CHAPTER 3

STUDY SITE

Background

Doi Suthep-Pui National Park is situated to the west of Chiang Mai City, northern Thailand (18°50′ N, 98°50′ E). The park was established on 14 April 1981. The highest peak, Doi Pui, has an elevation of 1,685 m above sea level. The park covers an area 261 km^2 (Figure 2). Deciduous and evergreen are the two basic kinds of forest which are roughly separated at about 950 m elevation (Maxwell, 1988; Maxwell and Elliott, 2001). Nong Hoi Highland Agriculture Research Station is the nearest weather station to the study site, which is directly north of Mae Sa Mai at about 1,000 m elevation. The annual rainfall recorded there was 1,854 mm in 2000 and 2,071.2 mm in 2001. Average annual temperatures were 24.3 °C in 2000 and 24.5 °C in 2001 (Figure 3). The average minimum temperatures were 16.3 °C in 2000 and 17 °C in 2001 while average maximum temperatures were 35.1 °C in 2000 and 34.5 °C in 2001 (Figure 4). The park has exceptionally high biodiversity (Elliott *et al.*, 1989; Maxwell and Elliott, 2001). A total of 2,247 species of vascular plant have been recorded, 21.6% of which are tree species (Maxwell, 2001). Animal species include 326 bird species (Round, 1984), 61 mammal species, 28 amphibian species, 50 reptile species, >500 butterfly species, and >300 moth species (Elliott and Maxwell, 1995).

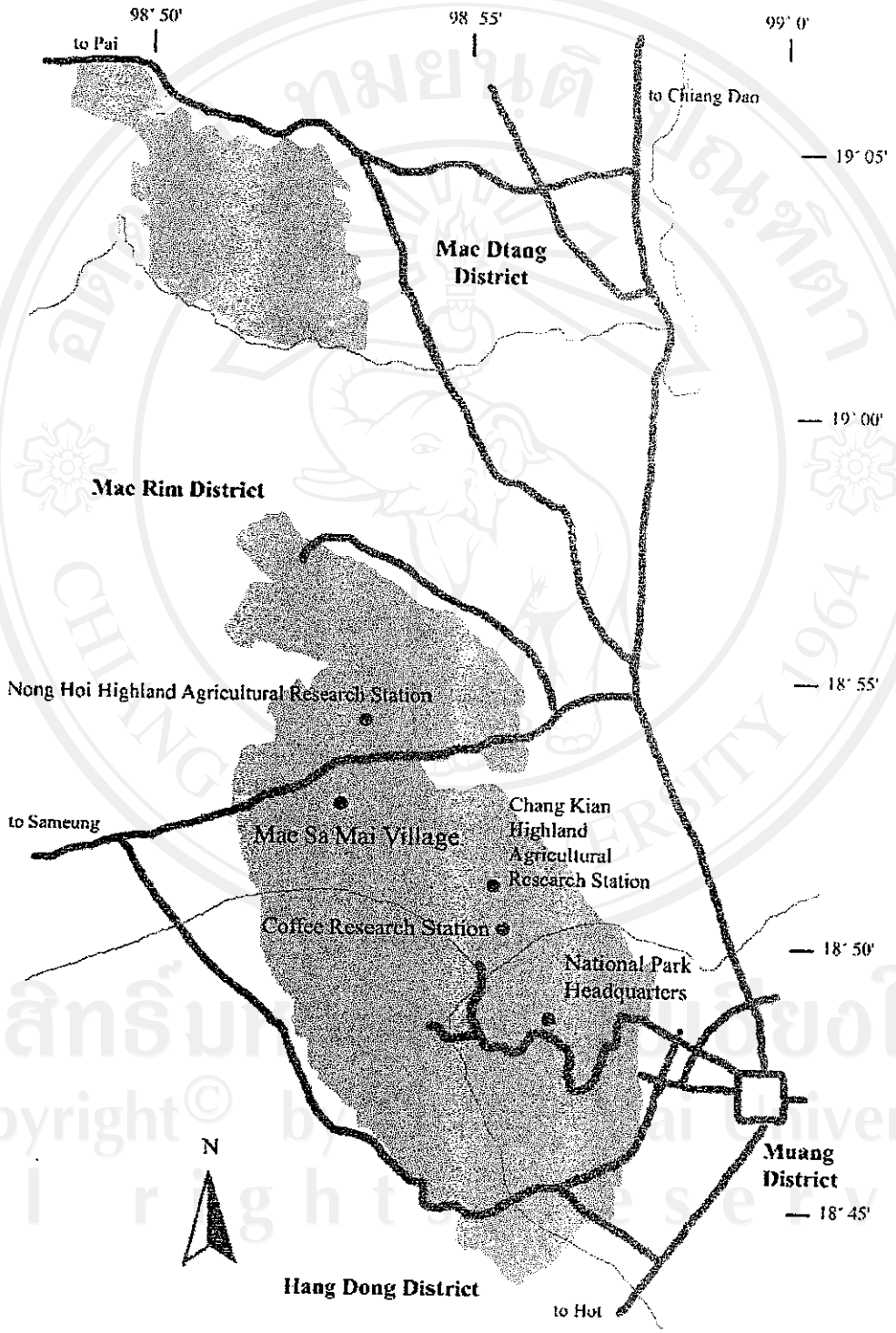

Figure 2 Map of Doi Suthep-Pui National Park, Chiang Mai

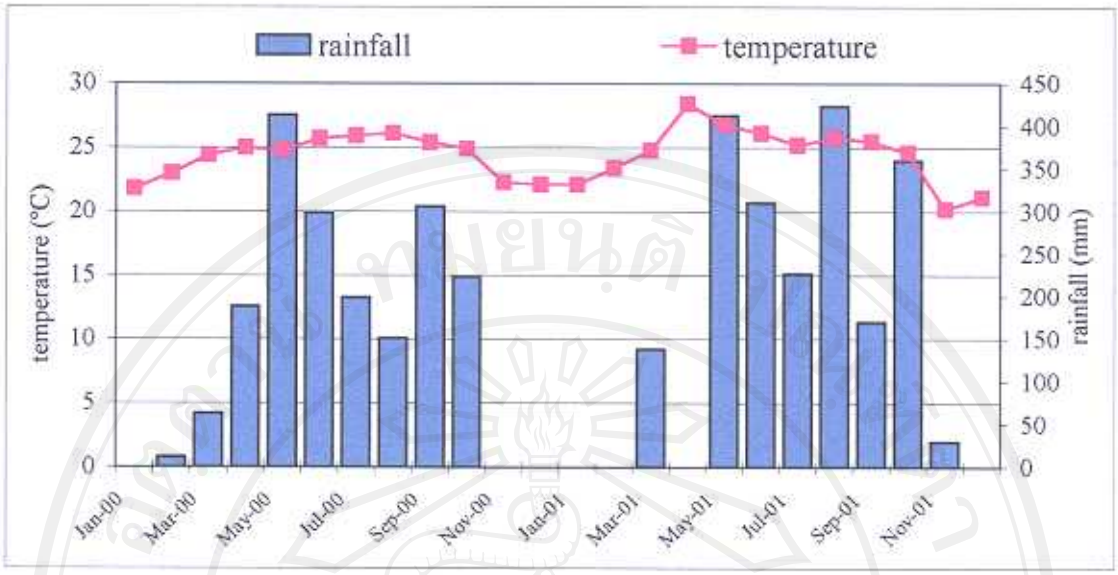

Figure 3 Average monthly temperature and rainfall at Nong Hoi Highland Agricultural Research Station

Source: Meteorological report 2000-2001, Nong Hoi Highland Agricultural Research Station, Faculty of Agriculture, Chiang Mai University

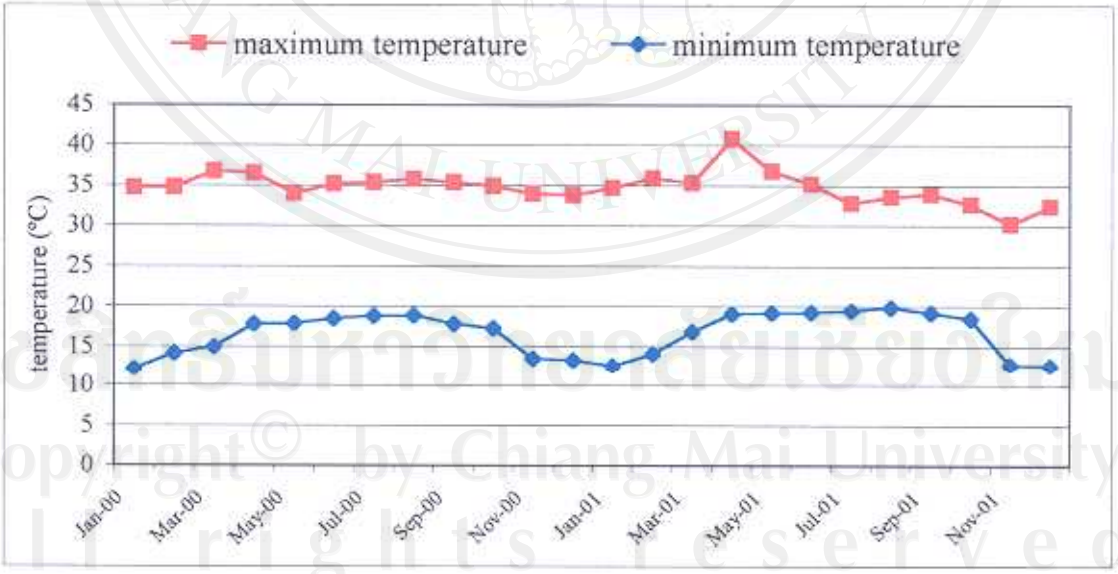

Figure 4 Average monthly minimum and maximum temperature at Nong Hoi Highland Agricultural Research Station

Source: Meteorological report 2000-2001, Nong Hoi Highland Agricultural Research Station, Faculty of Agriculture, Chiang Mai University

Deforested study site

My study plots were established in a deforested area in the northern part of Doi Suthep-Pui National Park about 300 m elevation above Mae Sa Mai village, a Hmong hill tribe community (Figure 5). The elevation of the plots is 1,200-1,310 m above sea level. Originally, the area had been covered in primary evergreen, seasonal forest, but the forest had been cleared about 25-30 years ago and the area cultivated for cabbages, corn, potatoes, and fruit trees (Elliott *et al.*, 2000b).

Although most mature trees were cut for village construction and preparing cultivated areas some trees remain along the dirt roads between fields. These include *Albizia chinensis* (Osb.) Merr. (Leguminosae, Mimosoideae), *Callicarpa arborea* Roxb. var. *arborea* (Verbenaceae), *Erythrina stricta* Roxb. (Leguminosae, Papilionoideae), *Gmelina arborea* Roxb. (Verbenaceae), *Heliciopsis terminalis* (Kurz) Sleum. (Proteaceae), and *Sterculia villosa* Roxb. (Sterculiaceae) *Schima wallichii* (DC.) Korth. (Theaceae). Furthermore, the Royal Forest Department planted some fast-growing trees, *Pinus kesiya* Roy. *ex* Gord. (Pinaceae) and *Eucalyptus camaldulensis* Dehnh. (Myrtaceae) in cleared areas about 20-25 years ago (Kuarak and Hitchcock, 1998). Other trees observed include *Bauhinia variegata* L. (Leguminosae, Caesalpinioideae), *Trema orientalis* (L.) Bl. (Ulmaceae), and *Ficus hispida* L. f. var. *hispida* (Moraceae) which are secondary growth and *Castanopsis diversifolia* (Kurz) King *ex* Hk. f. (Fagaceae) is primary growth.

The areas are mostly mono-cultivated and have many fallow places, abandoned and dominated by weedy herbaceous vegetation, including grasses

(*Pennisetum polystachyon* (L.) Schult., *Imperata cylindrica* (L.) P. Beauv. var. *major* (Nees) C.E. Hubb. *ex* Hubb. & Vaugh., *Thysanolaena latifolia* (Roxb. *ex* Horn.) Honda, and *Phragmites vallatoria* (Pluk. *ex* L.) Veldk., all Gramineae; *Pteridium aquilinum* (L.) Kuhn) ssp. *aquilinum* var. *wightianum* (Ag.) Try., Dennstaedtiaceae; *Bidens pilosa* L. var. *minor* (Bl.) Sherff, *Ageratum conyzoides* L., *Eupatorium odoratum* L., *E. adenophorum* Spreng., all Compositae; and *Commelina diffusa* Burm. f., Commelinaceae) (Elliott *et al.*, 1997; Elliott *et al.*, 2000b).

Elliott *et al.* (2000b) reported the soil characteristics in the study area and compared this with soil from undisturbed evergreen forest at a similar elevation (Table 1). The results showed that the soil in the study site is significantly more acidic, with much less organic matter, nitrogen, silt, and clay but more sand.

Table 1 Soil characteristics of the study site (n=16) compared with those in undisturbed primary evergreen forest (Reusee Cave, east side of Doi Suthep, elevation 1,100 m about 9 km from the study site) (n=20)

	degraded area		*evergreen forest*		t-test [1]
	mean	*SD*	mean	*SD*	p values
pH	5.44	0.423	6.22	0.545	0.001
organic matter (%)	5.35	0.997	7.30	2.480	0.010
nitrogen (%)	0.26	0.045	0.37	0.121	0.002
potassium (ppm)	274.84	137.637	295.67	72.093	ns [2]
moisture at field capacity (%)	34.76	2.571	35.35	4.363	ns [2]
sand (%)	68.52	6.290	52.13	17.872	0.010
silt (%)	18.26	3.090	22.04	5.473	0.020
clay (%)	13.22	3.880	25.83	16.343	0.010

[1] Two-tailed student's t-test, variances assumed equal, [2] ns = not significant at $p>0.05$

Source: Elliott *et al.* (2000b)

Most parts of this area are situated in the forest-planting project to celebrate His Majesty King Bhumibol Adulyadej's Golden Jubilee. The target area encompasses 0.32 km^2 (200 rai) of deforested land. Tree planting started in 1996 by the Forest Restoration Research Unit (FORRU), Chiang Mai University. This tree-planting program was implemented in collaboration with Mae Sa Mai villagers to plant and maintain the planting plots. Furthermore, the villagers make fire breaks and keep watch for forest fires every dry season, but fires still occur almost every dry season (Elliott *et al.*, 1997; Elliott *et al.*, 2000b; FORRU, 1998).

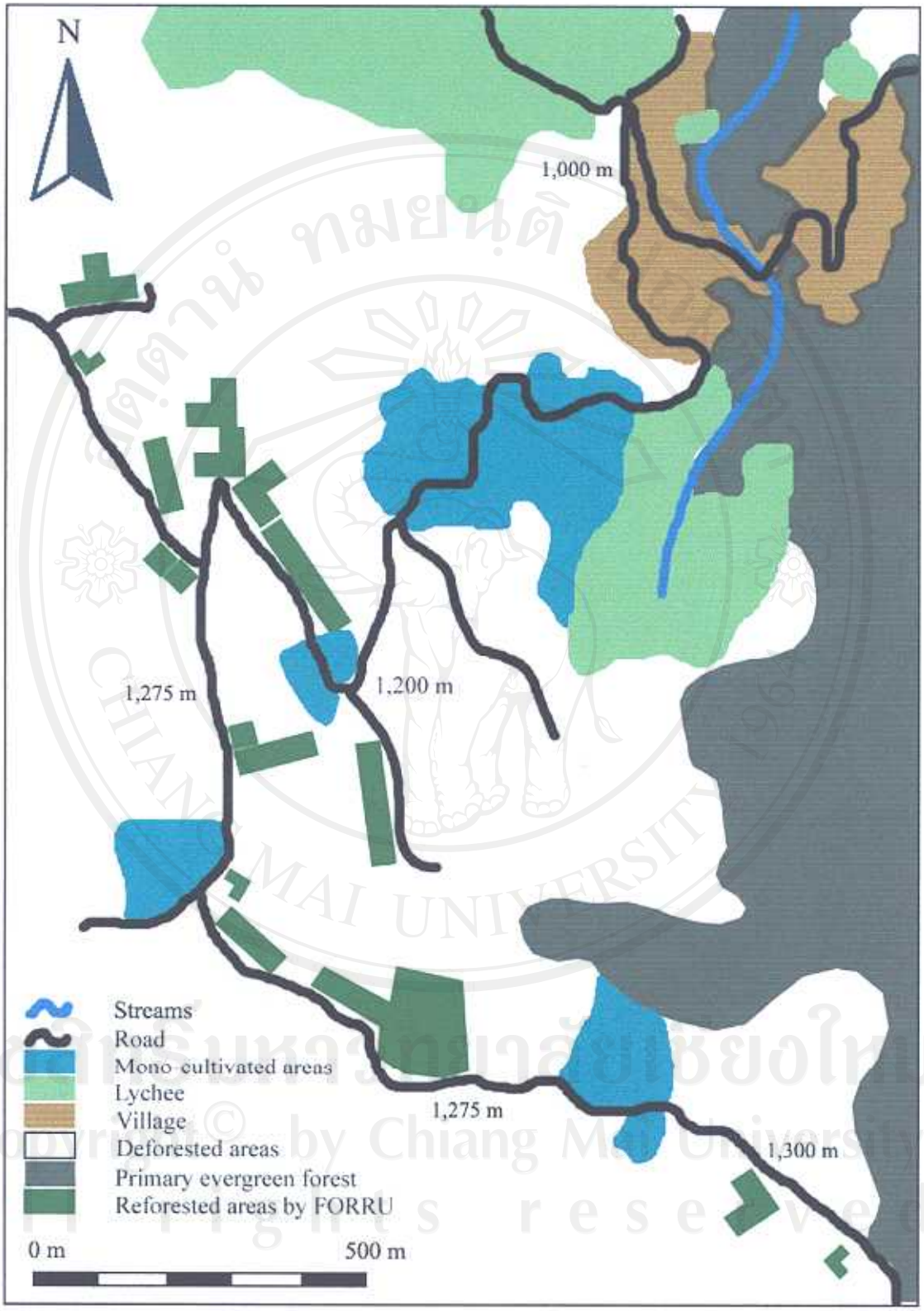

Figure 5 Land use map showing the deforested sites in Doi Suthep-Pui National Park, and Mae Sa Mai village