

## **Dong Cao Catchment: The MSEC Benchmark Site in Vietnam** (Based on Country Report)



### **Introduction**

In Vietnam, sloping lands and mountainous areas account for two-thirds of the total territory. The influence of topography, geology, morphology, climate, etc. and of human activities has resulted in serious environmental degradation, particularly of soil and water. According to the Ministry of Plan and Investment (UNDP, 1999), the total area having soil erosion problems in Vietnam is 13 million ha, (40% of the total area).

The cultivated land per capita in the country is decreasing annually. In 1989, it was 0.109 ha, but it decreased to only 0.089 ha in 1999. According to UNDP, with a projected population of 110 million in 2010, the cultivated land per capita will further decrease to 0.036 ha. These small landholdings coupled with inappropriate cultivation methods result in low productivity, famine, and poverty (Phien *et al.*, 1997). In the hills and mountains, agricultural productivity is decreasing due to the erosion of the fertile soil every year.

Over the centuries, Vietnamese farmers have been adopting land use systems that are compatible with the environment, such as shifting cultivation. However, as populations increase, the need for more food, fuel, fodder, and shelter has led to forest encroachment, expansion of cultivated areas onto steeper, more fragile areas in the uplands, declining soil productivity, and environmental degradation (Garrity, 1998). Watershed degradation now poses a threat to the livelihood of the ever increasing Vietnamese population and the country's economy in general.

Soil erosion reduces on-site soil fertility in terms of chemical, physical, and biological attributes. These soil changes will, in time, reduce crop yields and hence income and household food security. The off-site effects of soil erosion often have broader economic and environmental implications including sedimentation, flooding, and reduced water quality resulting in poorer living conditions for the people. Land management research has provided a range of technologies, which can reduce soil loss to acceptable levels, but sustainable adoption of these technologies has been very limited, especially at the watershed level.

Watershed management is an important issue in Vietnam not only to protect the existing forest but also to conserve agricultural land for sustainable agriculture and biological diversity. It is the best way to minimize land surface runoff, soil loss (Tengberg and Stocking 2001,) and to prevent frequent and intense flash floods which cause much loss of human and animal life, damage to property and the environment (Cao Dang Du, 2000).

To address these concerns, the Management of Soil Erosion Consortium (MSEC) has decided to adopt a new research paradigm based on a participatory, interdisciplinary, catchment level approach. This new paradigm is now employed in the consortium's activities in Vietnam to develop sustainable and profitable natural resource development as short- and long-term benefits for farmers, who live and do cultivate in the watershed

### **Benchmark Catchment**

A multidisciplinary site selection team composed of experts from IBSRAM and national agencies visited and evaluated three pre-selected sites in Vietnam. These are the Ngoc Thanh Watershed in Vinh Phuc Province, Thung Dau Watershed in Hoa Binh, and Dong Cao Watershed, also in Hoah Binh Province. They were visited in November 1997, May 1998, and October 1998, respectively.

Dong Cao catchment was finally selected as the model site for the project. It is located in the bow-shaped range of Vietnam mountainous area which connects the North and the South. Basically, it represents the typical cultivated mountainous uplands with slope of more than 25%. The watershed is located in Dong Cao village (thus its name Dong Cao watershed), Tien xuan commune, Luong son district, Hoa Binh province. (Figure 1). Tien Xuan commune consists of 18 villages: Co Dung 1, Co Dung 2, Xom Chua 1, Xom Chua 2, Que Vai, Dong Dau, Dong Cao, Go Choi 1, Go Choi 2, Binh Son, Trai Moi 1, Trai Moi 2, Xom Nhom, Xom Mieu 1, Xom Mieu 2, Go Me, Bai Dai, and Go Che. There are 1100 households in the commune.

The altitude varies from 125 to 700 m above sea level and the slope ranges from 15 to 60% (Figure 2). All the water discharged from the catchment is used directly for 10 hectares of paddy rice irrigation down stream. This provides a good opportunity for scientists to also evaluate the off-site effects of soil erosion from the upper catchments.

Dong Cao village has 38 households. It is located at  $20^{\circ} 57' 40''$  N and  $105^{\circ} 29' 10''$  E. The main crops are cassava, taro, peanut, rice, maize, forest plantation such as *eucalyptus*, *acacia mangium*, *cinammomum*, etc. Water from streams at the catchment is used for irrigation of 10 ha of paddy in Dong Cao village. Tien Xuan commune has 250 ha of paddy field.

Current road access to the site requires a 4WD vehicle. It will be muddy in the rainy days. Electricity is good. Accommodation is at the farmers' houses. Working house/office is now constructed at the site.

## **Biophysical characteristics**

### ***Climate***

Based on the meteorological data recorded in two nearby stations, the average annual rainfall in the area is 1500 mm. About 80-85% of the rainfall occurs from April to October (Figures 3 and 4). The mean temperature ranges from 15-27°C with the lowest occurring in February.

### ***Soils***

The soils of the area are derived from parent materials primarily consisting of shale. They are classified as Ferralsols and Acrisols or Ultisols in the USDA soil taxonomy system. They have shallow to medium depth and medium stone content with very low nutrient content. Texture is clay loam to clay. A sample profile description is shown in Table 1.

### ***Vegetation and land use***

Thirty years ago the catchment was covered with forest. Because of a need for more food, massive forest cutting was done after 1978. Annual crops, mainly upland rice was grown, soil erosion was accelerated and after 3-5 years, the soil fertility declined.

Cassava, com, and arrowroot are now cultivated on the sloping/steep lands. In some areas, there are secondary forests and plantation forests with *eucalyptus*, *acacia mangium*, *cinammomum*, and some fruit trees (Figure 5). Legume-based cropping systems are observed on gentle slopes and foothills. There are 10 ha of paddy rice down the outlet of the Dong Cao catchment. Water from the catchment is enough to grow two rice crops and one winter crop (com, bean, vegetable,).

### ***Livestock and fauna***

Livestock is also important source of income to support livelihood of farmers. Livestock provides draft power, manure, and meat. In Dong Cao village, the households have on the average 1 buffalo, 1 cow, 3 pigs and 32 chickens. Pigs and chicken raising provide additional source of income for the farmers.

## **Socioeconomic environment**

### ***Population and settlement history***

Dong Cao village is one of the three villages near the catchment. There are 38 families now living in the village which has a population 196 persons. mainly coming from other villages since the 1960s. Sixty per cent are the native Muong and 40% belongs to the Kinh ethnic group who migrated from Ha Tay province in the 1960s through a government program. The households have an average size of 5-7 members.

Recent survey conducted showed that about 45% are males and about half are economically active at ages from 15 to 60 years. They are engaged in different types of production activities like field crop cultivation and livestock raising. About 28% percent of the total population is below 15 years old.

During peak activities in the farm like planting, weeding and harvesting, all members of the family work. In 80% of the families, men are mostly responsible for land preparation, such as plowing, harrowing, pest and disease control while women do the weeding, fertilization and purchase of materials. The children help in the field after school time.

Animal husbandry and daily household activities like cooking, washing are done by women. They are also the one who gather firewood, buy and sell products. In general, family labor is not fully utilized for agricultural activities.

Decision-making on household needs depends on the kind of activities and the things to be purchased. In general, the daily household needs, such as food, and clothing are decided by women. Most agricultural activities are decided by women.

Almost all of the children go to primary school as it is situated within the village. Only a few children particularly the females continue to the secondary school. One reason is that it is far from the village.

### ***Land use history***

Before 1970, all of the area of 120 ha of land in Dong Cao catchment was covered by primary forest. The local farmers did agricultural activities only on the foothills and along the main stream for paddy rice and arrowroot.

After 1970, because of population growth, more food is needed. Forest was cut to have new lands for agricultural production. Since 1980, all the forest has been cut for cultivation. Corn and cassava have been planted as the major crop. Cassava was considered as the main crop since 1986.

### ***Predominant occupation and income***

Agriculture is still the major source of household income. The average total income is 8 million Vietnamese dong per household, 57% of which comes from farm produce and 39% from livestock. The average net income is however very low with only 58% of the households achieving a net annual income of 2.8 million VN dong.

All farmers in the village reported to be full time farmers and fully rely on agricultural activities for their livelihood. About 24% of the Muong households reported that their produce is enough only for less than 7 to 9 months of their annual food requirement, 24% are self-sufficient and 53% have food surplus. About 76% of the Kinh people are self-sufficient or have food surplus. All those with food shortage are the Muong people.

Farmers use fertilizers only for paddy rice at the rate of 72kg N as urea, 25kg P<sub>2</sub>O<sub>5</sub> as superphosphate, 53 kg K<sub>2</sub>O as potassium chloride and about 7-8tons farm yard manure (FYM) per ha. The application of FYM depends upon the number of livestock in the households. It was reported that farmers never use fertilizers for upland crops as they find difficulty in transporting it

to the upslope. Rice varieties commonly used are CR 203, Khang dan, Tap giao, and Q5 (from China)

### ***Land tenure arrangement and policy***

To overcome food shortages and to alleviate poverty, the Vietnamese Government has put much effort to manage natural resources, particularly the sloping lands for sustainable agricultural and forestry production. The first orientation is to reduce deforestation, encourage permanent cultivation and human settlement. To achieve these purposes, the Government allocates a large part of forest and barren lands (or unused land according to the Land Law) to people, with the aim to plant new forests and to protect existing natural forests. Program 327 with an annual budget of US\$ 50 million has been carried out since 1992 to rehabilitate, protect, and make special use of forests. In 1993, a legal status was also provided for the allocation of these lands to organizations, households, and individuals. Decree 02/CP of the Government on 15 January 1994 clarified how forestland can be allocated and used sustainably. The purposes of this program are: to speed up forest planting on barren land, to protect the existing forest, to increase the forest cover to 40% by 2010, to establish raw material (wood) for processing industries, and to create more jobs and income for farmers (Doan Diem, 1999).

According to Government land use policy, the land and forest are allocated to the farmers to have land use right for 30 years for annual crops and 50 years for perennial crops and forest trees. All the area of Dong Cao catchment is allocated to farmers ([Figure 6](#))

Conventional approaches to natural resources management have had little effect, because they were dominated by top-down solution to problems perceived by external stakeholders, not by the people who live there. In addition, forestry conservation policies have sometimes been defined inadequately. Programme 327, for instance, lacks clarity on how to manage the potentially conflicting objective of reforestation, environmental protection, poverty alleviation, and social integration. Moreover short-term income issue for uplanders has not been mentioned in the policy which they are facing every day.

Forests, therefore, have been cut not only as source of fodder and other products for sale, but also to have new land for agricultural production. Meanwhile the long-term income has not yet gained. That explains why the forest cover is receding and land degradation resulting in soil erosion becomes wider and more severe.

**Table 1.** Soil profile description of sample pit.

Soil Horizon Designation	Soil Depth, <i>cm</i>	Profile Description
Ap	0 – 20	Dark brown (7.5YR 3/4 moist; 7.5YR 4/4 dry); loam; moist; granular structure; porous; many fine and medium roots throughout and some small gravels; clear smooth boundary.
Bt	20 – 40	Brown (7.5YR 4/6 moist; 7.5YR 5/6 dry); clay; moist; granular structure; less porous than upper horizon; some small plant roots and animal channels; some small gravels; presence of weathered rock fragments; clear smooth boundary.
BC1	40 – 90	Bright brown (7.5YR 4.5/6 moist; 7.5YR 5/7 dry); clay; moist; granular structure; slightly porous; very few plant roots; many weathered rock fragments (30-40%); diffuse smooth boundary.
BC2	90 – 140	Yellowish brown (10YR 5/7 moist; 7.5YR 6/6 dry); clay; moist; many weathered rock fragments; granular structure.

**MAP OF CATCHMENT AREA**  
(TIENXUAN AND DONGXUAN COMMUNES - LUONGSON DISTRICT - HOABINH PROVINCE)

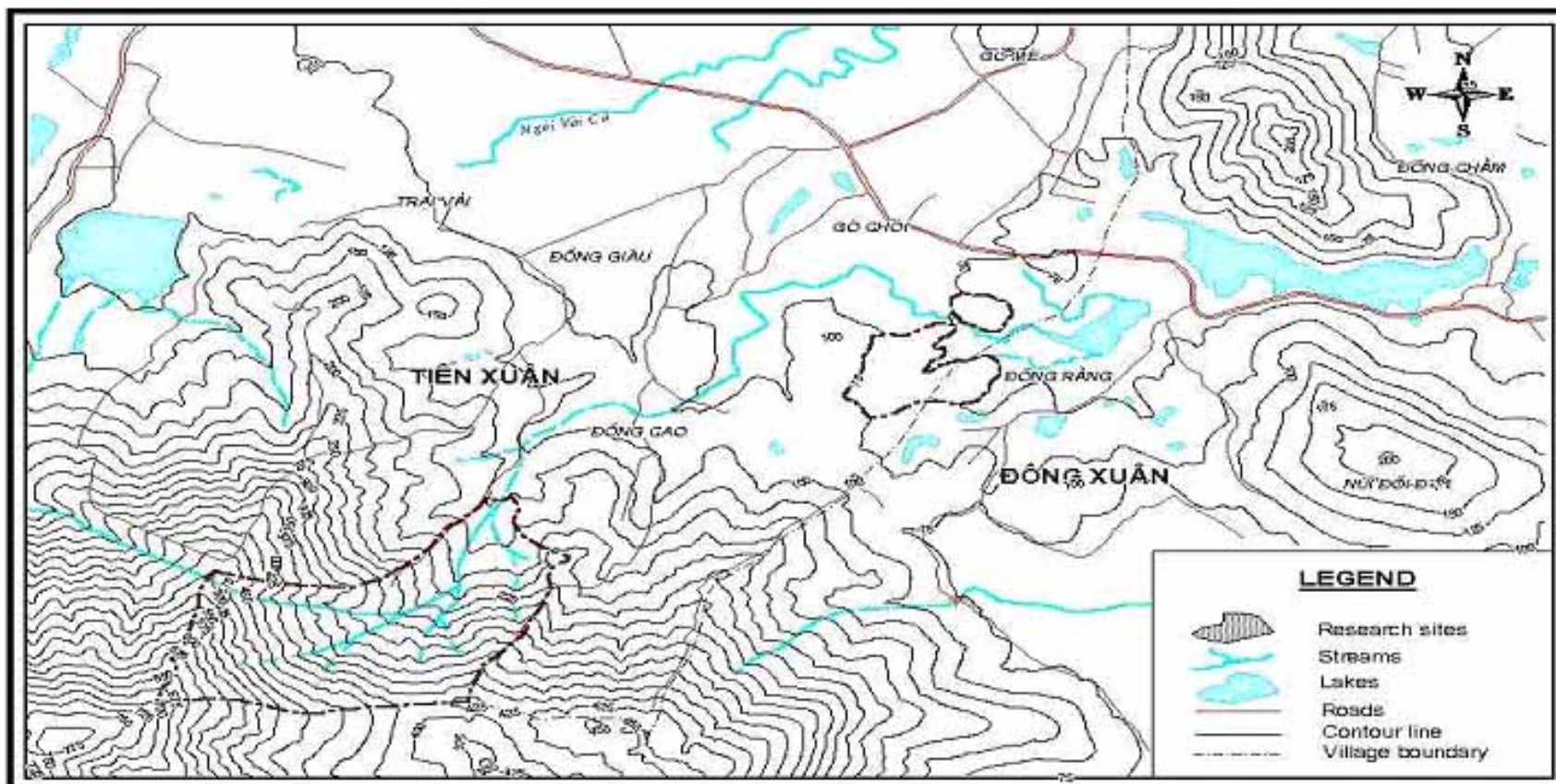
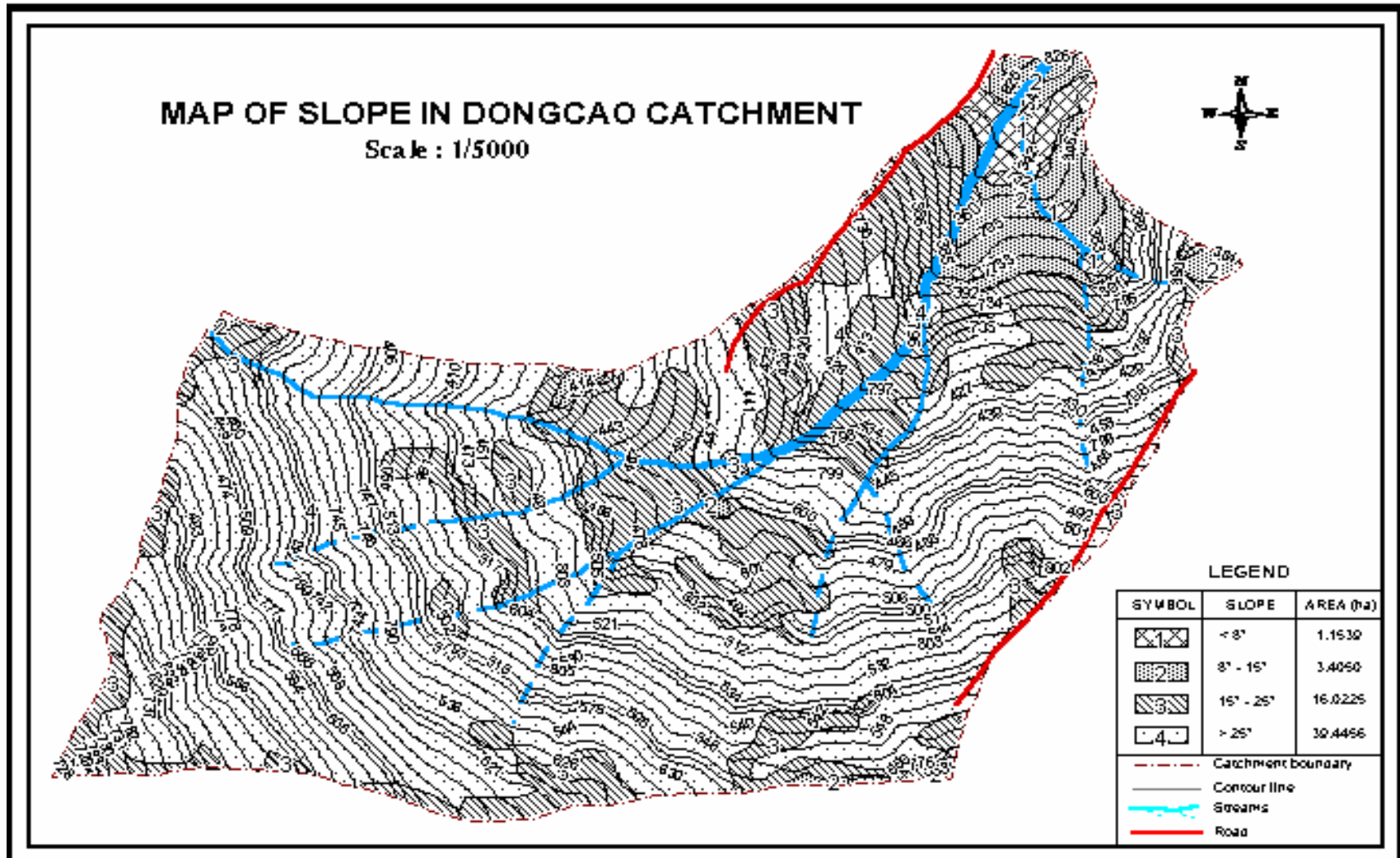
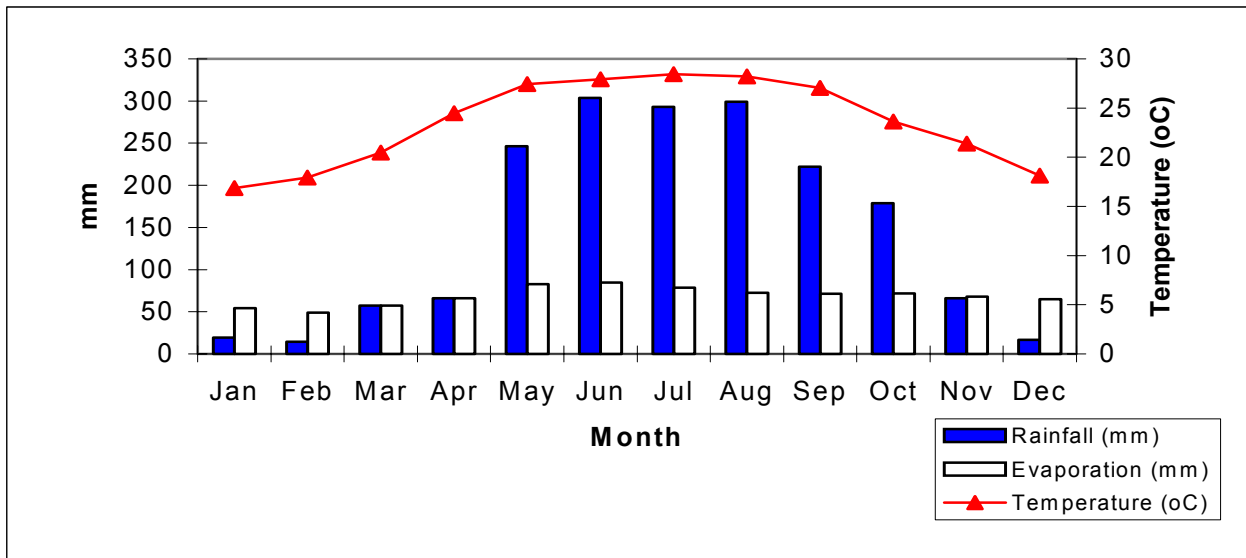


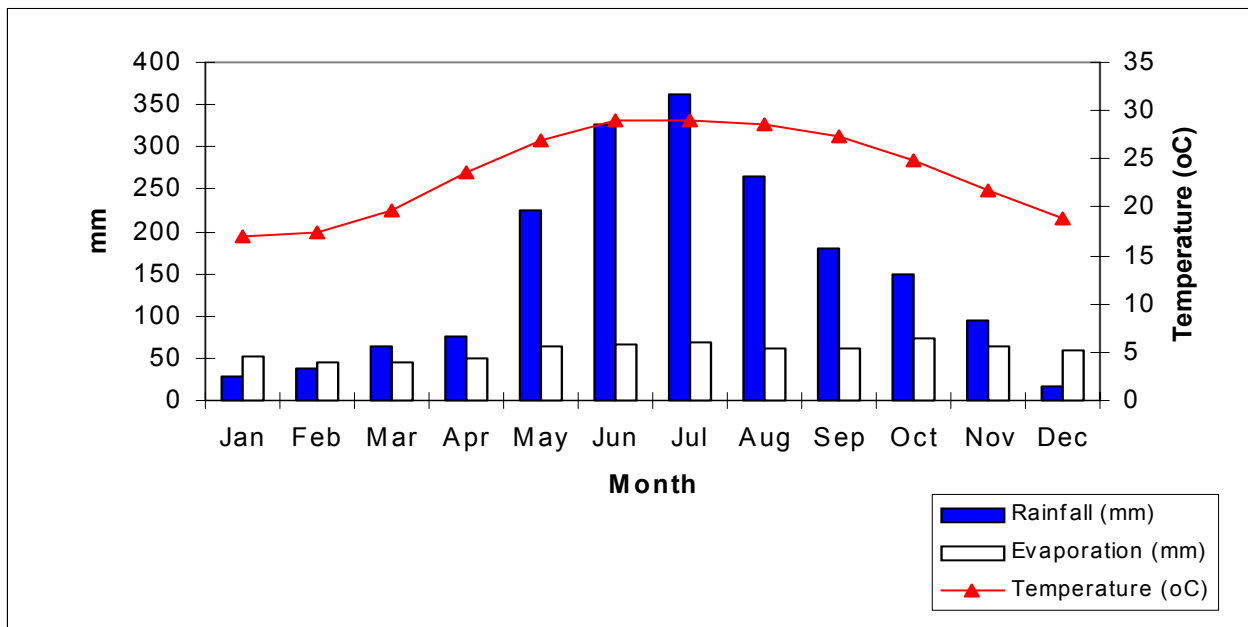
Figure 1. Map of Catchment Area



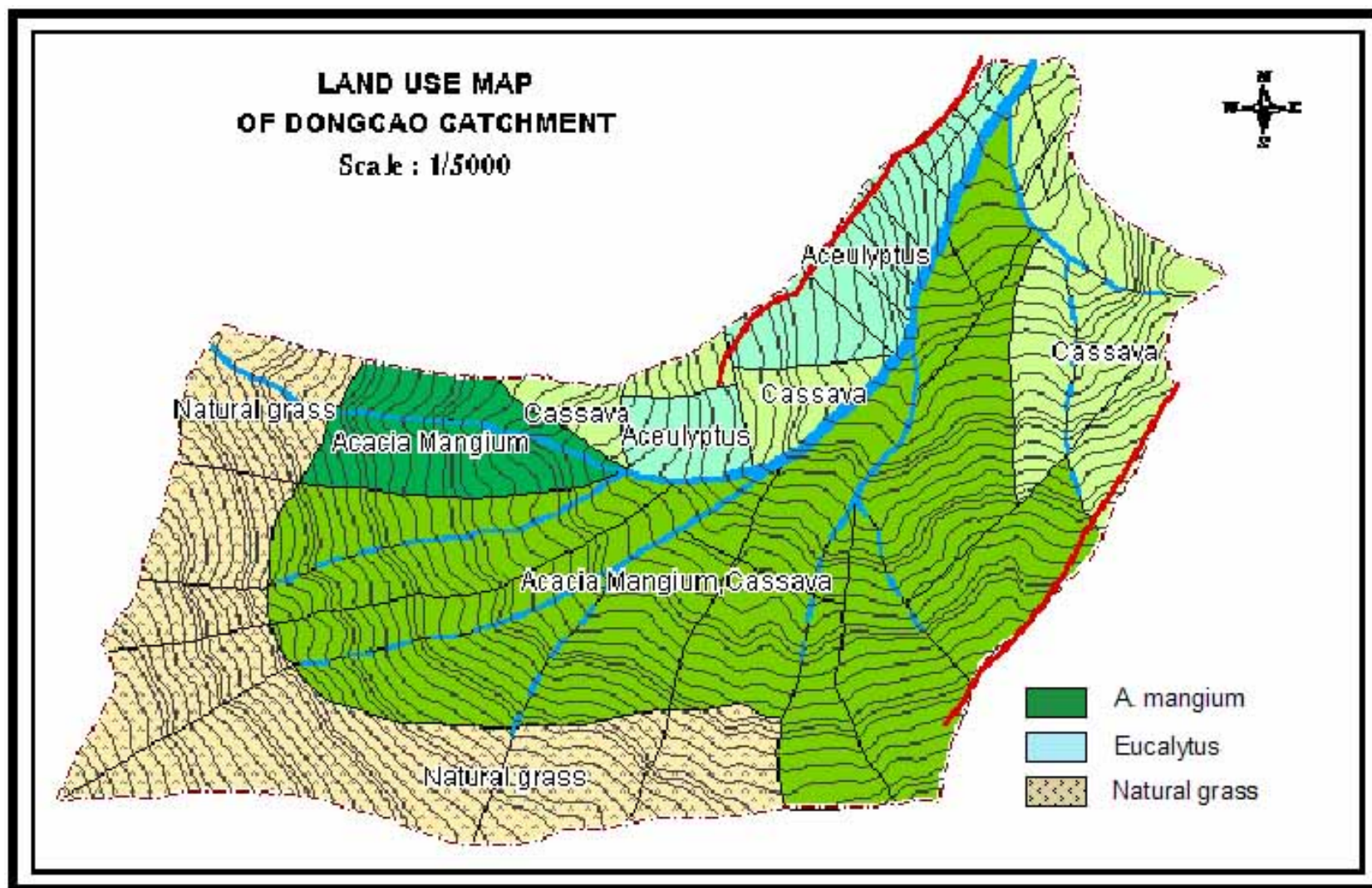
**Figure 2.** Map of Slope in Dongcao Catchment



**Figure 3.** Sixteen-year monthly average rainfall, evaporation and temperature recorded at Hoa Binh station from 1984–1999



**Figure 4** Sixteen-year monthly average rainfall, evaporation and temperature recorded at the Son Tay station from 1984-1999



**Figure 5** Land use map of Dongcao Catchment

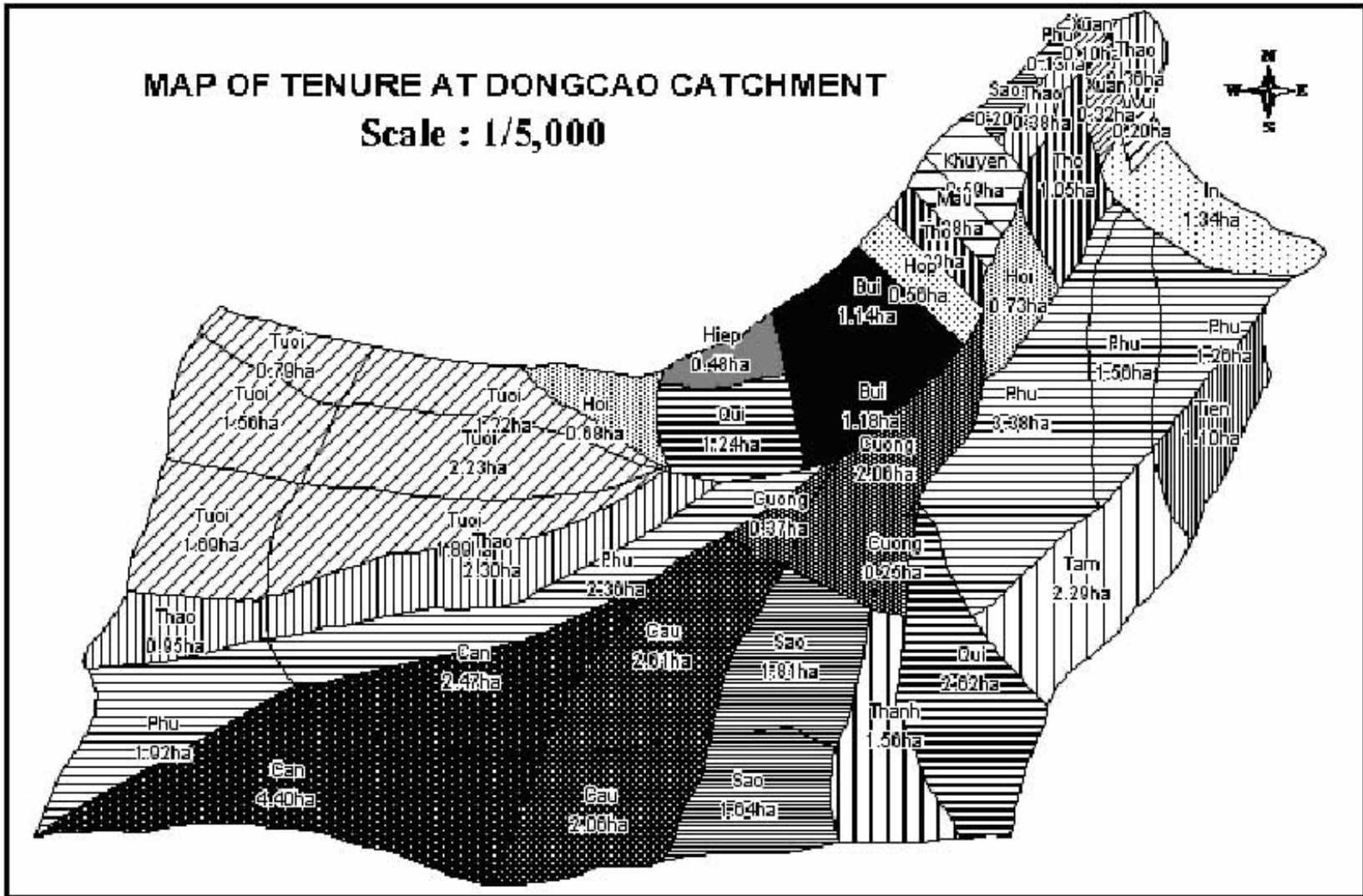


Figure 6 Map of Tenure at Dongcao Catchment