CHAPTER 5
DISCUSSION

There are 262 species of vascular ground flora in the study area. There were 195 species of perennial herbs and 67 annuals in three basic habitats:

1. **Open, fire-damaged, degraded areas (Plate 1B-C)** This habitat covers more than 90 % of the study site. This area is dominated by deciduous Gramineae (grasses) and the canopy is open due to fires and forest destruction. The ground flora here is very diverse with both perennial deciduous and annual herbs. There are 130 perennial deciduous species (49.8 % of total and 66.7 % of deciduous herbs). The dominant deciduous Gramineae include: *Arundinella setosa* var. *setosa, Alloteropsis semialata* var. *semialata, Capillipedium parviflorum*, *Heteropogon contortus*, *Pseudopogonatherum contortum*, and *Themeda triandra*. Common annual Gramineae are *Arthraxon hispidus* var. *hispidus Saccicolepis indica*, and *Setaria parviflora*. A naturalized grass, *Urochloa ruziziensis* is found in open, but not fire-damaged areas. Most Gramineae flower during the cool-dry season, especially in November. Some common deciduous Cyperaceae (sedges) are *Frimbistylis thomsonii*, *F. yunnanensis*, *Carex continua*, and *C. cruciata*. The perennial evergreen palm, *Phoenix loureiri* var. *loureiri* is very common and restricted to fire-prone places. Most other monocots are deciduous. Some abundant species are: *Curcuma zedoaria*, *Kaempferia rotunda*, *Globba reflexa*, *Zingiber* sp. (all Zingiberaceae), *Murdannia scapiflora*, *M. gigantea*, and *Aneilema sinicum* (all Commelinaceae).

A common and typical woody deciduous dicots is *Ochna integerrima* (Ochnaceae). Some common deciduous herbs include: *Crotalaria sessilifolia*, *Desmodium oblongum, Dunbaria bella* (all Leguminosae, Papilionoideae); *Inula nervosa*, *Piloselliodes hirsuta*, *Vernonia squarrosa* var. *orientalis* (all Compositae); *Perilepta siamensis* (Acanthaceae), *Premna herbacea* (Verbenaceae), *Scutellaria glandulosa*, *Orthosiphon rubicundus*, *Leucas decemdentata* (both Labiatae), and *Pouzolzia pentandra* (Urticaceae).

There were 42 species of annual herbs (63.6 % of total) found in this habitat. Most are common in open places. *Blumeopsis flava* and *Blumea fistulosa* (both

Compositae) are abundant. *Crotalaria* (Leguminosae, Papilionoideae), the most common genus in this area, has 10 species. The most common species are: *C. alata*, *C. ferruginea*, and *C. montana* var. *montana*. Some other common species are: *Isodon lophanthoides* var. *lophanthoides* (Labiatae), *Rungia parviflora*, *Justicia procumbens* (both Acanthaceae), *Buchnera cruciata*, *Sopubia trifida* (both Scrophulariaceae), *Biophytum umbraculum* (Oxalidaceae), *Drymaria diandra* (Caryophyllaceae), *Sonerilia erecta* (Melastomataceae), and *Borreria brachystema* (Rubiaceae).

The DOF in the study area is quite similar to similar forested places on nearby mountains. Some widespread species include: *Pimpinella cambodgiana* (Umbelliferae), *Blumeopsis flava*, *Inula cappa forma cappa*, *I. wissmanniana forma wissmanniana* (all Composiate); *Rubia siamensis* (Rubiaceae), and *Drosera peltata* (Droseraceae) are dominant in EGF and EG/Pine in the uplands of Doi Chiang Dao (Maxwell, 1998), Doi Sutep-Pui (Maxwell and Elliott, 2001), and Jae Sawn (Maxwell *et al.* 1997). *Apostasia wallichii* (Orchidaceae) and *Arisaema prazeri* (Araceae) are quite rare and restricted to DOF at Mae Sanam. They are only found in BB/DF and MXF in Doi Suthep-Pui (Maxwell and Elliott, 2001). *Globba reflexa*, *Kaempferia rotunda* (both Zingiberaceae) are very common and also grow in BB/DF at Jae Sawn National Park, while *Murdannia gigantea* (Commelinaceae) is only found in MXF there. *Delphinium siamensis* (Ranunculaceae) is rare in Doi Sutep-Pui (1450 m) (Maxwell, 2001) and in the uplands of Doi Chiang Dao Wildlife Sanctuary (*c.* 1,800 m) (Maxwell, 1998). The deciduous insectivorous *Drosera peltata* (Droseraceae) is abundant in poor nitrogen deficient soil in the study area as well as in EG/Pine forest in the uplands in other places *e.g.* Doi Sutep-Pui (Maxwell, 2001), Doi Luang (Maxwell, 2000), and Doi Chiang Dao (Maxwell, 1998).

Two parasitic deciduous Orobanchaceae are less abundant, *viz. Aeginetia pedunculata* is rare and mostly found in very open places near the top of the hill in grass clumps and is usually covered by matted leaves. *A. indica* is also found in this habitat, but is easily seen on bare ground, and is more common near the stream in habitat 3.

All Orchidaceae (orchids) found are deciduous. Although this family is diverse, most species are medium or rare, *e.g. Pecteilis susannae*, *Cymbidium ensifolium*, *Eulophia spectabilis*, *E. macrobulbon*, and *Habenaria dentata*. Commercial collecting

has caused this lack of individuals. Some species are more commonly seen in the rainy season, *e.g. Arundina graminifolia, Anthogonium gracile, Habenaria chlorina,* and *Liparis paradoxa.* From my observations, I found more than 10 orchid and mushroom sellers along the highway within 5 kilometers from Ban Mae Sanam Mai to Ban Bo Luang. The most common orchids they sell throughout the year are epiphytic including many species of *Dendrobium* and *Vanda.* Ground orchids are sold in the rainy season when they are flowering, *e.g. Pecteilis susannae* (L.) Raf., *Brachycorythis henryi, Habenaria dentata,* and *H. chlorina.* This is one of the main reasons for their depletion as well as forest fires, grazing, and land clearing.

Some species are variable by having different pigmentation, *e.g* the various flower colors of *Eulophia spectabilis* (Orchiadeae) with whitish and maroonish-violet variants, even in the same population and less than 1 meter from each other.

The type material of *Inula wissmanniana forma disciformia* (Compositae) was collected from this area, but my voucher specimen is *forma wissmanniana,* which grows both in habitats 1 and 3. It may be that *forma disciformia* may not be a distinct taxon.

2. Open bog/marshy areas (Plate 1D) are found in seasonally moist gullies. There are three perennial marshes scattered in the study site and cover an area of *c.* 200 m^2. There are 5 small moist gullies which are in partly shaded areas. Cyperaceae (sedges) are common in marshes, *e.g. Fimbristylis miliacea, C. pilosus* Vahl, *Fuierena ciliaris,* and *Scirpus mucronatus.* Many annual species are and restricted to this area, *e.g. Eriocaulon gracile, E. oryzetorum* (Eriocaulaceae), *Xyris capensis* (Xyridaceae), *Burmannia coelestis* (Burmanniaceae), *Drosera burmannii* (Droseraceae), *Hypericum japonicum* (Guttiferae), *Utricularia scandens, U. minutissima,* and *U. hirta* (Lentibulariaceae). Common weeds are *Spilanthes iabadicensis, Crassocephalum crepidioides,* and *Artemisia japonica* var. *japonica* (all Compositae). Common evergreen species restricted to this habitat are *Pogostemon pentagonus* (Labiatae), *Rotala rotundifolia* (Lythraceae), *Impatiens chinensis* (Balsaminaceae), and *Limnophila villifera* ssp. *gracilipes* (Scrophulariaceae). Some common deciduous species often occur in seasonally drier soil, *e.g. Viola betonaetifolia* (Violaceae), *Pogostemon auricularius* (Labiatae), *Osbeckia chinensis* var. *chinensis* (Melastomataceae), and *Centranthera cochinchinensis*

(Scrophulariaceae). An ecotone of this habitat and habitat **1** has some common species which include: *Aeschenomene americana*, *Desmodium microphyllum* (both Leguminosea, Papilionoideae), *Urena lobata* ssp. *lobata* var. *lobata* (Malvaceae), *Melastoma malabathricum* ssp. *malabathricum* (Melastomataceae), and *Justicia procumbens* (Acanthaceae).

Ranunculus siamensis (Ranunculaceae/topotype) is common in moist, partly shaded gullies as well as in the open marshes. Many pteridophytes are usually found along moist gullies, *e.g. Equisetum debile* (Equisetaceae), *Thelypteris dentata*, *T. xyloides*, *T. valida* (all Thelypteridaceae), and *Onychium siliculosum* (Parkeriaceae). *Phiaus tankervilleae* (Orchidaceae) is rare and mostly found in open places in this habitat. It has been extirpated by locals because of it economic ornamental value.

3. Shaded areas along the seasonal stream (Plate 1E-F) forms the northern boundary of the study area. There are bamboo thickets scattered along the stream banks. The vegetation consists of many species which are also found in the other two habitats. There are many common evergreen species which are only found in this area, *viz. Hygrophila intermedia*, *Sericocalyx parviflora*, and *Strobilanthes anfractuosus* (all Acanthaceae). Common annual species are *Canscora diffusa* (Gentianaceae), *Blumea mollis*, *Cyathocline purpurea* (both Compositae)- the last species being usually found in the dry stream bed during January-February. Some common species along steep banks are: *Selaginella ostelfeldii*, *S. kurzii* (Selaginellaceae), *Zingiber parishii*, *Globba* sp. (both Zingiberaceae), and *Pilea trinervia* (Urticaceae). Deciduous herbs are often found away from the stream in bamboo thickets and sometimes in burnt places, *e.g.*: *Gomphostemma strobilinum* var. *acualis* (Labiatae), *Peliosanthes teta* ssp. *humilis* (Liliaceae), *Desmodium laxiflorum* ssp. *laxiflorum*, *D. pulchellum* (Leguminosae, Papilionoideae), *Aeginetia indica* (Orobanchaceae), *Curcuma ecomata*, and *Zingiber* sp. (both Zingiberaceae). Some common annuals found in moist shaded areas include: *Blumea napifolia* (Compositae) and *Drymaria diandra* (Caryophyllaceae). Some rare deciduous species include *Paris polyphylla* (Liliaceae), *Geodorum recurvum*, and *Zeuxine affinis* (both Orchidaceae). There are three deciduous species restricted to this habitat which are down to a few individuals, *viz. Brachycorythis henryi*, *Peristylus prainii*, and

Tainia viridifusca (all Orchidaceae) (Table 5). Ground pteridophytes (ferns) appear here as well as along the gullies with *Thelypteris parasitica*, *T. dentata* (Thelypteridaceae), *Pteris venusta*, *P. ensiformis* (Pteridaceae), and *Dryopteris cochleata* (Dryopteridaceae).

Figure 6 shows that the flowering peak for the ground flora in this area is in October with 94 species (36 % of total) and lowest in March with 28 species. The flowering curves for annuals are different between the rainy and cool-dry seasons. The peak for annuals is in November with 41 species (62 % of all annual herbs). Annual herbs germinate and develop during the rainy season, then flower and fruit before the hot-dry season and fires come.

Most of the annuals are in Leguminosae, Papilionoideae *e.g. Crotalaria ferruginea*, *C. alata*, and Compositae *e.g. Anaphalis adnata*, *Blumeopsis flava*, and *Blumea fistulosa*. Scrophulariaceae here are mostly annual and flower after the rainy season include: *Phtheirospermum parishii*, *Alectra avensis*, and *Buchnera cruciata*. The flowering curve is lowest during the beginning of the rainy season (April-May) with only 5 species. Some common herbs which flower and fruit all year round include: *Spilanthes iabadicensis*, *Crassocephalum crepidioides* (both Compositae), *Hypericum japonicum* (Guttiferae), and *Polygonum persicaria* (Polygonaceae).

The flowering curve of perennial herbs is rather stable during the rainy season (June-October) with approximately 25.6 % of all perennial herbs. Many deciduous species flower after fires and before or at the beginning of the rainy season, *e.g. Ochna integerrima* (Ochnaceae), *Murdannia scapiflora* (Commelinaceae), *Disporum calcaratum* (Liliaceae), *Curcuma zedoaria*, *Kaempferia rotunda* (both Zingiberaceae), and *Scutellaria glandulosa* (Labiatae). Some deciduous species flower in the hot-dry season, *e.g. Eulophia macrobulbon*, *Pachystoma pubescens*, (both Orchidaceae), and *Gentiana timida* (Gentianaceae).