CHAPTER III. SITES DESCRIPTIONS

This study was conducted in two different sites of more or less the same elevation but of different ecological conditions, with one site being highly influenced by agricultural activities and the other characterized by its relatively pristine conditions.

The first stream representing the disturbed site, called Huai Nong Hoi is located in Ban Nong Hoi, Mae Rim District, Chiang Mai which is approximately 98° 50' E and 18° 55' N. It is about 7 km from the main road of Mae Sa and is a tributary of Mae Sa River in Mae Rim District. Three stations along the stream were selected for the study (Figure 1).

Station 1 was situated upstream at about 1200 m altitude with a stream width ranging from 40 cm to 2.5 m. (Figure 2). The water was very clear, shallow, fast-flowing, with a flow velocity that ranged from 0.44 - 1 m/s and was completely covered by riparian plants. These included plants which are common at higher elevation such as *Debregeasia longifolia* (Burm. f.) Wedd, *Diplazium* sp., *Psychotria ophioxyloides* Wall., *Parabaena sagittata* Miers ex Hk. f. and Th., *Forrestia mollissima* (Bl.) Kds., *Costus speciosus* (Koehl) J.E. Sm. and *Musa* sp., the most common. The substratum was dominated by gravel (40%), stone (30%) and the rest were coarse sands and roots of the riparian vegetations (30%). Upstream of this station was also an agricultural field. The only difference of this station to the rest was that trees and other vegetations have not been cut down.

Station 2 was about 1 km downstream at an altitude of 1000 m with a stream width

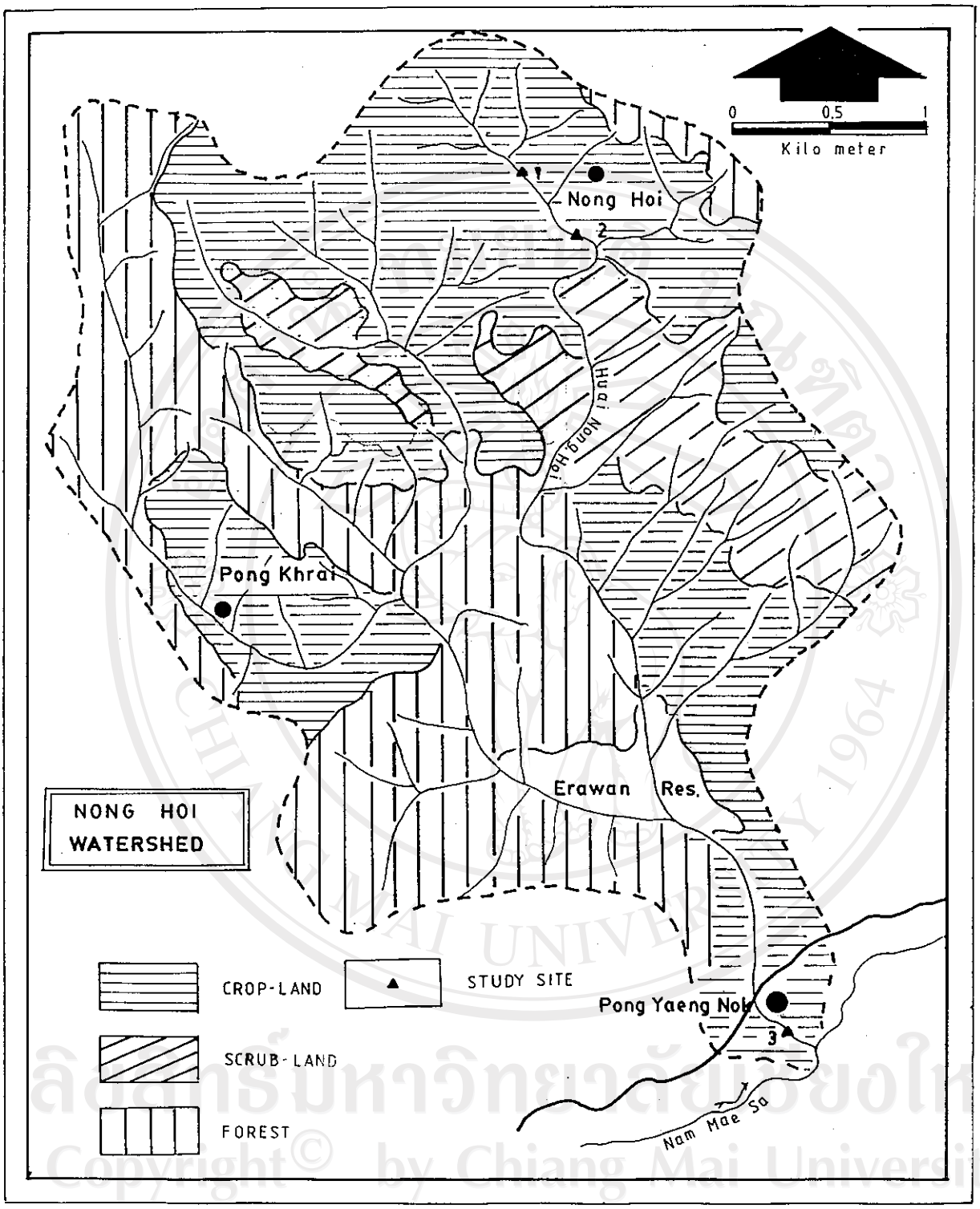

Fig. 1 map of Ban Nong Hoi Stream Showing the Three Stations Selected for Sampling

Fig. 2. Photo of station 1 of Ban Nong Hoi stream.

ranging from 30 cm to 1.5 m. (Figure 3.0). This station was severely influenced by agricultural activities as it was immediately located in the Highland Coffee Research Station of the Faculty of Agriculture, Chiang Mai University and vegetable fields of Hmong hilltribe. Vegetables extensively cultivated included carrots, cabbages and garlics and fruit trees as minor crops (Figure 3.1). The water was also shallow and fast-flowing (0.33 - 1 m/s) but turbid especially in the rainy season due to the erosion from the neighboring fields. As agricultural activities have been going on for quite some time now, substrates were highly altered. The most dominant was fine to coarse sands (70%), silt (25%) and some rocks which were partially or entirely covered by silt. Most parts of the stream were exposed as riparian trees have been felled down. Weeds dominated the riparian vegetations such as *Euphatorium adenophorum* Spreng., *Panicum maximum, Setaria palmifolia* (Koen.) Stapf var. *palmifolia, Cyrtococcum accrescens, Microstegium vagans* (Nees ex steud), *Amaranthus spinosus, Ageratum conyzoides* Linn. and *Musa* sp., the most abundant. Like station 1, aquatic plants were absent. Both hilltribe and the research station were using pesticides which included Malathion, Sumithion (a.i.: fenitrothion), Ecomax, Cupravit (a.i.: copper oxychloride) and Benlate (a.i.: benomyl) (used as fungicide and bactericide). Fertilizers in use were natural (manure and compost) and complete fertilizer (15 N-15 P-15 K). The hilltribe also used plant growth hormones and pesticide stickers especially during the rainy season to enhance the effectiveness of the applied pesticides.

Station 3 was about 5 km downstream of station 2 at an altitude of 750 m immediately before it joined the Mae Sa River (Figure 4.0). Stream width ranged from 1.2 m to 2.0 m. The water was very turbid and knee-deep in the rainy season, fast-flowing, with a flow velocity that ranged from 0.25 - 1 m/s. Most parts of the stream were

Fig. 3.0. Photo of station 2 of Ban Nong Hoi stream.

Fig. 3.1. Photo of the land-use of station 2 of Ban Nong Hoi stream.

Fig. 4.0. Photo of station 3 of Ban Nong Hoi stream.

Fig. 4.1. Photo of the land-use of station 3 of Ban Nong Hoi stream.

exposed except in some parts where weeds and some shrubs were growing and left uncut. These included *Mimosa diplotricha* C. Wright, the commonest weed species, *Polygonum chinense* L., *Debregeasia longifolia* (Burm. f.) Wedd, *Colocasia esculenta* L., *Ricinus communis, Ageratum conyzoides* Linn. and *Pennisetum typhoides* (Burm.) Stapf et C.E. Hubb. Like station 2, this station was characterized by extensive cultivation, but in contrast to station 2, irrigated rice was the main crop in this area with vegetables as minor crops (Figure 4.1). About 1 or 2 km upstream were Erawan resort and a new resort still in the process of construction. Substrates were dominated by fine sand (80%) and some parts where flow was slow occupied by silt (20%).

The other site selected for the study to represent the relatively pristine stream, is situated in Doi Chang Kian, Muang District, Chiang Mai, approximately 98° 54' E and 18° 50' N immediately where the other Highland Coffee Research Station of the Faculty of Agriculture, Chiang Mai University is located. It is actually not a pollution-free stream but because of the difficulty in finding a pristine one, this least polluted stream in DCK was then chosen. Three stations were also selected for the sampling (Figure 5).

Station 1 was found about 50 m upstream of the coffee fields at an altitude of 1300 m. (Figure 6). The water was clear, fast-flowing (0.33 - .36 m/s), shallow and the stream width ranged from 70 cm to 1.5 m. The stream was completely covered by riparian plants such as *Camellia oleifera* Abel var. *confusa* (Craib), *Trichosanthes wallichiana* (Ser.) Wight, *Parabaena sagittata* Miers ex Hk. f. and Th, *Grewia acuminata* Juss., *Callophylum polyanthum* Wall, *Costus speciosus* (Koehl) J.E., *Saurauia nepaulensis* DC. and *Microstegium vagans* (Nees ex Steud). A small area planted with vegetable was found upstream of the station but during the rainy season it was abandoned by the farmer.

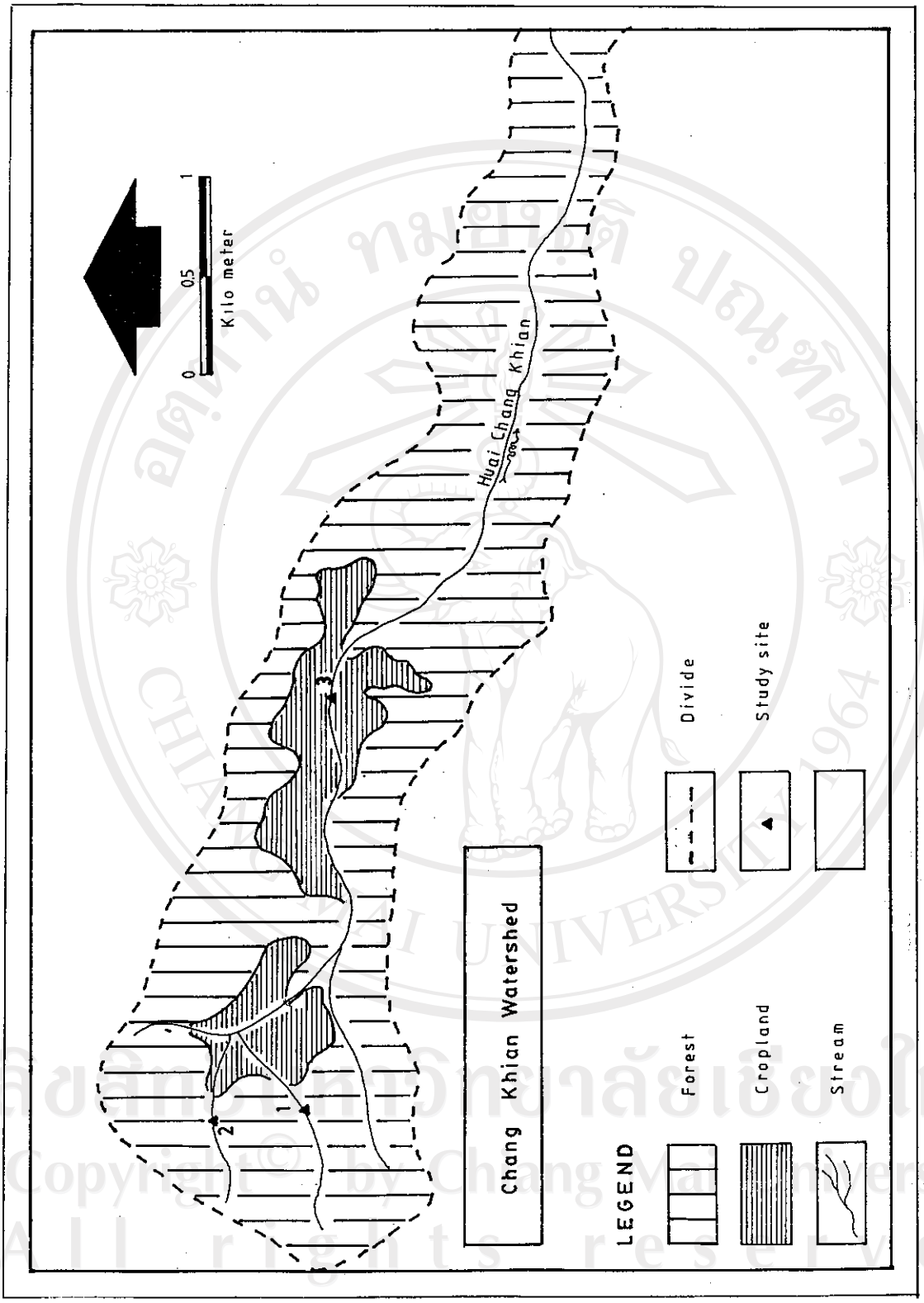

Fig. 5 map of Doi Chang Kian Stream Showing the three Stations Selected for Sampling

The substrates were composed of gravels (20%), coarse sands (50%), small stones (10%), roots (10%) and litter (10%) where flow was very reduced.

Station 2 was a separate stream running parallel to station 1 and was about 500 - 600 m away from it and approximately 1 km away from the coffee fields (Figure 7). This was rather smaller than station 1 with a stream width ranging from 20 - 70 cm but of the same elevation that of station 1 (1300 m). The water was clear, very shallow and fast-flowing (0.33 - 0.36 m/s). This station was not influenced by cultivation and was totally covered by riparian plants commonly found in evergreen forest like *Euodia triphylla* DC., *Litsea salicifolia* (Roxb.), *Rourea minor* ssp. *minor* (Gaertn.) Leenh, *Bridelia pubescens* Kurz, *Ostodes paniculata* Bl., *Fraxinus floribunda* Wall. and *Zingiber* sp.. The substrates were composed of gravels (40%), sand (30%), small stones (10%), roots (10%) and litter and mud (10%) in sections where flow was very much reduced.

Station 3 was a section of Huai Chang Kian about 5 km downstream of stations 1 and 2 (these two upstream stations were tributaries of station 3) at an altitude of 1000 m. (Figure 8.0). The water was turbid and knee-deep in the rainy season, fast-flowing (0.44 - 1.17 m/s), and the width ranged from 1.5 - 4.5 m. Substrates were composed of big stones (40%), sands (20%), gravels (30%) and silt (10%). This station was located immediately in the agricultural fields of Hmong hilltribe where rice, corn, vegetables and fruit trees were extensively grown (Figure 8.1). Some parts of the stream have been dammed and water was diverted to irrigate the ricefields. Most parts were still covered by dense shrubs and some trees although some parts were also exposed to the open. Riparian plants included *Eupatorium adenophorum* Spreng., *Polygonum chinense* L., *Microstegium vagans* (Nees ex Steud), *Ageratum conyzoides* Linn., *Setaria palmifolia*

Fig. 6. Photo of station 1 of Doi Chang Kian stream.

Fig. 7. Photo of station 2 of Doi Chang Kian stream.

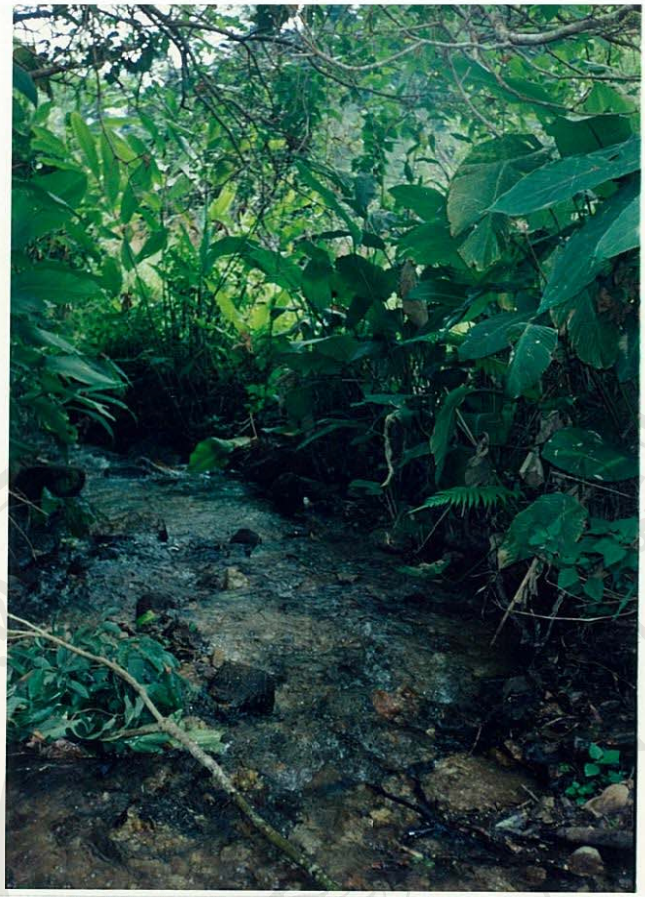

Fig. 8.0. Photo of station 3 of Doi Chang Kian stream.

Fig. 8.1. Photo of the land-use of station 3 of Doi Chang Kian stream.

(Koen.) Stapf var. *palmifolia*, *Etlingera littoralis* (Koen.) Gise and *Bidens pilosa* L. var. *minor* (Bl.) Sherff.