

ASSESSMENT OF SOIL EROSION FOLLOWING LAND USE CHANGES  
IN KUP KAP STREAM **DISCUSSION** MAE TAENG DISTRICT  
CHIANG MAI PROVINCE

### **Causes of Land Use Changes**

During the last 20 years land use in Kup Kap Stream Valley has changed mainly from relatively undisturbed forests (evergreen and deciduous) to degraded forests and agricultural lands. Relatively undisturbed forests declined from 67% of the total area in 1977 to 13.8% in 1997. Degraded forests increased from 27.8% to 62.1%. Grassland and secondary growth in this area decreased slightly from 7.65 to 6.2%. Agricultural lands increased from 3.4% to 17.9% (Table 7). This indicates that deforestation is happening in the study area. The main reasons for deforestation are logging activities and the need for agricultural lands.

#### *Logging Activities*

Logging activities were done legally in Kup Kap Valley by logging companies until "logging ban" was announced by the Thai Government in 1989. Logging is still done illegally by lowland people and hilltribe people from the villages in the study area as evidenced by many recently cut logs and tree stumps in the forest as well as many solid wooden houses in the villages.

The mining site, which is located on the eastern side at 1000 m contributed to deforestation in the study area. Mining of lead-zinc (Pb-Zn) was operated only for two years (1966 to 1968) and a dirt road was constructed connecting the mining site to the road along the Mae Taeng River to remove mine products. The means of

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transportation were elephants, horses, and men. This road passed through the lowland forest and resulted in the removal of many trees. This road also gave accessibility to logging companies to penetrate the forest to cut and extract logs. Since the logging ban 9 years ago, the road has been abandoned. Unpaved roads in highland areas are significant sources for soil erosion because of its low infiltration rate and producing more surface runoff (Ziegler, 1997).

#### *Need for Agricultural Lands*

The people in the study area are all farmers who need land for agriculture to support their basic needs. Their presence has caused land use changes from original forested land to agricultural land. During the past 20 years, people living in the study area can be divided into two groups, viz. people in the abandoned village (old Kup Kap) and those in present villages (Pa Daeng and Kup Kap Villages). According to Mr. Bprawah Bpranee, a resident of old Kup Kap, now 50 years old, and living in Pa Daeng Village, old Kup Kap was a Red Lahu village established at least 60 years and had more than 80 households. Mr. Bpranee was born and lived in that village until all villagers moved out, mostly to other places outside of the study area. Shifting cultivation was widely practiced by villagers extending over the top of Doi Sahng Liang (1625 m). They grew upland rice and corn, but opium poppy was their main cash crop. The Thai government's drug control programme resulted in the abandonment of this villages.

Shifting cultivation, which is commonly practiced in northern Thailand as well as throughout southeast Asia, is one of the main reason for deforestation. Shifting

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cultivation with slash and burn techniques have changed the original characters of much of the forest cover. There are two basic type of shifting cultivation in Thailand: pioneer and rotational. In the pioneer type, farmers clear and burn a piece of forest land for growing crops for several years and when productivity declines or weeding requirements become too high, the land is abandoned. A new piece of forest is then cleared and the village normally relocates to the new site. Rotational shifting agricultural villages are settled permanently, originally with 8 - 15 years of fallow, but now fallow periods have become shorter, i.e. 2 - 5 years (Kunstadter, 1978). Pioneer shifting agriculture is uncommon now as new forested land is hard to find and illegal to destroy (TDRI, 1994).

People in the present villages of Pa Daeng and Kup Kap are completely dependent on the agricultural land they have. Pa Daeng Village was established 18 years ago, while Kup Kap Village was established 6 years later. People moved to this area because this area was still unoccupied. The mountainous and very rough land in this area is not suitable for agricultural activities, especially for seasonal crops, but villagers have no choice because they have to cultivate this land to grow their food. This land can not provide optimal production since most of the area is steep and soils are relatively shallow as a consequence of soil erosion. When agricultural production decreases and is not sufficient to support the villagers needs, farmers will expand their lands by creating new agricultural land from abandoned fields or forested areas. In Kup Kap Village the evidence of forest clearing to create a new agricultural land is very obvious. For this reason, villagers in Kup Kap Village can be classified as

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 pioneer shifting cultivators. Deforestation in Kup Kap Village and its surroundings is very rapid and far more environmentally destructive compared to Pa Daeng Village.

Study on land use changes in Mae Taeng Watershed using aerial photographs and satellite images from 1977 to 1991 by DLD revealed that forest cover decreased from 97.57% to 84.81%, but this study did not classify forests according to the level of degradation. Agricultural lands increased from 2.02% to 13.27% (TDRI, 1995).

### **Status of Soil Erosion in Kup Kap Valley**

Prediction of soil erosion by using the USLE model showed that within 20 years soil loss in the study area increased from 54.1 ton/ha/year in 1977 to 174.3 ton/ha/year in 1997 (Tables 14-15). Based on FAO soil erosion criteria and on TMU reclassification, areas with low or slight erosion decreased from 43.1% to 9.9%; moderate erosion is relatively unchanged from 22.9% to 22.5%; high erosion increased from 31.2% to 43.9%; and very high erosion increased from 2.8% to 23.7% (Figures 20-21). By using a USLE model in this study, the reason for the increase in soil erosion can only be explained by changes in the dynamics factors (C and P) of soil erosion since the permanent factors (R, K, and LS) are assumed to be constant.

The increase of total soil loss in Kup Kap Valley from 38,121.7 tons in 1977 to 122,945.2 tons in 1997 is a consequence of area expansion of land use types which has a high C factor value (degraded forests and upland fields). Absence of conservation measures in upland fields contributes to a high P factor value.

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Total soil loss in the study area, which is using a sub-catchment as study unit, does not mean that all soil lost is transported to the catchment's outlet. The USLE model, which was developed by using experimental plots, does not imply the transportation of detached soils. The eroded soil may be delivered to streams, but some still remains within watershed, e.g. in relatively flat areas at the lower elevations.

Direct effects of soil erosion are reducing soil depth in upland places and sedimentation in the lowlands. Upland fields are very susceptible to erosion because the slope is generally steep and exposed to rainfall. In such conditions, soil formation is not sufficient to replace soil loss and as a result, soil becomes shallower. Soil depth can be applied for assessing soil quality. Generally, at higher degrees of erosion, productivity and erodibility change adversely because of the modification of soil properties as the soil profile decreases in thickness (Rhoton and Lindbo, 1997). In the study area, steep slopes and shallow soils as a consequence of soil erosion are the main constraints for agricultural activities.

According to land capability criteria from the USDA (Klingebiel and Montgomery, 1986), this study area is not suitable for agricultural activities. Ideally, this area should be preserved for conservation purposes. This is not possible since there are two farming villages there. A compromise should be introduced to this area to keep the catchment from not being further deteriorated while people have the opportunity to live there.