the lack of effective watershed functions was perceived to be linked to 229 flood-or-drought events during the January 2002 – March 2003 period that caused 505 deaths and caused 1,070,378 people to be evacuated. The standard response of the government is reforestation programs, targeting 100,000 ha for 2003 alone. Reforestation programs will absorb a substantial amount of government funds – and yet, it is unlikely to be effective in enhancing the actual environmental services as there is no clear identification of the cause-effect chains involved; there is a dominance of command-and-control interactions with the people living in the areas concerned, and a real lack of real incentives for participation. Among the research and development community in Indonesia there is a clear interest in alternative ways of achieving the goal of effective environmental protection along with poverty reduction. A better understanding of the real thresholds where land use change starts to affect quantifiable watershed functions is urgently needed. Broadening the array of policy options for achieving the targets of ‘rehabilitation’ requires both research and effective communication.

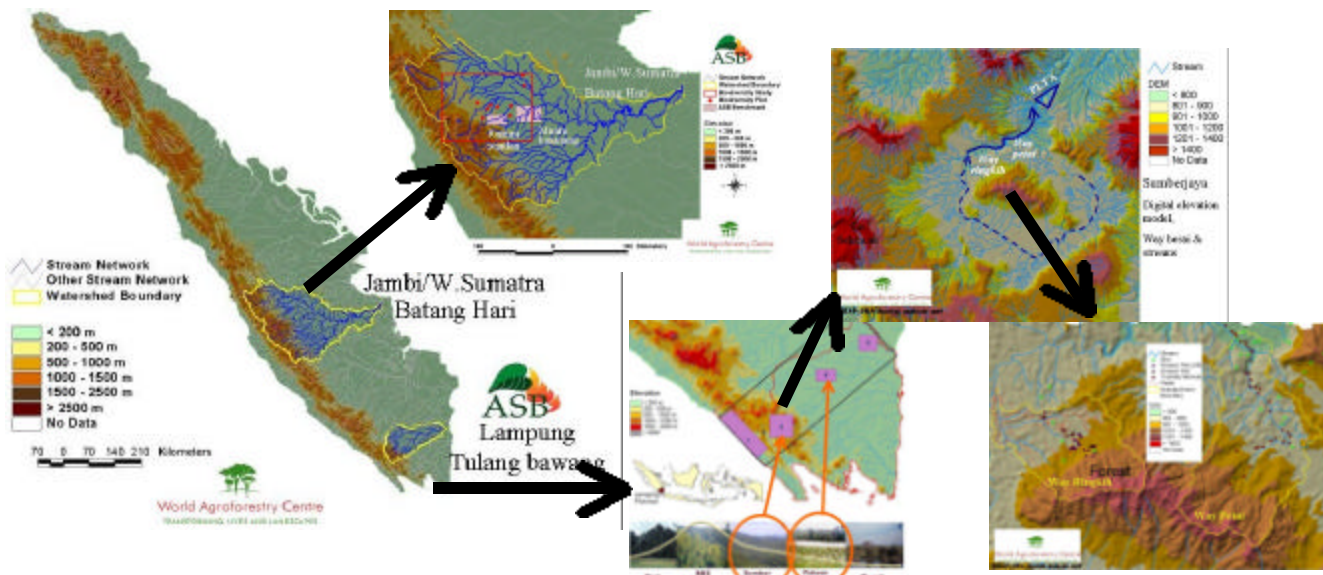


Figure 2.24. Batang Hari and Tulang Bawang watersheds of Sumatra as focal areas of ASB research and development activities in Indonesia

In Phase 1 and 2 of the Alternatives to Slash and Burn (ASB) project, research and development activities focused on two cross sections of the ecological zones of Sumatra: one in centre of the island (Jambi province, roughly coinciding with the Batang Hari watershed) and one in the southernmost tip of the island in the province of Lampung, mostly in the Tulang Bawang watershed. In Phase 3 and for this report most of the attention went to Lampung and especially to the Way Besai subwatershed (Sumberjaya sub-district), in the upper reach of the Tulang Bawang.

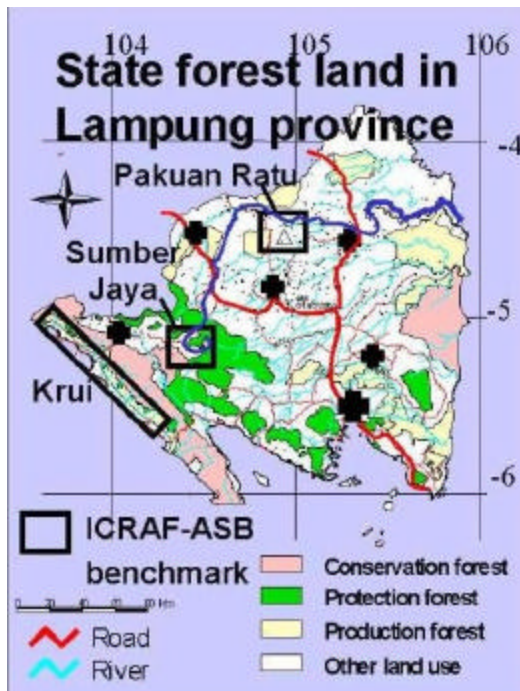
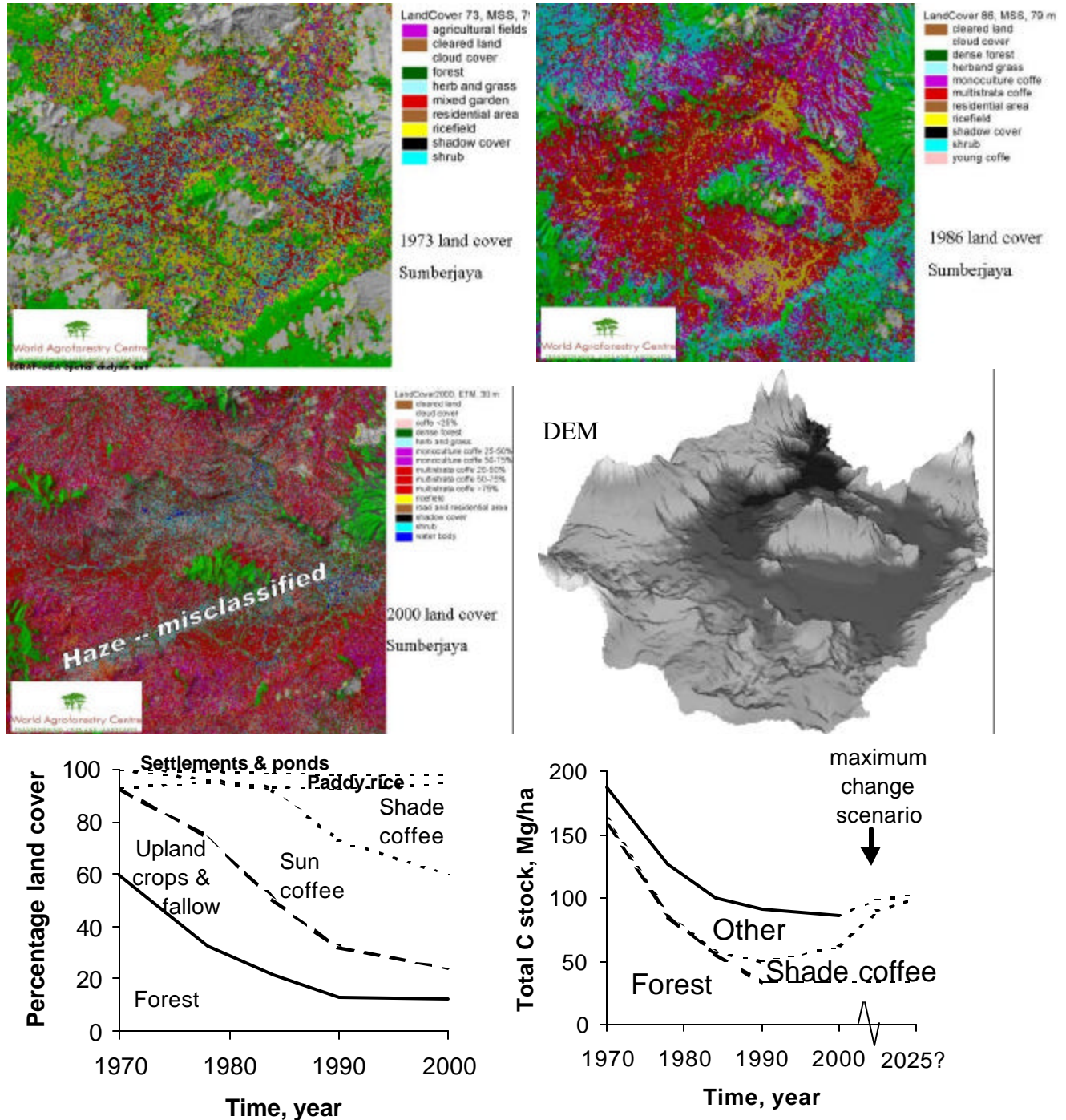


Figure 2.25. Lampung province as the demographic and developmental transition point between the densely populated island of Java and the island of Sumatra, with its official classification of state forest lands by major use category

The island of Sumatra is composed of a chain of (inactive) volcanoes and mountains (running parallel to its west coast) and a vast lowland peneplain with generally acid sedimentary soils on its eastern side (van Noordwijk *et al.*, 1998b). The richer soils are found in the mountains and foothills (piedmont). Many of the valleys in the mountains have been used for agriculture for thousands of years, with pottery and other archaeological remains providing evidence of long-term external trade links via the rivers. Sumberjaya is one of these valleys, having an elevation of between 500 and 800 m a.s.l. and rainfall averaging 2614 mm year⁻¹ (Agus *et al.*, 2002). Until the middle of the 20th century, the valley remained relatively inaccessible by road and was sparsely populated. Population densities have now reached 147 per km² (BPS, 1999), as a result of immigrants flowing into the area either from traditional coffee-growing areas to the north, or from the island of Java. Coffee (*Coffea robusta*) is the main component of the majority of gardens. A considerable part of the area has been designated ‘protection forest’, and hundreds of households have been evicted from the area in the name of ‘watershed-protection functions’. Only after the political changes of the late 1990s have farmers resettled the area, and they are currently negotiating tenurial rights in the context of ‘community forest management’ arrangements. Perceptions of watershed functions thus have a direct, political relevance in this area.

Coffee cultivation methods and garden typology vary widely across the district (Verbist *et al.*, 2002). Gardens range from young monocultures of coffee, through simple shaded coffee to complex multistrata agroforests. Increasing land scarcity has resulted in the cultivation of steeper land and the conversion of most primary and secondary forest to agriculture, except in the case of some of the steepest slopes and the top of a ridge which formally held the status ‘protection forest’. Soil conservation in these erosion-susceptible areas is a priority, in order to sustain coffee yields in the short term and prevent a longer term decline in productivity. Consequently, various soil management strategies and

garden typologies have developed to suit different locations. A variety of soil conservation measures are applied in coffee gardens – from physical barriers such as terraces, trenches, ridges and pits, to the choice, positioning and manipulation of the plant components within the garden. These measures are often practiced in conjunction with soil improvement through cultivation, and fertilizer and compost application.



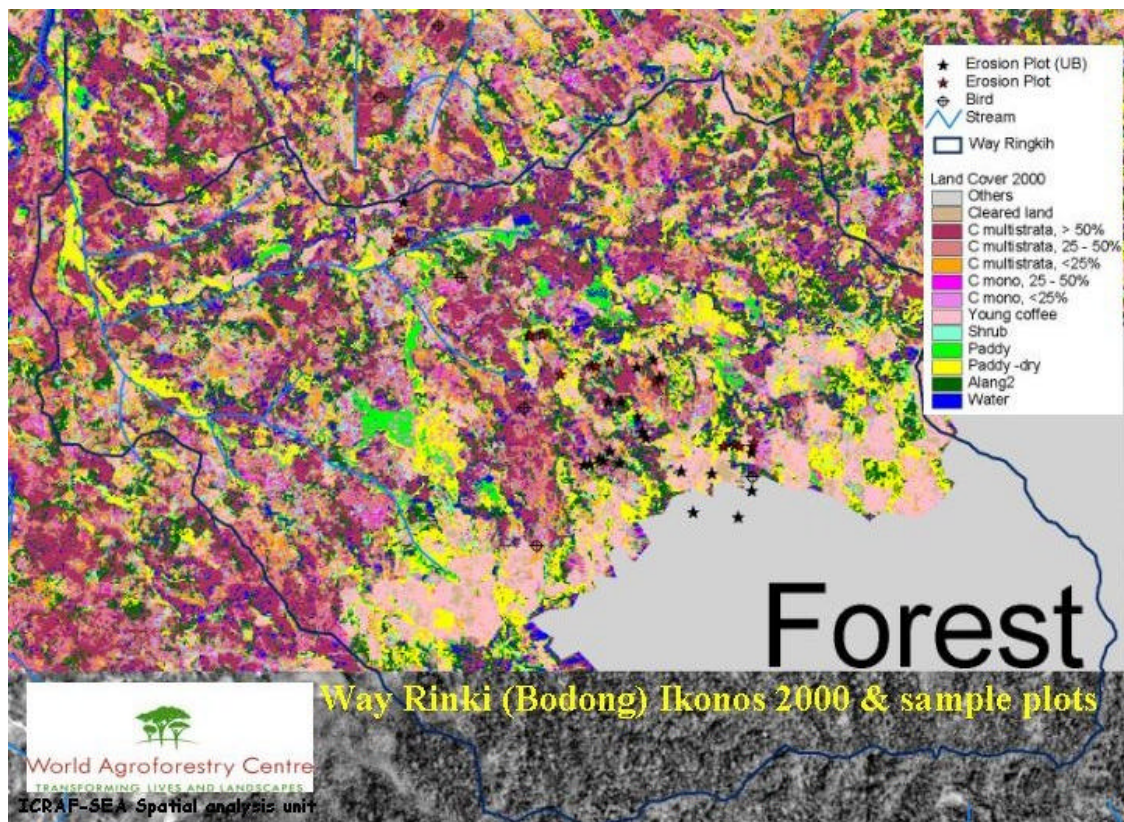


Figure 2.27. Land cover and land use in the Way Ringkih subcatchment in the Bodong neighbourhood, where detailed investigation of the hydrological impacts of conversion from forest to coffee gardens take place in the context of ASB Phase 3 project