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THESIS

CHANGE IN BIRD SPECIES ASSEMBLAGES FOLLOWING SUCCESSIONAL STAGES IN ABANDONED SETTLEMENT AREAS IN THUNG YAI NARESUAN WILDLIFE SANCTUARY, THAILAND

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A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
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Change in bird species assemblages following successional stages in abandoned settlement areas was studied in dry evergreen forests (DEF) and abandoned hill tribe settlement villages in Thung Yai Naresuan Wildlife Sanctuary, Thailand. The main objective was to determine the plant and birds' response to abandoned settlement ecosystem. Sixteen of 1-ha permanent plots in the four abandoned settlement areas (ASA) were established for plant community study. Eleven (2- km length) permanent transects were established within the abandoned settlement area and undisturbed DEF for bird surveying. The change on diversity and composition of birds were investigated for consecutively 3 years.

The results showed that the vegetation comprised 210 species with 3,957 individuals of trees diameter at breast height over 4.5 cm. Three groups of plant communities were classified as undisturbed forest, mid-succession and early- succession, with trended to be progressively succession. Considering for all seasons, 245 bird species were recorded during the study period. They were composed of 52 migratory and 193 resident species for all seasons, and 171, 132 and 200 species for 6-8 years old, 10-12 years old and undisturbed forest of ASA and DEF respectively. Similarity and Shanon-Wierner indices had positive relationships with age of abandonment. The sallying insectivore guild showed a significant negative correlation with successional age of habitats. On the other hand, foliage-gleaning and terrestrial frugivore guilds had significant positive correlation with successional age. Bird communities in the vertical layers of both DEF and ASA were classified into three major groups. The DEF supports more species than the ASA. The relationship of resident species with the habitat was defined into 3 groups, open-secondary forest preference species, edge or mutuality habitat preference species and primary or mature forest preference species. The study demonstrated that plant community and bird species had a clear recovery pattern in abandoned sites after removing human settlement. Recommendations are given such as limitation on human disturbances to allow a change for maximum avian diversity to recover.

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Student's signature Thesis Advisor's signature

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INTRODUCTION

Changes in tropical habitats and animal communities due to human land use pactices are major concern in conservation biology. This is particulary in the field of biodiversity rich tropical rainforests (Raman *et al*., 1998). Secondary succession in tropical areas after human disturbances are becoming more common.This is particularly evident in the three regions of tropical rainforest, valued by conservationists for their remarkable species diversity (Chinea, 2002). In southeast Asia, as in the neotropics, central Africa and south Asia, tropical forests have been logged for timber, cleared and cultivated, exploited for non-timber natural products, submerged under reservoirs, and converted with plantations and other land uses (Johns, 1989; Raman and Sukumar, 2002). As secondary forests increase in area in the tropics, there is a clear need to assess their conservation values through studies of their vegetation and animal communities (Johns, 1989).

Similar to other tropical developing countries, Thailand has faced major problems by unbalanced sharing of benefits gained from natural resources. The root of these problems lies on the rapid growth of population in the last few decades. Fortunately, Thailand has the Wildlife Preservation and Protection Act 1960 and the National Park Act 1961 to protect the valuable forests. According to the laws, the protected areas in Thailand are divided into two main types according to the objectives: “wildlife sanctuary” for wildlife habitat conservation and “national park” for outdoor-recreation activities.

Currently, Thailand has approximately 140 protected areas; 90 national parks and 50 wildlife sanctuaries. They account for approximately 15 % of the total land

area of the country (Pattanaviboon, 1999). However, only 6 wildlife sanctuaries are free from human settlement (Chompoochan *et al,* 1996). Many conflicts are found between government officers and local communities who live in the protected areas, especially in wildlife sanctuaries.

Two extreme dichotomics have immerged; one is to allow people to live inside protected areas and the other is to resettle them to new sites outside the protected areas. However, the protected area managers still lack of data on how the ecosystem would respond after village abandoning. It is therefore hoped that this research will provide some guidelines to answer the questions on how ecosystems respond to the abandoned lands in the protected areas.

OBJECTIVES

1. To examine the changes of vegetation cover following abandoned settlement areas,

2. To compare bird species richness, diversity, guild composition and vertical stratification between abandoned settlement areas and primary forests,

3. To examine the relationship between abandoned settlement area characteristics and bird assemblages,

4. To document turnover rate of bird assemblages in abandoned settlement areas following with a predictable sequence over time to attain the primary forest community composition.

LITERATURE REVIEW

Plant species composition and forest succession in tropical zone

Forest succession in tropical zone was an interesting topic to study especially process and trend. The study generally focused on general descriptions of successional sequences, structural development, and nutrient dynamics during the fallow periods of shifting cultivation (Chinea, 2002). Chinea and Helmer (2003) concluded that land use history has as much influence in species composition as biophysical variables and that there is no large influence of forest landscape structure on species diversity or composition. Several studies suggested that abandoned pastures and the subsequent secondary forest could constitute habitat islands. The diversity of these habitat islands is controlled by the degree to which these secondary forests were surrounded by primary forest, their size, and the degree and nature of human activities still occurred within them(Chinea, 2002; Chinea and Helmer, 2003). Aide *et al.* (1995) found a positive relationship between stand age and species richness in northeast Puerto Rico forest, and these attributes were also positively related to the basal area. Although site age was the best predictor of species richness and diversity, distance to older forest at the time of abandonment added significantly to the explained variability (Chinea, 2002).

Ewel (1983) reported that a pioneer species would completely cover abandoned land in disturbed forest less than 25 years. Aide *et al.* (1995) confirmed that abandoned farmland less than 10 years still had herb cover but trees were commonly seen in the abandoned land of more than 15 years of age. Chinea (2002) supported that secondary forest >30-year old did not show significant differences in any primary forest structural characteristics. In India, Raman *et al*. (1998) founded that vegetation variables in shifting cultivation such as woody plant species richness, tree density and vertical stratification increased with age in a rapid, non-linear, asymptotic manner.

In Thailand Sukwong (1973) studied on forest succession in old shifting cultivation around Sakaerat Environment Research Station. He found that *Eupatorium odoratum* covered almost in first 5 years, after that it changes to *Saccharum spontaneum* , and fire resistant tree species began establish in 26 years later but still had *Saccharum spontaneum.* Drew *et al*. (1978) studied on biomass change along the succession process and recommended that in the 1st, 3rd, 6th and 9th years, herb biomass varied between 7.7 – 16.1 ton per ha , herb biomass had 7.8 ton per ha in 20 years, but tree biomass had 39.2 ton per ha. Nakmuenwai (2002) studied in Thung Yai Naresuan wildlife sanctuary by using geographic information system Macof Model and concluded that successional vegetation in abandoned settlementt areas would reach their stage of balance in next 50 years and needed at least 145 years more in the dry evergreen forest.

Relationships between birds and forest succession

Bird diversity

Study on relationships between wildlife and plant succession were mostly concentrated on bird because bird are sensitive to habitat changes. The species diversity of bird communities was significant higher in natural forest than in plantation (Ohno and Ishida , 1997). In contrast, Knok and Corlett (2000) found that the avifauna of secondary forest of different age-classed had invader species originated from open lands, whereas others were canopy birds that followed the foliage-air interface of the forest. Also, Welford (2000) indicated that the number of bird species recorded in each successively older abandoned pasture increased but only half the number of species recorded in the undisturbed forest site were recorded in the most mature pasture. Bird species richness, abundance and diversity, in shifting cultivation increased rapidly and asymptotically during succession paralleling vegetation recovery as shown by positive correlations with fallow age (Raman *et al*. , 1998).

Bird community

Bird communities have been frequently used for conservation assessment and monitoring. Past studies from tropical rainforest regions showed that agroforestry plantations, logged forests and secondary successional forests generally harboured fewer bird species and community composition altered as compared with primary forest (Johns, 1989; Raman and Sukumar, 2002). The relationship between degree of habitat alteration and change in bird communities was, however, not precisely understood. The observed effects might be a non-linear function of disturbance intensity (Johns, 1986) with the degree of change in bird community structure and composition being strongly related to the magnitude of alteration of rainforest vegetation structure and floristic composition (Raman and Sukumar, 2002).Within the community, individual bird species differed in their responses and susceptibility to habitat alteration. Habitat changes have been reported particularly to affect rare and restricted-range birds, rainforest habitat specialists and altitudinal migrants (Raman, 2001). Other factors that influenc susceptibility included body size, fecundity, diet-guild and foraging stratum (Thiollay, 1999) . Few studies had addressed avian use of abandoned former pastures (Andrade and Rubio-Torgler, 1994). Johns (1989) compared the avifauna of undisturbed tropical forests, slightly logged forest ,secondary growth ,and crop fields, he concluded that many species were found in most habitat types although the similarity decreased with increasing disturbance intensity and over index between early secondary growth and undisturbed forest.

The bird community similarity of sites with primary forest also increased asymptotically with fallow age indicating sequential species turnover during succession (Raman , 2001). Raman *et al*. (1998) found that the bird community similarity of sites with primary forest (or between sites) was positively correlated with both physiognomic and floristic similarities. The non-linear relationships implied that fallow periods less than a threshold of 25 years for birds, and about 50-75 years for woody plants, were likely to cause substantial community alteration.

Bird and vertical stratification

The vertical structure of tropical rain forests can be described as a number of distinct, though intergrading, vegetation layers which gradually modulate certain biotic (i.e. floristic composition, leaf area, biomass density, species diversity etc., and abiotic parameters (like temperature, wind speed,and insolation) along the vertical gradient ranging from ground level to the upper canopy (Whitmore, 1984). Stratification refers here to the distribution of bird species in relation to the vertical distribution of the foliage (Pearson,1971). Various studies of tropical ecology include investication of vertical stratification of both plants and animals, but few studies have been made precise measurements of the vertical distribution of the organisms. Spatial heterogeneity has long been recognized as an important factor promoting diversity of animals and plants, particularly in species rich tropical forests. Among vertebrates, forest birds provide well documented examples of coexistence of species by means of vertical stratification (Pearson,1971, 1975,1977; Winkler and Preleuther, 2001; Walther, 2002). Many bird communities characteristically segregate into groups of species living predominantly at ground level, at intermediate levels, or in the forest canopy. Bird are the most diverse and conspicuous component in the crowns of the rain forest trees (Kays and Allison, 2001). Because of their extreme vertical mobility, birds are especially sensitive to vertical stratification of vegetation (Pearson, 1971, 1975, 1977). Generally, tropical forest, birds utilized most at 2 m and 25 m levels and the zone between 5 m and 10 m are least (Pearson,1971). The bird species foraged at lower levels in the forest were found in habitats with denser vegetation and less light and midstorey birds are to be found in a wider range of light habitats and illuminations than either canopy and understorey birds is consistent with the pattern that midstorey birds also use a wider vertical niche (Walther, 2002). Manoprawithr (2000) was classified the vertical stratrum use of birds in tropical Australia into four major groups: ground foragers, low shrub foragers, aboreal foragers and canopy foragers.

Study Site

Thung Yai Naresuan Wildlife Sanctuary is located between (longitude) 14 ^{o} 55′ to 15 ^{o} 45′ north, and (latitude) 98^{o} 25′ to 99 ^{o} 05′ east (Figure 1).

In 1957, before this forest area was gazetted as a wildlife sanctuary, hilltribes had settled in the area and started converting forests into agriculture lands. Thung Yai Naresuan was declared as a wildlife sanctuary in 1974 and was identified as a natural world heritage by UNESCO in 1991. The Hmong villages were removed from Thung Yai Naresuan by the cooperation project of the Royal Forest Department and the Royal Thai Army in 1987. They were moved to resettle in Prop Phra distict of Tak province. However Karen villages still remain in the area. This research is focus on the abandoned settlements sites of the Hmong.

Faculty of Forestry (1989) described physical features of Thung Yai Naresuan Wildlife Sanctuary that the altitude ranges from 250 m to the peak of Khao Thai Par at 1,811 m in the south-west quarter of the sanctuary. There are several peaks over 1,500 m and many over 1,100 m distributed throughout the sanctuary. The topography is generally mountainous with a network of many permanent rivers and streams dividing the area into valleys and lowland plains. The sanctuary's distinguishing feature is a large central grassland plain, from which it takes the name of Thung Yai . Within the catchment area there are four important rivers: the Mae Khlong; Kwae Noi, Mae Kasart and Mae Suriya. Red-brown earths and red-yellow podzols are the predominant soils, the former derived from limestone and found in the upland and Mae Chan Valley, whilst the latter is found in the Huai Kha Khaeng Valley. A physical feature that is important for wildlife is the presence of mineral licks. These occur throughout the sanctuary as either wet or dry, and most appear to be located on, or around, granite intrusions in areas with red-yellow podzolic soil and may be associated with the massive faults or lineaments in the intensely folded geomorphology of this area. Limestone sink holes are found; most are only about 10-12 m in diameter, but some are more than 2 km long, 250 m wide and drop as much as 30 m depth.

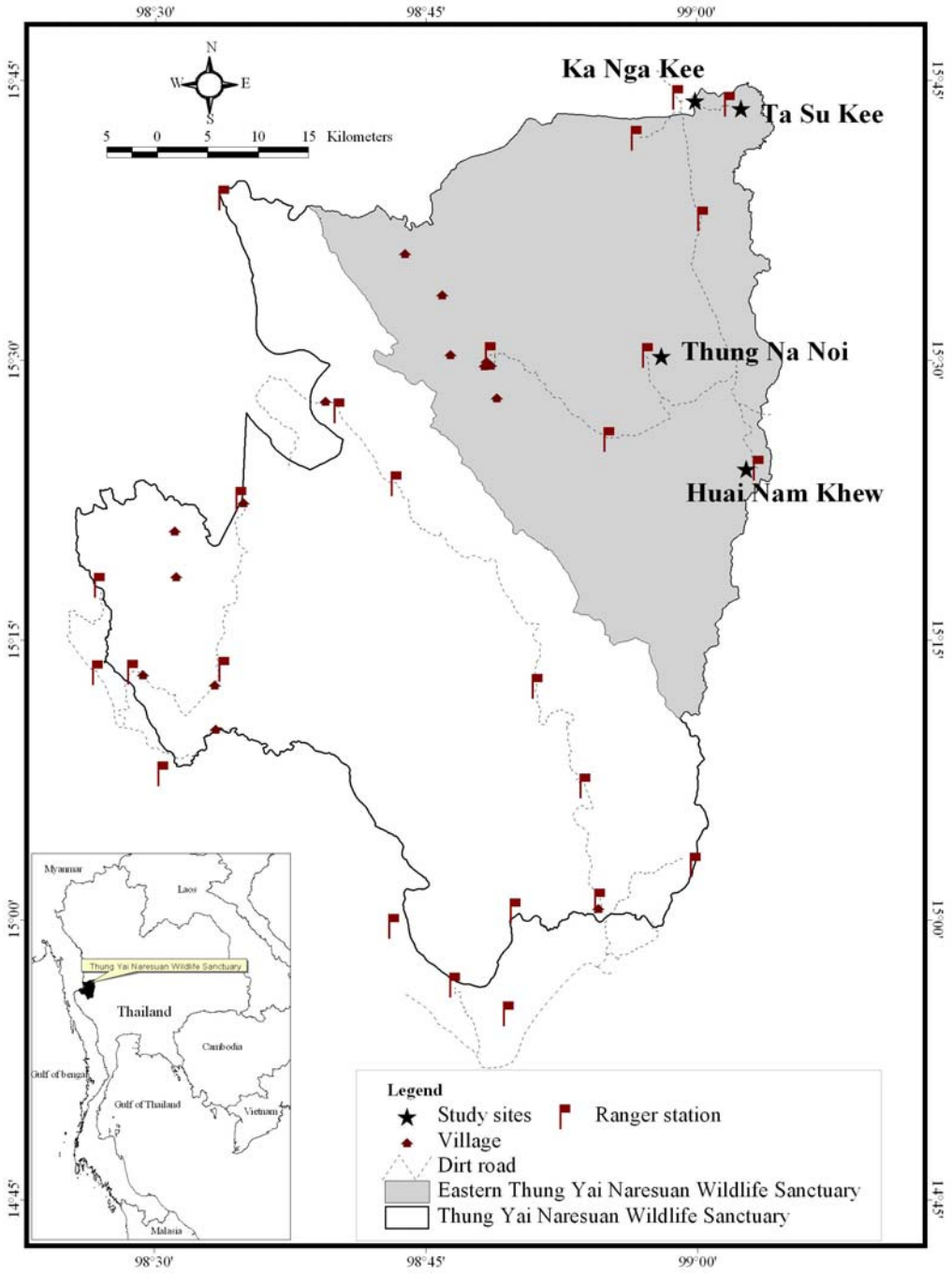


Figure 1 Location of the Thung Yai Naresuan Wildlife Sanctuary and four study sites.

The climate conditions range from tropical to semi-tropical. It is the monsoonal type, with dry season from November to April/May, and hot wet season from May to October. Mean annual rainfall in the west is 2000-2400 mm, declining to 1600-2000 mm in the east. There is a strong orographic effect, and more than 80% of the rain is brought by the south-west monsoon. Mean minimum and maximum temperatures range from 15°C to 35°C during the hot season; 20°C to 33°C during the wet season and 10°C to 29°C during the cool season. Minimum and maximum night and day temperatures fall in the range 7°C to 40°C.

The principal vegetation types, and their estimated cover is as follows: hill evergreen forest (54,900 ha); dry evergreen forest (112,900 ha); mixed deciduous forest (164,100 ha); dry dipterocarp forest (3,600 ha); savanna forest (9,900 ha); grassland (3,900 ha); and areas of swidden agriculture (15,400 ha). The highest ground is generally covered with hill evergreen forest, is known as tropical lower montane rain forest, but slopes above 600 m generally support dry evergreen forest (seasonal evergreen forest). This latter formation is tall, dense, stratified and always dominated by Dipterocarps, and may appear to be evergreen in wet areas such as the central uplands of the sanctuary. In some areas, particularly broad valleys, there is often a mosaic of vegetation types.

Nakasathien *et al*. (1987) and Faculty of Forestry (1989) reported that the fauna of both Thung Yai and Huai Kha Khaeng included an unusual mix of species with primarily Sundaic, Indo-Chinese, Indo-Burmese and Sino-Himalayan affinities, many of whose ranges do not overlap. Most species are either characteristic of the Oriental/Indo-Malayan region or more specifically associated with the Indo-Chinese province of that region, but with a strong Sundaic element included. A small proportion is Palaearctic. Thung Yai is big enough to support several of the larger and increasingly rare mammal species, such as tiger (*Panthera tigris)* , leopard (*P. pardus*), clouded leopard (*Neofelis nebulosa*), elephant (*Elephas maximus*), tapir (*Tapirus indicus*), Sumatran rhinoceros (*Didermocerus sumatraensis*), gaur (*Bos*

gaurus) and serow (*Capricornis sumatraensis*) and Javan rhinoceros (*Rhinoceros sondaicus*). It includes some 69 mammals, 289 birds, 48 reptiles, 15 amphibians and 67 freshwater fish as confirmed occurrences (Faculty of Forestry, 1989)

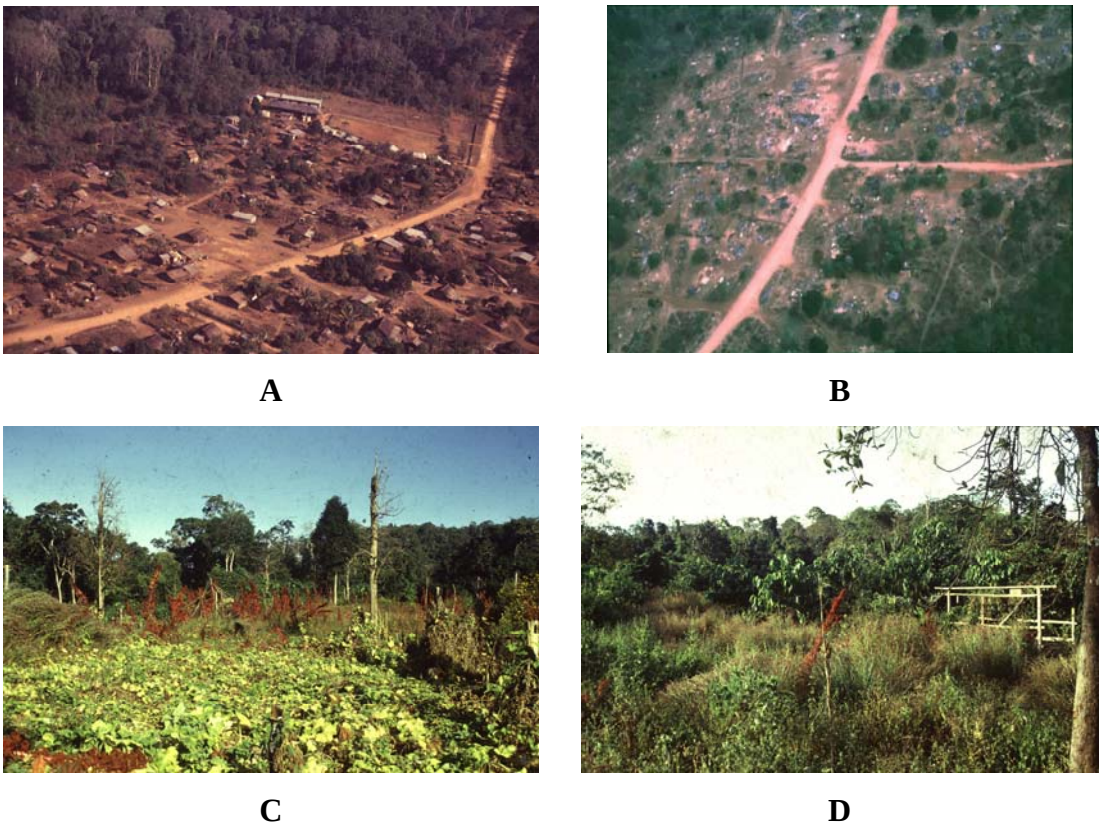
MATERIALS AND METHODS

Site Selection

The study was designed to collect data on the bird assemblages in dry evergreen forests and abandoned hill tribe settlement areas located in Thung Yai Naresuan Wildlife Sanctuary (Figure 2). Four established Hmong hill tribe village areas were selected: Ka Nga Kee, Ta Su Kee, Thung Na Noi and Huay Num Khew (Figure 1). The four sites differed in time of abandonment and size. Elevation varied between 700 –900 MSL (Table 1)

Table 1 Characteristics of the abandoned settlement area study sites

Sites	**Approx. time since abandonment (year)**	**Approx. size area (km^2)**	**Approx. Elevation (meters)**
Ka Nga Kee	~6	~16	~700
Ta Su Kee	~8	~8	~700
Thung Na Noi	~10	~16	~800
Huai Num Khew	~12	~2	~900



A **B**

C **D**

Figure 2 Land cover change of some study sites in the Thung Yai Naresuan Wildlife Sanctuary, A : Hmong hill tribe 's village (Ka Nga Kee) before resettlement, B : Hmong hill tribe 's village (Ka Nga Kee) after resettlement, C and D: First 3 years old of abandoned settlemen areas after resettlement (Photo by Mr.Sompoch Maneerat)

Vegetation Survey

For long-term study of dry evergreen forest in western part of Thailand, it was recomended that 1 ha permanent plot size is most suitable (Lauprasert, 1988). The permanent plot size Sixteen 1-ha (100X100 m^2) permanent plots in the four abandoned settlement areas (ASA) were established: three in the abandoned settlement areas and one in the undisturbed dry evergreen forest (DEF) (Figure 3). Each sample plot was further divided in to 100 sub-plots (10 X10 m^2). At the corner of each 10X10 m^2, a small plot of 4X4 m^2 and 1X1 m^2 were also established. Field data collections are follows:

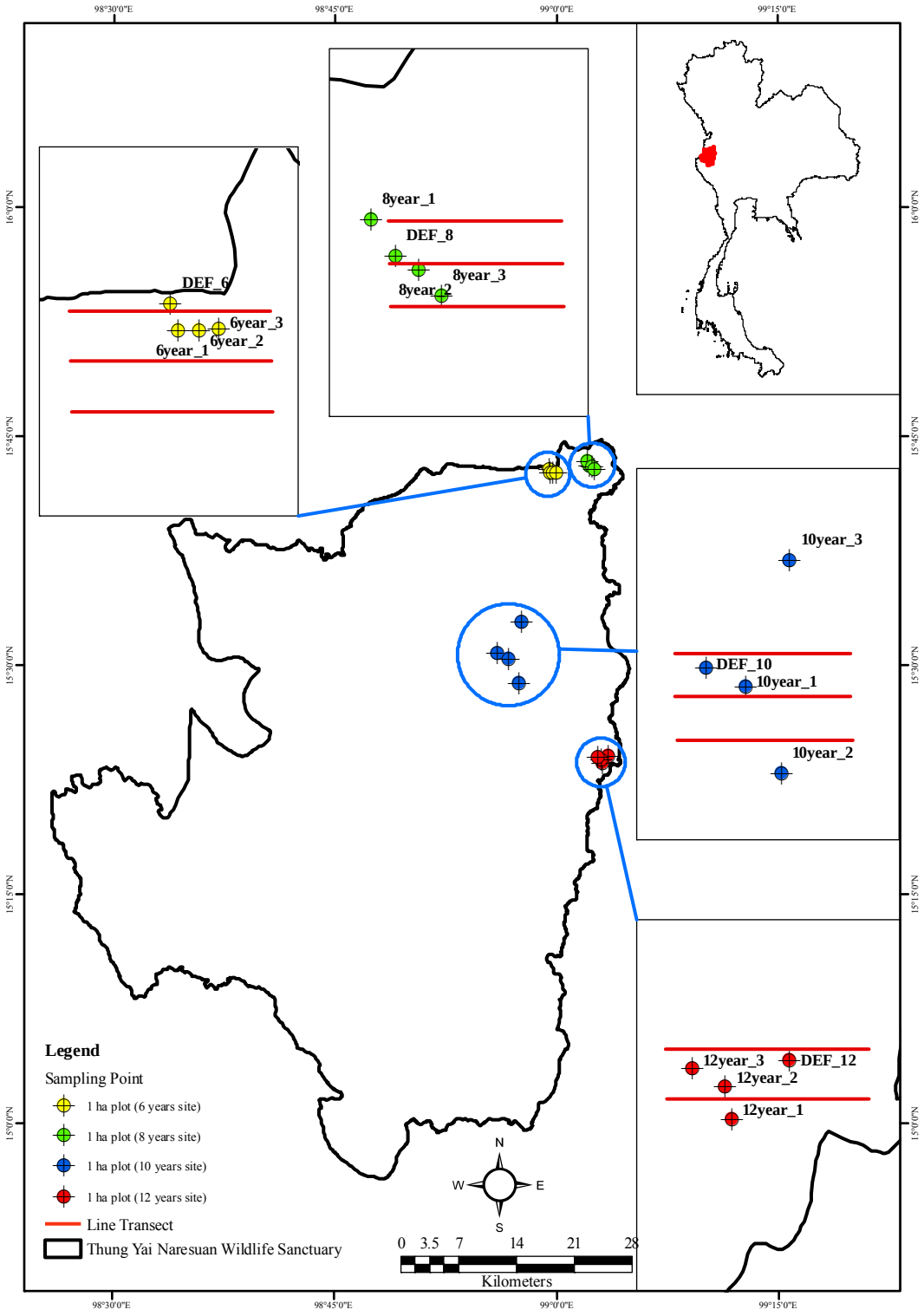


Figure 3 Location of the 16 permanent plots and 11 lines transects of this study in Thung Yai Naresuan Wildlife Sanctuary

In each sub-plot of 10X10 m^2, all tree over 4.5 cm in DBH existing in each plot were tagged with aluminium number tags just below a painted ring marking DBH for repeating measurement. All trees were identified to species identification and estimated the total height.

1. In each sub-plot of 4X4 m^2, all sapling (DBH< 4.5 cm but taller than 1.3 m) in all sub-plot were indentification and counted. Aluminium number tags were tagged at the DBH level for remeasurement.

2. In each sub-plot of 2X2 m^2, all seedlings (lower than 1.3 m in height) of in all sub-plot were identified and counted. Aluminium number tags were tagged at the DBH level for remeasurement.

Bird Survey

1. The line transect method was used to survey the diversity and estimated the abundance of birds, this is a common method widely used for bird assessment in the disturbance tropical forest (e.g. Johns, 1989; Raman *et al*., 1998; Round and Brockelman, 1998; Pattanaviboon, 1999; Raman, 2001). Three permanent transects with the total length of 2 km were set in each study site (Figure 3). For each, 1-km transect was established in the abandoned settlement area and continued for another 1 km into undisturbed the dry evergreen forest. However, due to the small size of Huay Num Khew, only 2 permanent transects were established in this site. The transects were marked at 100 m intervals with aluminum tags. Surveys were conducted three times a year in every season {in summer season (March -May), rainy season (June-October), and cool season (November- February)} from 7.00-10.00 am and 4.00-6.30 pm in each transect for 2 consecutive days. Birds observation conducted by walking slowly, therefore, it took about 2.5-3 hours to complete the 2 km transect.

Birds were observed by using binoculars (8X35). All birds within 30 m from the transect line by direct sight or indirect hearing were counted, identified and recorded. This method was suggested by Raman *et al*., (1998) and Round and

Brockelman (1998). The recorded data included: species identification using Lekagul and Round (1991) guide book, number of individuals, time of observation , behavior and activity, and visually estimated height above the ground in 7 intervals : 0, 1-5, 5-10, 10-15,15-20,20-25 and >25 m . Bird surveys were skipped on rainy, mist, and stormy days because of the difficulty in observing birds and hearing their calls. Bird taxonomy description is based on Inskipp *et al.* (1996).

2. The surveys were conducted 3 years consecutively from rainy season 2000 to summer season in 2003.

Analysis of Data

1. The importance value index (IVI) for plant community of each species in each plaot was determined as:

IVI = % relative density + % relative frequency + % relative dominace

where, % relative density = $\frac{\text{density of species i}}{\text{total tree density}} \times 100$

% relative frequency = $\frac{\text{frequecy of species i}}{\text{total tree density}} \times 100$

% relative dominace = $\frac{\text{dominace of species i}}{\text{total tree density}} \times 100$

i = 1, 2, 3, 4, …, S

S = total number of species

The relative density was determined from all standing tree of DBH larger than 4.5 cm in the whole plot of 100 X 100 m^2. The relative frequency was determined for one hundred 10X10 m^2 subplots set by regularly subdividing the 100 X 100 m^2 plot. The relative dominace was obtained from the basal area at breast height, calculated as $\pi D^2/4$, of each tree in the whole plot.

2. The cluster analysis using the similarity index of Sorensen was run for grouping the plant community. Data used for constructing the dendrogram were of tree species (DBH>4.5 cm) from each 1 ha plot.

3. Diversity indices

The bird abundance was used to derive a quantitative index of Shanon-Wiener function (*H′*)

$$H' = \sum_{i=1}^{s} (Pi \ln Pi)$$

where S = the total number of bird species

Pi = the proportion of all the bird individuals which belong to the *i*-th species

The H' index and their standard deviation value were calculated using program Species Diversity and Richness II for Windows (Pisces Conservation Ltd, 2001). Using a simple test for change in community structure after Solow (1993) to statistical test different value of *H′*.

Hill's number 1 (*H1*) (Ludwig and Reynolds,1998 ; Rotenberry and Wiens,1980) was calculated as follows:

$$H1 = e^{H'}$$

where H' = Shanon-Wiener index

e = 2.718

This index was show values in the number of abundance species, excluding rare species, and it is useful for assess bird species diversity in tropical (Raman *et al*., 1998; Pattanaviboon, 1999)

4. Species richness and abundance are simple measure that do not allow for comparisons of avian composition. In order analyze for compositional differences, an index of community similarity was computed (Krebs,1989) for paired exposure and reference sites as follows:

$$P = \frac{2XS_{re}}{S_r + S_e}$$

Where P = percentage similarity between site 1 and 2 (expose and reference)

S_{re} = Species in common between reference and exposure site

S_r = Species in reference site

S_e = Species in exposure site

Values were range from 0 (totally dissimilar-no species in common) to 1.00 (totally similar species composition is identical)

5. From information derived from Lekagul and Round (1991), species composition was analyzed in 2 broad scale groups : 1) Resident (including the resident and migrant species status) and 2) Migratory (including a breeding migrant species).

6. The cluster analysis (CA) technique by the similarity index of Sorensen was used to generate a dendrogram for grouping bird communities between sites (Raman *et al*., 1998 Raman and Sukumar, 2002).

7. The bird species were classified and grouped according to feeding guild type and ecological requirement after Johns (1986) and Round and Brockelman (1998) : Groups include (1) Arboreal frugivores (AF), (2) Arboreal insectivore/frugivore (AIF), (3) Bark-gleaning insectivore (BGI), (4) Arboreal faunivore/frugivore (FF), (5) Foliage-gleaning insect (FGI), (6) Raptor (R); including pisivore, (7) Insectivore/nectarivore (IN), (8) Sallying insectivore (SaI), (9) Sweeping

insectivore (SwI), (10) Terrestrial insectivore (TF), (11) Terrestrial insectivore (TI) and (12) Terrestrial insectivore/frugivore (TIF).

8. Vertical stratification analysis

8.1. In order to construct the dendrogram, of relative abundance of birds in the form of log (x+1) transformation was used. The cluster analysis using similarity index of Sorensen by program PC – ORD was run for grouping the bird in each stratum (McCune and Mefford, 1999).

8.2. This study quantified and described the niche of each species and the degree of niche specialisation. The degree of specialisation between species was measured by the Shanon-Wiener diversity index (Krebs, 1989; Stiles, 1980; Manopawitr, 2000).

9. Abundance of the resident bird species from total survey were also compared with quantitative vegetation characteristics by means of the Canonical Correspondence Analysis (CCA). This is a multivariate technique that ordinates plots using both a primary matrix of species abundances and a secondary matrix of environmental variation (ter Braak, 1986; Satersdal and Birks, 1993 Freifeld, 1999). CCA in PC-ORD (McCune and Mefford, 1999) was performed. Seven of vegetation characteristic variables were selected for a secondary matrix of environmental variation: (1). Tree density (Tree_den, stems/ha), (2) Sapling density (Sapling_den, stems/0.16ha), (3) Seedling density (Seed_den, stems/0.16ha), (4) No. of tree with DBH<55 cm (D<55, stems/ha) and (5) No. of tree with DBH>55 cm (D>55, stems/ha) (6) No. of tree with height<15 m (H<15, stems/ha) and (7) No. of tree with height> 15 m (H>15, stems/ha). To assess the significance in the CCA axes, I used the Monte Carlo simulation to test the hypothesis that there was no correlation between the primary (bird) and secondary (habitat) matrices. *P*- values were based on the proportion of 1000 Monte Carlo simulations with eigenvalue greater than the observed eigen value.

It is an appropriate technique if the responses of the dependent variables are expected to be unimodal along environmental gradients (ter Braak & Prentice, 1988). Redundancy Analysis is another ordination technique where the underlying response model is a monotonic distribution of species along environmental gradients, which limits its use when large gradients are analysed and also CCA is appropriate when dealing with occurrence data (ter Braak, 1986).

The Kendall rank-order correlation scores along the ordination axis was applied, it is produced from CCA, for analysis and classified the assemblages and species of bird.

10. Statistical analyses

Kruskal–Wallis non-parametric *ANOVA* was employed to test for overall differences in plant variable among the successional stages and the undisturbed dry evergreen forest and primary forest. Post multiple comparion using the Nemenyi test (Zar, 1999).

Statistical comparisons of bird diversity indices between the abandoned areas and dry evergreen forest were made by Mann-Whitney's *U-test*.

In order to understand how long since abandoned affected plant and bird communities, simple linear regression procedure was used. The outcome is used in examination how vegetation characteristic variables and bird diversity index distribution corresponded with time since abandoned (Raman, 2001).

Non-linear (asymtopic) was employed to assess the relationship between similarity in bird communities with primary forest and years since abandonment. This method was suggested by Raman *et al*. (1998).

Guild assemblage analysis across successional stages was calculated using Spearman's rank correlation coefficients of relative abundance and proportion in each groups. The correlation coefficients were used as a measure of which habitat variables were best explained habitat preference in bird guild group between successional stage habitats.

Places

Eastern Thung Yai Naresuan Wildlife Sanctuary in Tak province was selected as study site. The data analysis was conducted at Faculty of Forestry, Kasetsart University.

Duration

Field data collection was from June 2000 and September 2003. Data analysis and model development were undertaken about 2 years from October 2004 to September 2006.

RESULTS AND DISCUSSION

Plant Community

Species composition

The vegetation data from 100 X 100 m^2 sample plots in 4 undisturbed evergreen forest communities refleted that there were 280 plants species with 38,173 individual stems. For trees over 4.5 cm in diameter at breast height (dbh) was 210 species with 3,957 individuals, while, the other were presented only in sapling and seedling. The dominant species in the top layer were *Polyalthia parviflora, Paranephelium longifoliolatum, Dracontomelum dao, Memecylon sp.* and *Cyathocalys martabanicus.* The sapling composed of 208 species with 13,519 individual plants. The dominant sapling species represented by *Ixora ebarbata, Paranephelium longifoliolatum, Glycosmis pentaphylla , Nephelium hypoleucum* and *Micromelum sp.* Total seedling species was 201species with 20,697 individual plants. The dominant seedling species composed mostly of the species existing in the upper layers, such as *Paranephelium longifoliolatum, Polyalthia parviflora, Siphonodon celasterineus, Celtis tetrandra* and *Picrasma javanica.*

The vegetation data from 12 abandoned settlement plot of 100 X 100 m^2, on the other plaots comprised of 251 of plant species with 39,511 individual plants.Total tree species was 184 species with 3,944 individual stems. The dominant tree species in this community were *Dendrocnide sinuate,Polyalthia parviflora, Ficus elastic, Colona floribunda and and Broussonetia papyrifera.*Total sapling was 209 species with 21,041 individual plants.The dominant sapling species represented by *Glycosmis pentaphylla, Clerodendrum viscosum, Acacia concinna* and *Broussonetia papyrifera.* Total seedling species was 170 species with 14,526 individual plants. The dominant seedling species represented by *Glycosmis pentaphylla , Clerodendrum viscosum, Jatropha curcas, Sapindus emarginatus* and *Colona flagrocarpa.*

Cluster analysis

Results from cluster analysis of tree (DBH> 4.5) of sixteen one ha plots, tree communities in these sites could be divided in to three groups (Figure 4).

The first group (G1; undisturbed forest and old-growth succession) comprised of 5 plots from undisturbed dry evergreen forest (DEF_6, DEF_8, DEF_10 and DEF_12) with old-growth successional stage sites (10years_1) as it was located in the abandoned hill tribe cemetery. G1 was the most diverse in term of species composition and the highest complex community structure. Species and structure composition of stands were significant difference from other groups. Considering from 13 plant characteristics (Table 2), only 3 characters, *H′* of tree, seedling and salping density that shared with G2 and G3. Vertical structure of G1 was divided into 3 canopy layers. The top of canopy is as high as 30 m with emergent trees exceeding 40 m. The dominant species were *Dracontomelum dao*, *Ficus spp*., *Alphonsea sp*., *Litsea sp.* and *Toona ciliate*. Below the top canopy was a middle layer comprised of medium tree size between 10-25 m. The common plant species in this layer consisted of *Polyalthia parviflora, Mallotus paniculatus, Dysoxylum cyrfobotryum, Harpullia cupanoides* and *Baccaurea kunstleri*. A ground layer was shrubs and small trees up to 5-10 m height. Sapling of tree species was abundant on the top canopy including *Memecylon sp., Dendrocnide sinuate, Ixora ebarbata, Beilschmiedia gammieana* and *Glycosmis pentaphylla.*

The second group (G2; mid-succession) comprised of 6 plots mainly in the abandoned settlement areas with 10-12 years old (10years_2, 10years_3, 12years_1, 12years_2 and 12years_3) and 1 plot (located beside a stream) of 8 years old (8years_1). Species and structure composition of these stands differed markedly from G1 but slightly differed from the third group (G3). Espectially, tree density of G2 was dramatically decreased from G1, G2, it had only 1 canopy layer. The average height of top canopy was 15-20 m composing with pioneer tree specis. The dominant species were *Broussonetia papyrifera Macaranga indiaca*, *Trema angustifolia Trevia nudiflora* and *Gmelina arborea*. Below the top canopy

was a ground layer comprised of small sized tree. The open gap between trees is filled in with tall grass (*Saccharum porphyrocoma*, *S. spontaneum* and *Thysanolaena maxima*) and pioneer annual plant (*Chromolaena odoratum* and *Imperata cylindrica*)

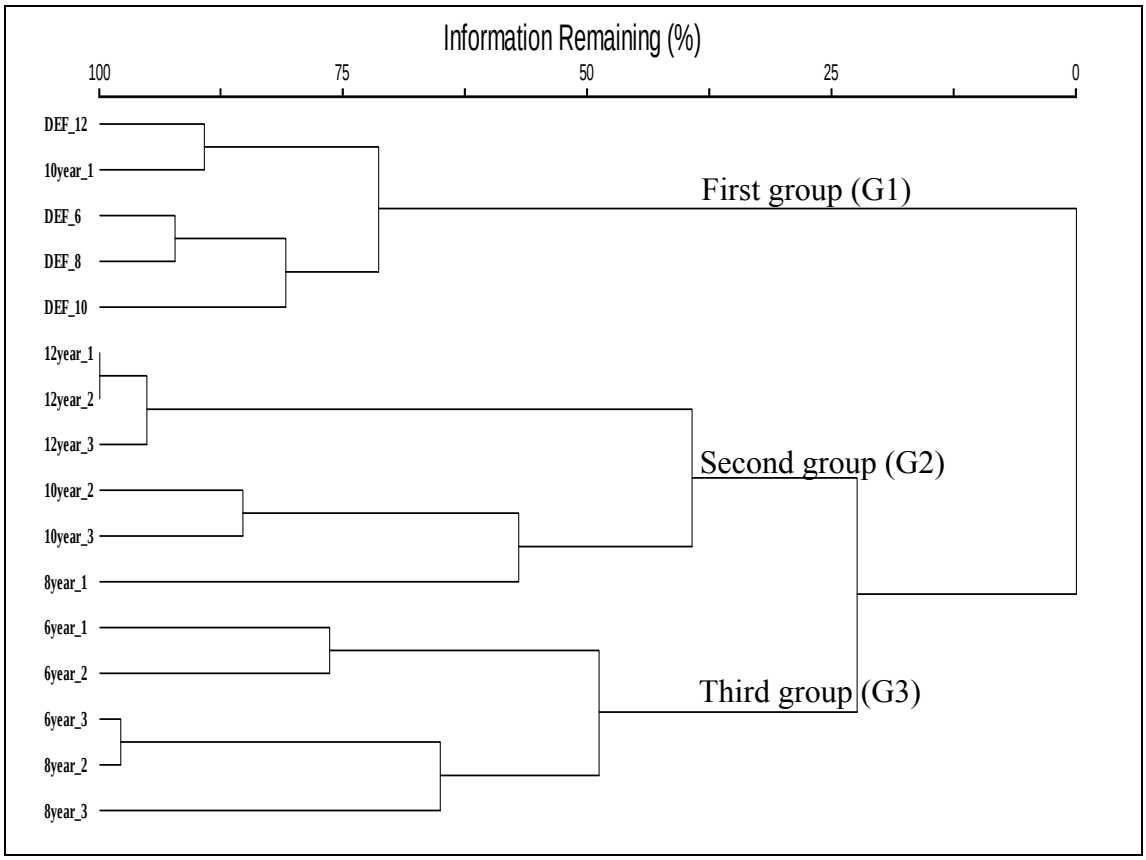


Figure 4 Cluster analyses illustrating the grouping of plant communities of the sixteen 1 ha plots in the study sites. The letter codes are explained in the text. The first is the natural dry evergreen forest and the successional stage closed to the climax community, the second group is the middle stage of succession, the third group is the pioneer stage of succession.

Table 2 Mean of vegetation characteristic in the ASA and DEF with SD in parenthesis. Different superscript letter indicate significantly different mean for each successional fallows/dry evergreen forest ($P<0.05$)

Habitat variable	Successional Fallows/dry evergreen forest					*P*-value**
	6-year (n=3)	8-year(n=3)	10-year(n=2)	12-year(n=3)	Primary(n=5)*	
H′ of Tree	1.874 [a] (0.406)	2.052 [a] (0.622)	2.370 [ab] (1.111)	3.097 [ab] (0.191)	3.712 [b] (0.5730)	*0.050*
H′ of sapling	1.932 [a] (0.545)	2.174 [a] (0.146)	3.419 [bc] (0.315)	3.010 [b] (0.335)	3.843 [c] (0.207)	*0.016*
H′ of seedling	2.259 [ab] (0.579)	1.508 [a] (1.369)	3.471 [c] (0.265)	2.689 [ab] (0.506)	3.532 [c] (0.200)	*0.024*
Tree species (species/ha)	11.666 [a] (8.32)	21.333 [ab] (24.090)	44.000 [b] (9.899)	45.333 [b] (3.78)	117.000 [c] (6.055)	*0.029*
Sapling species (species/0.16 ha)	45.000 [a] (19.157)	40.667 [a] (6.807)	66.000 [a] (9.899)	55.333 [a] (4.041)	126.750 [b] (19.989)	*0.022*
Seeding species (species/0.16ha)	41.333 [a] (11.503)	34.667 [a] (4.1633)	61.500 [b] (13.435)	52.667 [ab] (4.163)	123.500 [c] (5.196)	*0.020*
Tree density (stems/ha)	61.333 [a] (73.323)	141.000 [ab] (198.849)	231.000 [ab] (144.250)	457.000 [b] (35.341)	989.250 [c] (126.703)	*0.018*
Sapling density (stems/0.16ha)	3154.333 [a] (1183.613)	1214.667 [a] (183.424)	357.500 [a] (9.192)	894.333 [a] (368.96)	3379.750 [b] (751.519)	*0.017*
Seedling density (stems/0.16ha)	1401.000 [a] (41.219)	875.000 [b] (527.582)	345.500 [b] (118.087)	1019.667 [b] (355.750)	5174.250 [a] (1277.016)	*0.017*
No. of tree with DBH<55 cm (stems/ha)	58.667 [a] (74.849)	140.000 [ab] (197.122)	230.500 [ab] (144.957)	455.000 [b] (36.865)	957.500 [c] (125.269)	*0.018*
No. of tree with DBH>55 cm (stems/ha)	0.333 [a] (0.577)	0.333 [a] (0.577)	0.000 [a] (0.00)	1.000 [a] (1.0000)	30.000 [c] (2.9439)	*0.034*
No. of tree with height<15 m (stems/ha)	61.333 [a] (73.323)	134.000 [a] (186.759)	230.000 [ab] (145.664)	440.000 [b] (48.538)	828.000 [c] (87.472)	*0.018*
No. of tree with height>15 m (stems/ha)	0.333 [a] (0.577)	7.000 [a] (12.1244)	1.000 [a] (1.414)	17.000 [a] (14.731)	161.250 [b] (71.49)	*0.026*

* including the 10 year-old 1 ha plot (10year_1) located at the abandoned hill tribe cemetery (see Figure 4)

** ***Kruskal–Wallis*** **non-parametric Test**

The third group (G3; early- succession) comprised of 5 plots in early successional stages 6-8 years old (6years_1, 6years_2, 6years_3, 8years_2 and 8years_3). These stands were found few large trees (DBH>55 cm) but higher in sapling density. The canopy layer could not be distinguished between solitaly and scatter clums of pioneer species tree. The pioneer dominant species were : *Colona floribunda, Broussonetia papyrifera, Gmelina arborea Blumea balsamifera Ricinus communis, Clerodendrum viscosum* and *Berrya ammonilla*. In this sites, there were still covered mostly by tall grass (i.e., *Saccharum porphyrocoma*, *S. spontaneum* and *Thysanolaena maxima*) and pioneer annual plant (i.e., *Chromolaena odoratum* and *Imperata cylindrica*) .

The result from successional study indicated that, there were obviously change in diversity and density of tree, sapling and seedling (see Table 2 and Figure 5). Successful forest regeneration depended upon multiple site and species attributes including characteristics of disturbance intensity, time since abandoned, and their proximity to seed sources (Andrade and Rubio-Torglen, 1994; Aide *et al*., 1995; Chinea, 2002). As in other studies of forest recovery after agricultural abandonment, age since abandonment was the best predictor of the structural recovery of forest (Aide et al., 1996 and Chinea, 2002).The results from cluster analysis indicated have sequent trend was correlated with abandoned time. Degree of disturbance and site quality although slightly affected in some areas (i.e. abandoned cemetery and beside stream). Generally, it started rapid initial recovery of vegetation attributes following by a accelerating phase. This condition was documented earlier from studies of forest succession after shifting cultivation (Sukwong, 1973; Drew *et al*.,1978, Raman *et al*., 1998). In tropical zone, the abandoned land in disturbed forest took more at least more than 50 years for maturity of the forest and it needs more than 100 years for fully recovery (Ewel, 1983; Aide *et al.*, 1995; Chinea, 2002; Nakmuenwai, 2002). However, Jones *et al.* (2004) studied on natural regeneration in *Saccharum spontaneum* grasslands and suggested that bird dispersal may be a fundamental driver in seedling recruitment. Because the movements of birds in the abandoned pasture were directed to certain vegetation components (trees and shrubs) served as food sources and perchsites. Along the movement, seeds carried by birds were being dispersed in a nonrandom fashion (Da Silva *et al.*, 1996; Holl, 1998). Results of the present research supported the hypothesis that at least 20 species (~10 % of 170 seedling species) founded

in ASA showed the same fruit-tree species for bird from DEF (*i.e. Paranephelium longifoliolatum, Gmelina arborea, Cinnamomum inners, Carallia brachiata, Polyalthia lateriflora* and *Spondias pinnata*).

A

B

C

Figure 5 Three groups of main plant community found in study sites in the Thung Yai Naresuan Wildlife Sanctuary, A : Early successional stages 6-8 years old, B : Old-growth successional stages 10-12 years old, C : Undisturbed dry evergreen forest

Bird Communities

Bird species diversity

The result from all seasons, two hundred forty-five bird species were recorded in this study. They were composed of 52 migratory and 193 resident bird species from all seasons, 171, 132 and 200 species from 6-8 years old, 10-12 years old of ASA and DEF respectively (Table 3). Across all transects, 20% of all migrant species (34 spp.) and 80% of all resident species (170 spp.) were detected in 6-8 years old of ASA, 24% of all migrant species (41 spp.) and 76% of all resident species (132 spp.) were detected in 10-12 years old of ASA and 20% of migrant species (39 spp.) and 80% of resident species (161 spp.) were found in DEF (Table 3).

The number of bird species in DEF was clearly higher than all of ASA and the *H´* index in the DEF (4.274) was significantly higher ($P<0.05$) than in the 6-8 years old (3.726) and 10-12 years old (4.144) of ASA, and also the evenness and *H1* in the DEF were higher than in the ASA.

The majority of species restricted to one habitat were resident birds in early-succession stage (58%) and DEF (75%) see Table 3 and Appendix Table 17. Resident species restricted to 6-8 years old of the ASA habitat type e. g. were plain-backed sparrow (*Passer flaveolus*), yellow-eyed babbler (*Chrysomma sinense*), chestnut-headed bee-eater (*Merops leschenaulti*) and grey-headed parakeet (*Psittacula finschii*) and common migratory e. g. included red-rumped swallow (*Hirundo daurica*), siberian rubythroat (*Luscinia calliope*) and slaty-backed flycatcher (*Ficedula hodgsonii*). Common resident species restricted to 10-12 years old of the ASA habitat type e. g. golden babbler (*Stachyris chrysaea*), striated yuhina (*Yuhina castaniceps*) and common flameback (*Dinopium javanense*) and common migratory e. g. Eastern Crowned Warbler (*Phylloscopus coronatus*), Blue-throated Bee-eater (*Merops viridis*) and forest wagtail. Common resident species restricted to DEF e. g. were ruby-cheeked sunbird (*Anthreptes singalensis*), little pied flycatcher (*Ficedula*

westermanni), silver-breasted broadbill (*Serilophus lunatus*), blue-eared barbet (*Megalaima australis*) and banded woodpecker (*Picus mineaceus*). Common migratory species restricted to DEF e. g. included rosy minivet (*Pericrocotus roseus*), ashy minivet (*P. divaricatus*), black-naped oriole (*Oriolus chinensis*), eyebrowed thrush (*Turdus obscurus*) and white-tailed leaf warbler (*Phylloscopus davisoni*).

Table 3 Statistical summary of bird species from successional stages of ASA and DEF in the Thung Yai Naresuan Wildlife Sanctuary.

	Number and Diversity of Bird		
	Early- succession (6-8 years old)	**Mid-succession (10-12 years old)**	**Dry evergreen forest (DEF)**
Total no. of species detected			
Resident	137	132	161
Migrant	34	41	39
All species	171	173	200
H′ index	3.726*	4.144*	4.274
Evenness	0.677	0.753	0.777
H1	41.480	63.014	71.805
Total no. of restricted species detected			
Restricted Resident	15	6	21
Restricted Migrant	11	7	7
All species	26	13	28
Index of community similarity**	74.39	80.96	

* The comparision of *H′* between successional stages of ASA were significantly ($P<0.05$) lower than DEF.

** Species similarity comparison with DEF, multiplied by 100, where 0=complete dissimilarity and 100 =identical.

Bird-habitat relationships

Similarity of bird community between DEF and ASA with abandonment years

Before analysis of similarity index, the data of birds from nine time surveys of four study sites was separated each site in 2 grougs between ASA and undisturbed DEF. Similarity index of bird species composition between DEF and ASA ranged from low similarity between undisturbed DEF and the 6-years abandoned site and increased up in 8 and 10 years respectively (Table 4). However, the similarity index in same site showed high variation across the seasonal change particulary in 12-year-old site, values ranged from 0.450 in rainy season to 0.651 in summer. The comparision mean of similarity index between 6-year-old site were significantly ($P<0.05$) lower than 8 and 10 years sites (Mann-Whitney's *U-test*) but 12 year-old site was not statistically significant ($P<0.1$) (Table 5). As the follow ages, the bird community convered toward the primary forest bird community in an asymptotic fashion (Figure 6). Especially, The similarity index of bird community change rapidly from the 6 year-old to the 8 year-old.

Table 4 Similarity index of bird species composition between DEF and ASA in each site after years since abandonment (data of the 3 years consecutively from rainy season 2000 to summer in 2003).

Season	Years since abandonment sites*			
	6	**8**	**10**	**12**
Rain 2000	0.660	0.549	0.543	0.450
Cool 2000	0.427	0.491	0.667	0.574
Summer 2001	0.477	0.625	0.618	0.630
Rain 2001	0.500	0.590	0.563	0.500
Cool 2001	0.456	0.513	0.54	0.626
Summer 2002	0.602	0.672	0.59	0.651
Rain 2002	0.360	0.615	0.549	0.636
Cool 2002	0.444	0.569	0.563	0.528
Summer 2003	0.536	0.583	0.550	0.595
Mean (SD)	0.496 (0.092)	0.579 (0.056)	0.576 (0.042)	0.577 (0.070)

*species similarity between ASA and DEF, where 0 = complete dissimilarity and 1 =identical

Table 5 *P*-value from Mann-Whitney's *U-test* of the parewise of similarity index among sites in the chrono-sequence.

	Years since abandonment			
	6 -year-old	**8-year-old**	**10-year-old**	**12-year-old**
6 -year-old	-	-	-	-
8-year-old	0.040	-	-	-
10-year-old	0.024	0.796	-	-
12-year-old	0.077	0.730	0.730	-

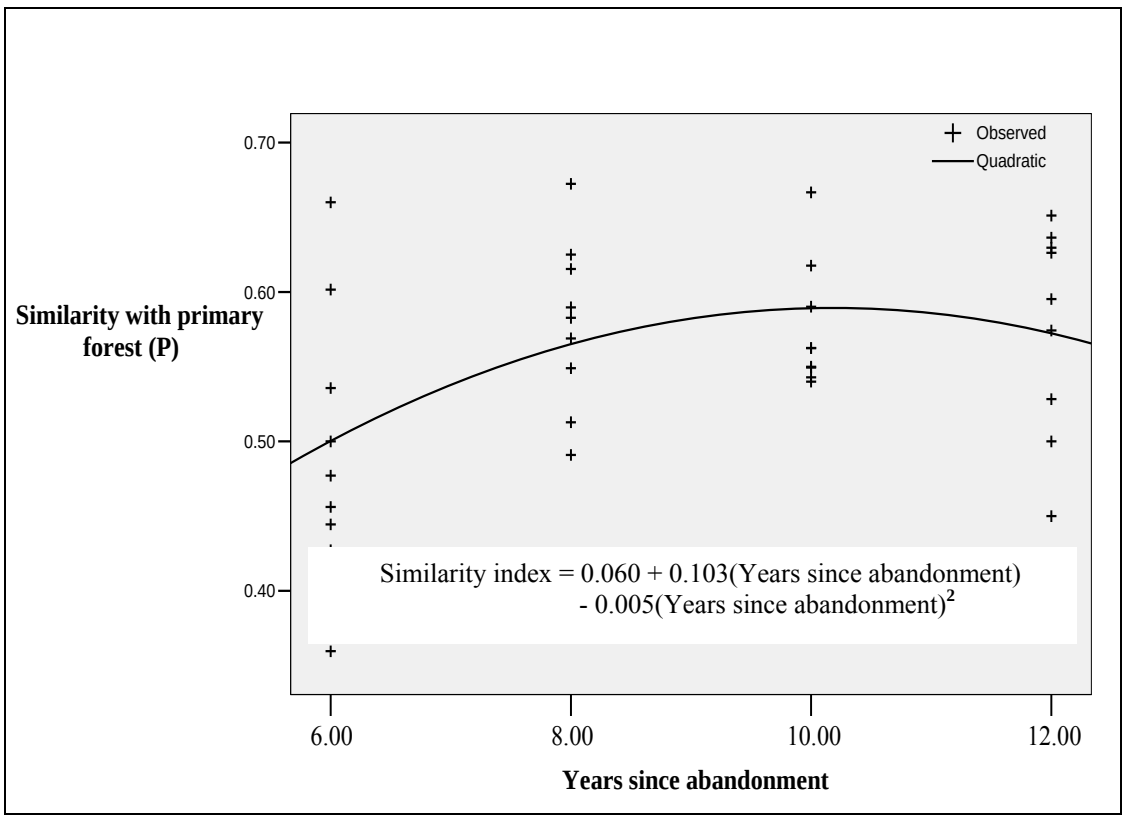


Figure 6 Relationship between similarity in bird community composition and years since abandonment ($r^2 = 0.919$).

Relationship between Shanon-Wierner index (*H'*) of ASA and years since abandonment

There were significant positive relationships between *H'* and age since abandonment ($r^2 = 0.297$, $P = 0.011$) (Figure. 7). Mean value of *H'* showed an increasing trend along with habit successional stages from 6- year-old to 12- year-old sites. It indicated that the diversity of bird population increased with an increasing of the diversity of plant community.

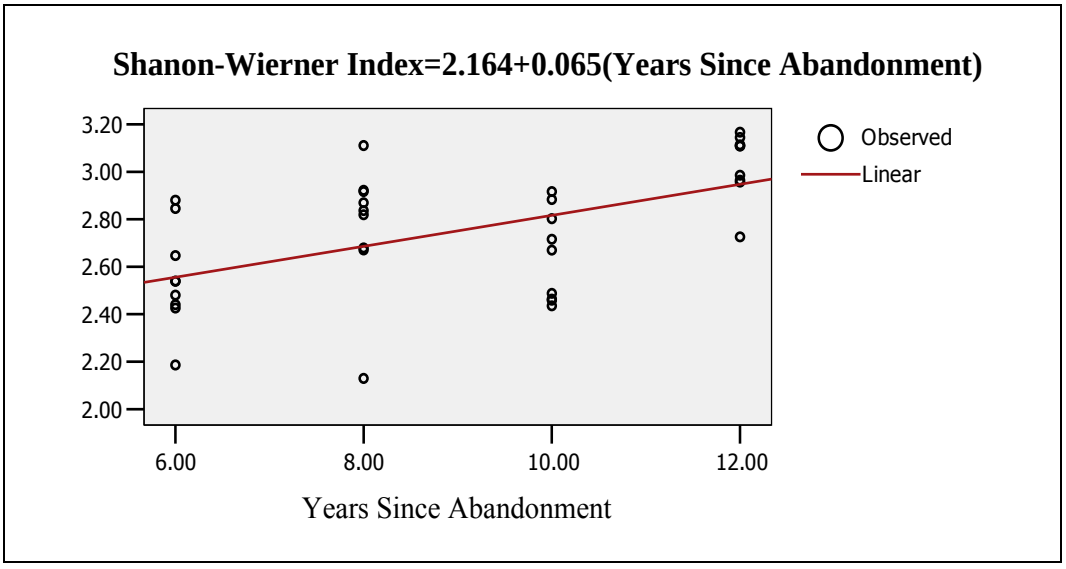


Figure 7 Relationship between Shanon-Wierner index(*H'*) and years since abandonment ($r^2 = 0.297$, $P = 0.011$).

Comparison of diversity indices between the ASA and the DEF among sites in the chrono-sequence

Overall data between rainy season of 2000 to summer of 2003, the cumulative number of bird species reached maximum (149 species) in the cool season of 2000 and droped down to 109 species in the rainy season of 2002. In general, the number of bird species and *H'* index oscillations increased to the highest level during the cool season but

decreased in summer and rainy seasons of each year. Comparisons of the *H′* index of different aged (6–12 years old) sites indicated that the *H′* index from 6 to 10 years old of ASA mostly tended to be lower than in the sites of the DEF (except in rainy season of 2000 in 6 -year-old, summer of 2001 in 8 -year-old and summer of 2003 in 10 year-old)(Figure 8A-8C). However, in the 12-year-old ASA, the *H′* index was greater than in the DEF in every rainy season, in cool season of 2002, and in summer of 2003 (Figure 8D).

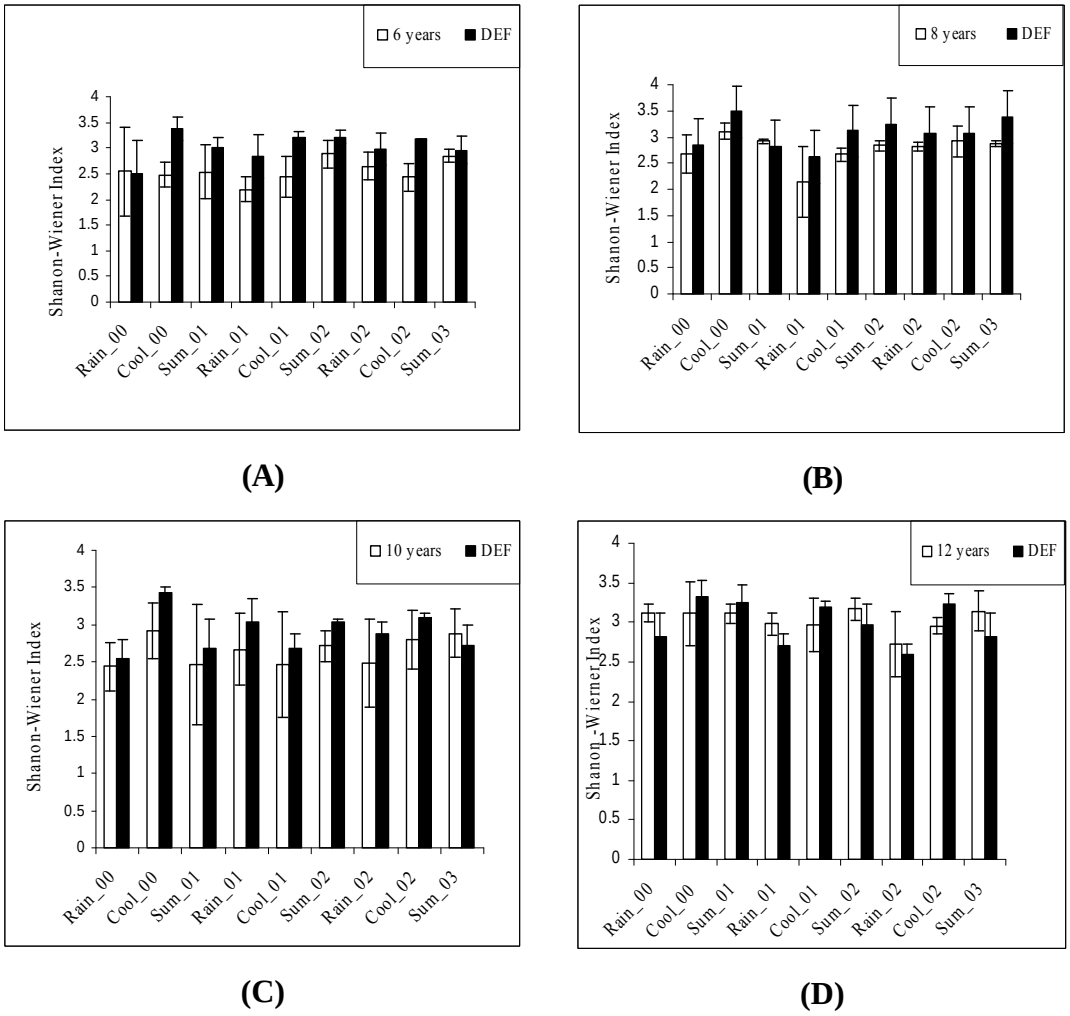


Figure 8 Shanon-Wierner index (*H′*) (mean ± 1 SD) of bird diversity between the ASA and DEF in the Thung Yai Naresuan Wildlife Sanctuary from the rainy season 2000 to the summer season 2003: (A) 6-year- old ASA;(B) 8-year- old ASA;(C) the 10-year- old ASA; (D) the 12-year- old ASA.

Studies on the relationships between wildlife and plant succession were mostly concentrated on bird because bird has ability to fly from place to place in a long distance and also they were very sensitive to seasonal and habitat changes (*e.g.* Andrade and Rubio-Torgen, 1994; Raman *et al* ,1998; Welford, 2000; Raman, 2001; Raman and Sukumar, 2002). In this study, bird species diversity was first strongly influenced by land use pattern followed by seasonal change. The results also reflected the same trend reported by Ohno and Ishida (1997). They concluded that the diversity of bird communities was significant higher in the natural forest than plantation. In contrast, Knok and Corlett (2000) concluded that bird species diversity in exotic species forest plantation (*Lophostemon confertus*) differed insignificantly when compared with secondary forest, especially species composition. Welford (2000) also indicated that the number of bird species recorded in each successively old abandoned pasture with time of abandonment increased but only half of species recorded in the undisturbed forest site were recorded in mature pasture.

In general, the tropical zone including Thailand, season is the second factor effect to bird diversity. All indices of occurring one notably highest in cool season and lowest in rainy season. The seasonal factor mainly affects the change of bird diversity due to the migratory birds moved from the northern part of hemisphere to these areas during in cool season (December to late of February), particularly insectivore birds (*e.g.* warbler 13 spp. and flycatcher 5 spp.), and they commonly leave from these areas during late of summer and rainy season (April to October).

Bird communities were frequently used for conservation assessment and monitoring. Many studies in tropical rainforest regions showed that forest plantations, logging forests and secondary forests generally harbour fewer bird species and have altered community composition as compared to primary forest (Johns, 1989; Raman and Sukumar, 2002). However relationship between the degree of habitat alteration and the change in bird communities was not precisely

understood. The relationship on observed effects and disturbance intensity may be a non-linear function (Johns, 1986, 1989). The degree of change in bird community structure and composition being strongly related to the magnitude of alteration of rainforest vegetation structure and floristic composition (Raman and Sukumar, 2002). Within the community, individual bird species differed in their responses and susceptibility to habitat alteration. Habitat changes were reported that it affects on rare and restricted-range birds, rainforest habitat specialists and altitudinal migrants (Raman, 2001). Other factors that influence susceptibility included body size, fecundity, diet-guild and foraging stratum (Thiollay, 1999). Few studies addressed avian use abandoned former pastures (Andrade and Rubio-Torgler 1994). Johns (1989) compared the avifauna of undisturbed tropical forest, slightly logged forest, secondary growth, and crop fields. He concluded that many species were found in most habitat types although the similarity decreased by increasing disturbance intensity between early secondary growth and undisturbed.

My results agreed with Dunn (2004) and Raman *et al*., (1998) who concluded that bird species richness, abundance and diversity, in shifting cultivation increased rapidly and asymptotically during succession paralleling vegetation recovery as shown by positive correlations with fallow age. The non-linear relationships implied that fallow periods less than a threshold of 25 years for birds, and about 50-75 years for woody plants, are likely to cause substantial community alteration (Raman *et al.*, 1998).

Cluster analysis on bird communities

Two hundreds and fifty-five bird species were found comprising 52 migratory and 193 resident species. A total of 214 species were recorded from ASA and 192 species from DEF. These bird assemblages were grouped into 8 groups based on land use pattern and time after abandoning (Table 6).The data were analized using cluster analysis method.

Table 6 Description of bird assemblages and code for cluster analysis.

Assemblage from	CODE
1. ASA 6 year-old site	6_YEARS
2. Dry evergreen forest around the 6 year-old site	DEF_6
3. ASA 8 year-old site	8_YEARS
4. Dry evergreen forest around the 8 year-old site	DEF_8
5. ASA 10 year-old site	10_YEARS
6. Dry evergreen forest around the 10 year-old site	DEF_10
7. ASA 12 year-old site	12_YEARS
8. Dry evergreen forest around the 12 year-old site	DEF_12

First, the cluster analysis dendrogram (from total species including resident and migrant species) showed a clear difference in bird assemblages between (G 2 $_T$) ASA abandoned 6-10 years sites (6_YEARS, 8_YEARS and 10_YEARS) and (G 1 $_T$) DEF (DEF_6, DEF_8, DEF_10 and DEF_12), and ASA 12 years follow (12_YEARS) (Figure 9).

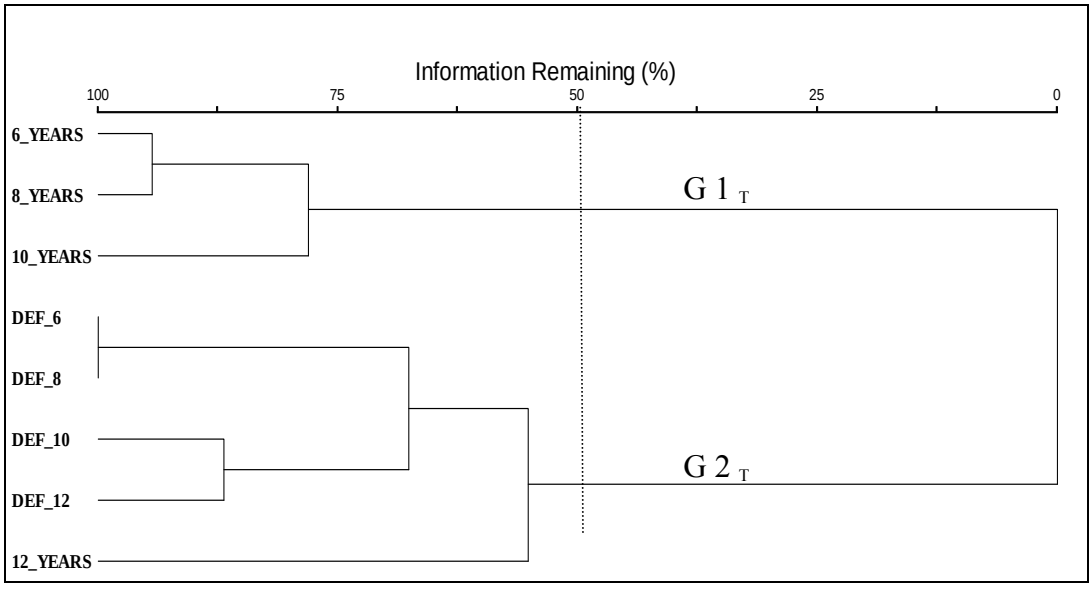


Figure 9 Dendrogram of the 8 bird assemblages (including resident and migrant species). The letter codes are explained in the text.

Second, the cluster analysis dendrogram (only resident species) still showed same pattern. The difference in bird assemblages between the (G 2 $_R$) ASA abandoned 6-10 years-was clearly seen is also sites (6_YEARS, 8_YEARS and 10_YEARS) and (G 1 $_R$) DEF (DEF_6, DEF_8, DEF_10 and DEF_12), and ASA 12 years follow (12_YEARS) is still evident (Figure 10).

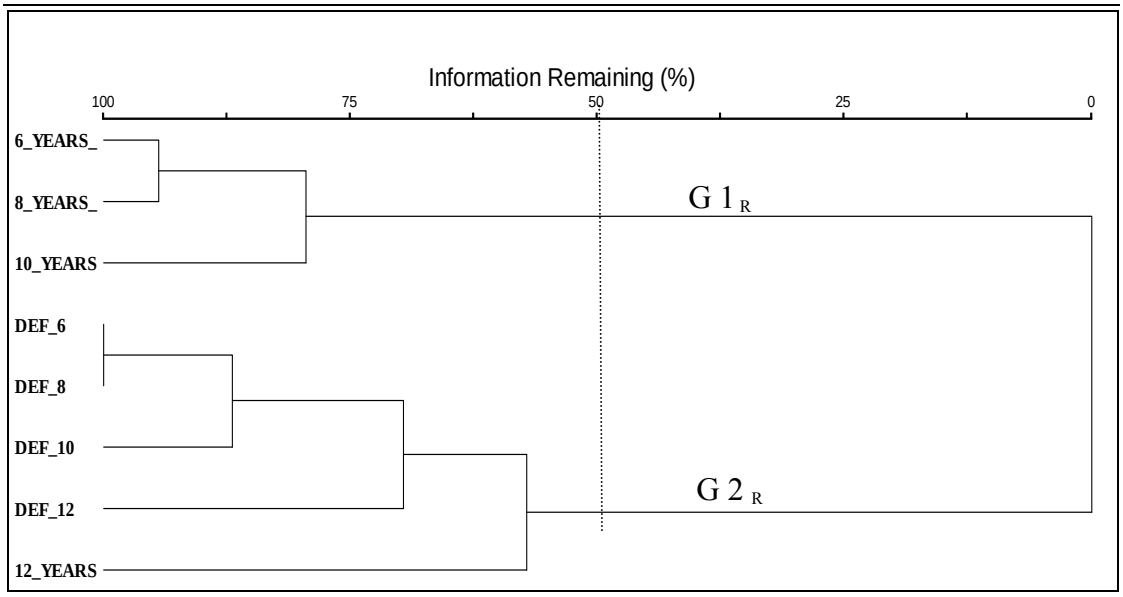


Figure 10 Dendrogram of the 8 bird assemblages (only resident species). The letter codes are explained in the text.

Third, the dendrogram was constructed only from migratory bird (excluding resident species). The dendrogram shows that two sites (G 1 $_M$ and G 2 $_M$) of DEF (DEF_6 and DEF_8) and ASA abandoned 6-10 years ago (6_YEARS, 8_YEARS and 10_YEARS) when clustered together were distinct from the other sites (*i.e.* DEF_10 , DEF_12 and 12_YEARS) (Figure 11). Bird assemblages were highly similar within each sites (8_YEARS-DEF_8, 6_YEARS-DEF_6 and DEF_10- DEF_12 -12_YEARS). All sites sharing between 70 to 100 percent of their species similarity were found. The degree of overlap in bird composition between ASA 10 years site (G 1 $_M$) and DEF site (G 2 $_M$) was highly different with non shared species. Generally migrant species always move through or over different habitats, survival may depend on their ability to utilize disturbed vegetation.

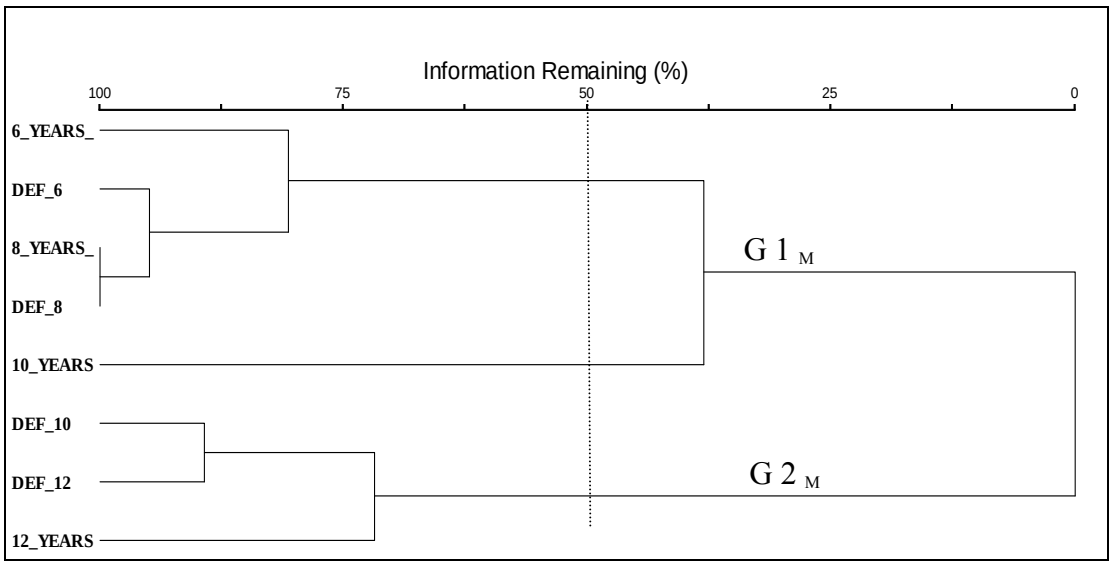


Figure 11 Dendrogram of the 8 bird assemblages (only migrant species). The letter codes are explained in the text.

The mainly results indicated that bird community in ASA 12 years ago had the same species composition as in undisturbed dry evergreen forest. One of supporting result was the resident birds restricted in ASA 12 years site and DEF did not found in the other sites such as; White-hooded Babbler, White-necked Laughingthrush, Large Woodshrike, Lesser Racket-tailed Drongo, Little Cuckoo Dove and Rufous-necked Hornbill. The resident birds have been focus of habitat conversation practice, especially in tropical forests which are known to harbor a large proportion of resident species (Thiollay, 1999; Raman, 2001).

The dendrogram between DEF and ASA bird communities due largely to the high degree of species similarities between the two habitats. Similarity of species assemblages (total and resident species; Figure 7 and 8) among habitats was consistently higher in this study than levels documented among regenerating stages of temperate riparian forest (Farley *et al.* 1994) among subtropical wet forest, tree fall gaps, and secondary-growth clearings in Puerto Rico (Wunderle *et al.* 1987), and between regenerating forest of 7 to 17 years and mature primary forest in Colombia (Andrade and Rubio-Torgler 1994). Therefore, regenerating areas in tropical Asia

appear to recover rapidly from disturbance, quickly attaining bird assemblages associated with mature forest (Raman, 2001). In tropical India, forest birds readily colonizing successional forests having structural and floristic characteristics similar to primary mature habitat (Raman *et al.* 1998). Also in South East Asia, the avifauna of undisturbed tropical forests shows trend of the similarity decreased with increasing disturbance intensity and over index between early secondary growth and undisturbed forest (Johns, 1989). Most species (>30 species) are resident, associated with the early stage (6-10 years follow) of succession, they were already absent from the forest sites in this study (*e.g.*, Common Myna, Yellow-vented Bulbul, Dollarbird, Oriental Turtle Dove, Plain-backed Sparrow, Barred Buttonquail and Scaly-breasted Munia). However, most species were common to urban and commonly occurred in disturbed habitat. Suggesting that 12 years follow stages of secondary growth are supported bird species normally found in primary forests but it does not suitable for resident of non-forest birds in this area. Resident tropical forest birds are thought to be generally more specialized than their migratory counterparts, requiring narrower and more specific habitats and microhabitats (Stouffer and Bierregaard 1995), a feature that may prevent them from inhabiting earlier successional stages (Smith *et.al.* 2001). For example, many tropical insectivores specialize in foraging on dead leaves, epiphytes, or vines, microhabitats that may be less prevalent in younger forests. The low layer and large area requirements of some resident species may excluded be from early secondary growth forest (Stouffer & Bierregaard 1995).

The results strongly support that the migrant species have occurred over different disturbed habitats (Figure 9). Similar to the past studies, they suggested that migrants are more flexible than residents in their habitat use, and thus potentially more tolerant of disturbance (Karr, 1976; Greenberg, 1995). This result is supported by previous report from tropical India that this group of species is likely to benefit from habitat conversion due to abandoned areas (Raman, 2001). Yet migrant and resident forest birds commonly share similar distribution patterns in the Neotropics (Petit *et al.* 1999; Smith *et al.* 2001). In general, widespread species that are able to persist in highly disturbed habitats, they are relatively secure from a conservation point of view. However, Smith *et al.* (2001) found that both species richness and abundance of

migrants and residents displayed positive association across successional habitats, indicating that the two groups use the same habitats. The overlap in distribution between migrant and resident birds suggests not only residents may be as flexible as migrants (and conversely that neither group is more tolerant of disturbance), but also that efforts to protect habitat for one group may benefit the other. These broad generalizations, however, do not reflect the habitat requirements of all birds. Individual species of both migrants and residents can be more specialized in their habitat use, demanding particular conservation attention. Although most migrant and resident species occurred in two or more habitats. The majority of these specialists occurred in primary forest. As birds restricted to one habitat, these species may be inherently rare. Alternatively, they may be more numerous and widely distributed but difficult to detect. Only resident species were classified as habitat specialists, again with most in the primary forest. It thus appears as if some resident birds are dependent on mature forest in the study area; further surveys would help resolve this issue.

Feeding guilds

The overall bird community attributes such as species richness and similarity with undisturbed forest showed patterns of increase along with the plant community succession. Individual guilds showed different patterns of change. Nakmuenwai (2002) recommended that successional vegetation in abandoned settlement areas needed at least 145 years or more to reach the dry evergreen forest. From twelve feeding guilds, the number of bird species, in six guild groups were positively coordinated with successional age ($r_s>0$): aboreal frugivores, aboreal insectivore/frugivore, aboreal faunivore/frugivore, insectivore/nectarivore, terrestrial insectivore and terrestrial insectivore/frugivore. The others were negative correlation (Table 7). Also sallying insectivore guild, a group of swift and swallow bird, showed significantly ($r_s=-0.89, P<0.05$) negative correlation value with successional age. The abundance of six guild groups were positive ($r_s>0$) with successional age: bark-gleaning insectivore, faunivore/frugivore, insectivore/frugivore and terrestrial insectivore/frugivore. Only the foliage-gleaning and terrestrial frugivore guilds showed highly negative correlation ($r_s=-0.90, P<0.05$) with successional age.

Table 7 Relative abundance of feeding guild of birds between ASA and DEF.

Bird Guild	Success ional plant community strata					Spearman correlation coefficients(r_s)
	6-year	8-year	10-year	12-year	DEF (~145-year)	
Aboreal frugivores (AF)						
Number of species	12	9	10	8	37.41	0.10
Relative abundance	52.33	56.29	76.63	65.10	37.41	-0.10
Aboreal insectivore/frugivore (AIF)						
Number of species	15	15	16	17	15	0.33
Relative abundance	45.33	54.99	61.76	58.36	44.89	-0.10
Bark-gleaning insectivore (BGI)						
Number of species	5	7	7	13	4.25	-0.05
Relative abundance	37.10	30.38	16.36	39.39	69.19	0.60
Arboreal faunivore/frugivore(FF)						
Number of species	3	2	3	3	3.75	0.67
Relative abundance	43.86	38.36	30.50	53.85	58.36	0.60
Foliage-gleaning insect (FGI)						
Number of species	69	76	71	79	67.5	-0.10
Relative abundance	40.03	37.58	48.88	50.45	55.76	.90*
Insectivore/nectarivore (IN)						
Number of species	3	5	6	6	4.75	0.36
Relative abundance	35.50	40.96	40.59	62.32	55.16	0.80

Table 7 (Continued)

Bird Guild	Success ional plant community strata					Spearman correlation coefficients(r_s)
	6-year	8-year	10-year	12-year	DEF (~145-year)	
Raptor (R)						
Number of species	6	3	5	5	3.75	-0.36
Relative abundance	70.97	60.00	72.22	47.06	37.44	-0.70
Sallying insectivore (SaI)						
Number of species	4	4	4	3	0.75	-0.89*
Relative abundance	86.00	58.62	100.00	0.00	13.84	-0.60
Sweeping insectivore (SwI)						
Number of species	3	1	3	1	0.5	-0.74
Relative abundance	90.00	53.33	100.00	0.00	56.67	-0.30
Terrestrial insectivore (TF)						
Number of species	4	5	6	4	4	-0.22
Relative abundance	40.86	44.44	60.00	54.29	50.10	.90*
Terrestrial insectivore (TI)						
Number of species	3	8	4	6	7	0.40
Relative abundance	66.67	61.04	33.83	56.25	45.55	-0.70
Terrestrial insectivore/frugivore(TIF)						
Number of species	3	5	5	5	4	0.22
Relative abundance	27.59	31.93	84.62	34.35	55.38	0.70

*indicated statistically significant difference

The proportion of guilds composition changes in each site between ASA and DEF, both in number of species and abundance. The proportion of canopy and understory user (*i.e.,* aboreal frugivores, aboreal insectivore/frugivore, foliage-gleaning insect, insectivore/nectarivore, bark-gleaning insectivore and faunivore/frugivore) and a group of terrestrial feeder (*i.e.*, terrestrial frugivore and terrestrial insectivore/frugivore) increased with age follow sites (Figure 12 and 13) but no statistical difference was found. On the contrary; mainly group of feeding on air sallying insectivore, sweeping insectivore, raptor and group of terrestrial insectivore dramatically decreased with age follow sites and sallying insectivore. Sweeping insectivore groups were not found from 10-12 years age follow but no statistical difference was found (Figure 14).

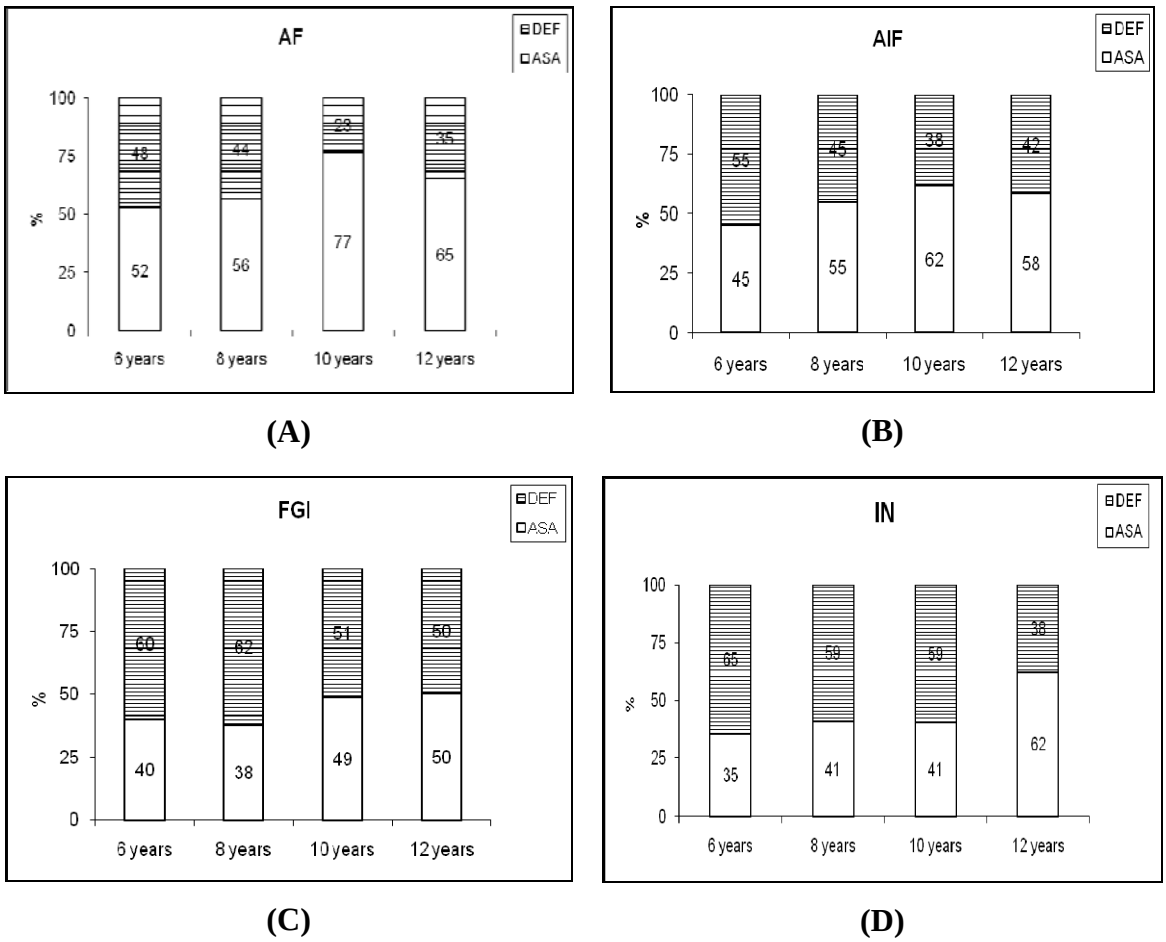


Figure 12 Proportion of guilds between ASA and DEF in each study sites, (A): AF; aboreal frugivores (r_s*=0.80, P=0.20*), (B): AIF; aboreal insectivore/frugivore (r_s*=0.80, P=0.20*), (C): FGI; foliage-gleaning insect (r_s*=0.80, P=0.20*), (D): IN; insectivore/nectarivore (r_s*=0.80, P=0.20*).

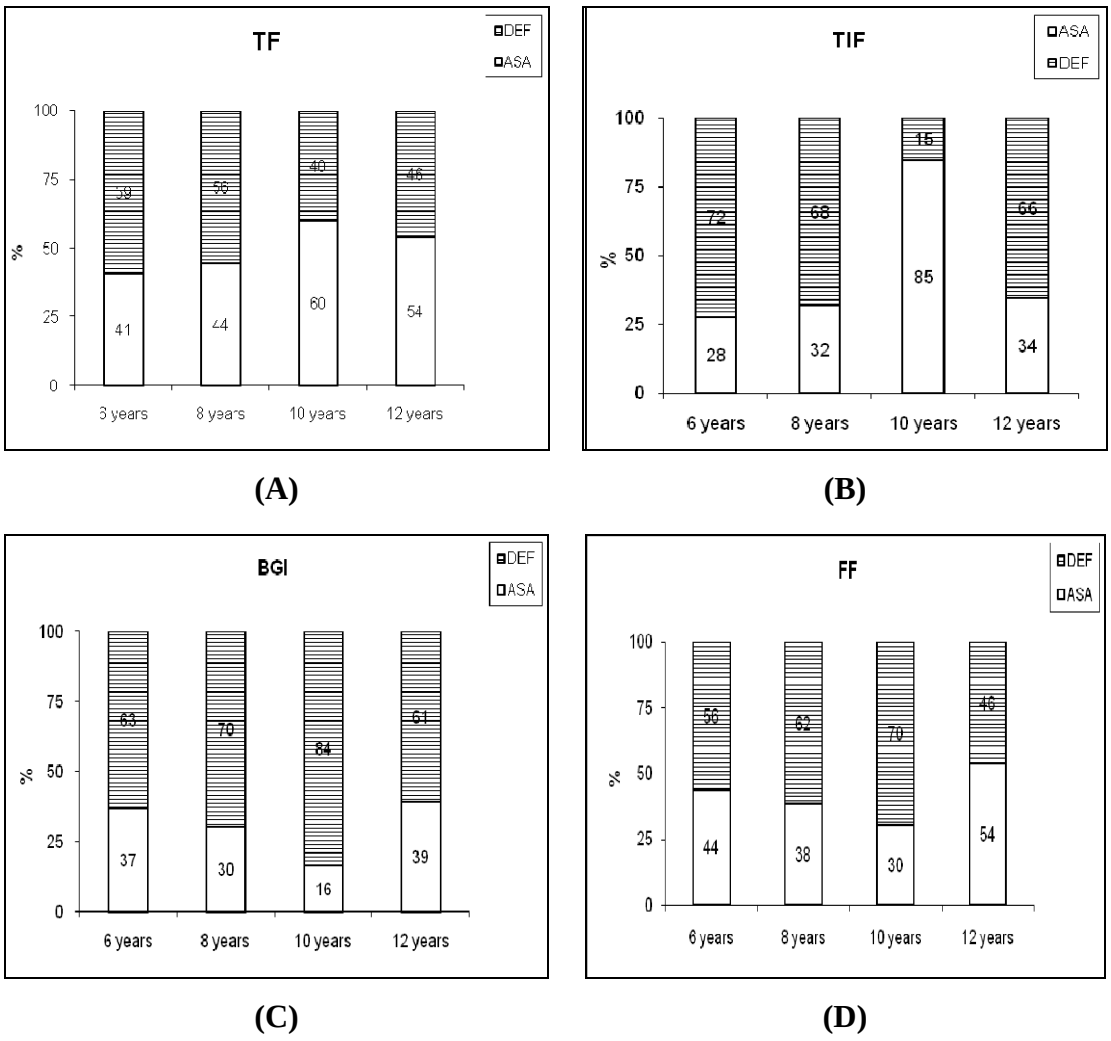


Figure 13 Proportion of guilds between ASA and DEF in each study sites (A): TF;terrestrial frugivore (r_s*=0.80,P=0.20*), (B):TIF; terrestrial insectivore/frugivore (r_s*=0.80,P=0.20*) ,(C): BGI; bark-gleaning insectivore (r_s*=0.20,P=0.80*) and (D): FF; arboreal faunivore/frugivore (r_s*=0.20,P=0.80*).

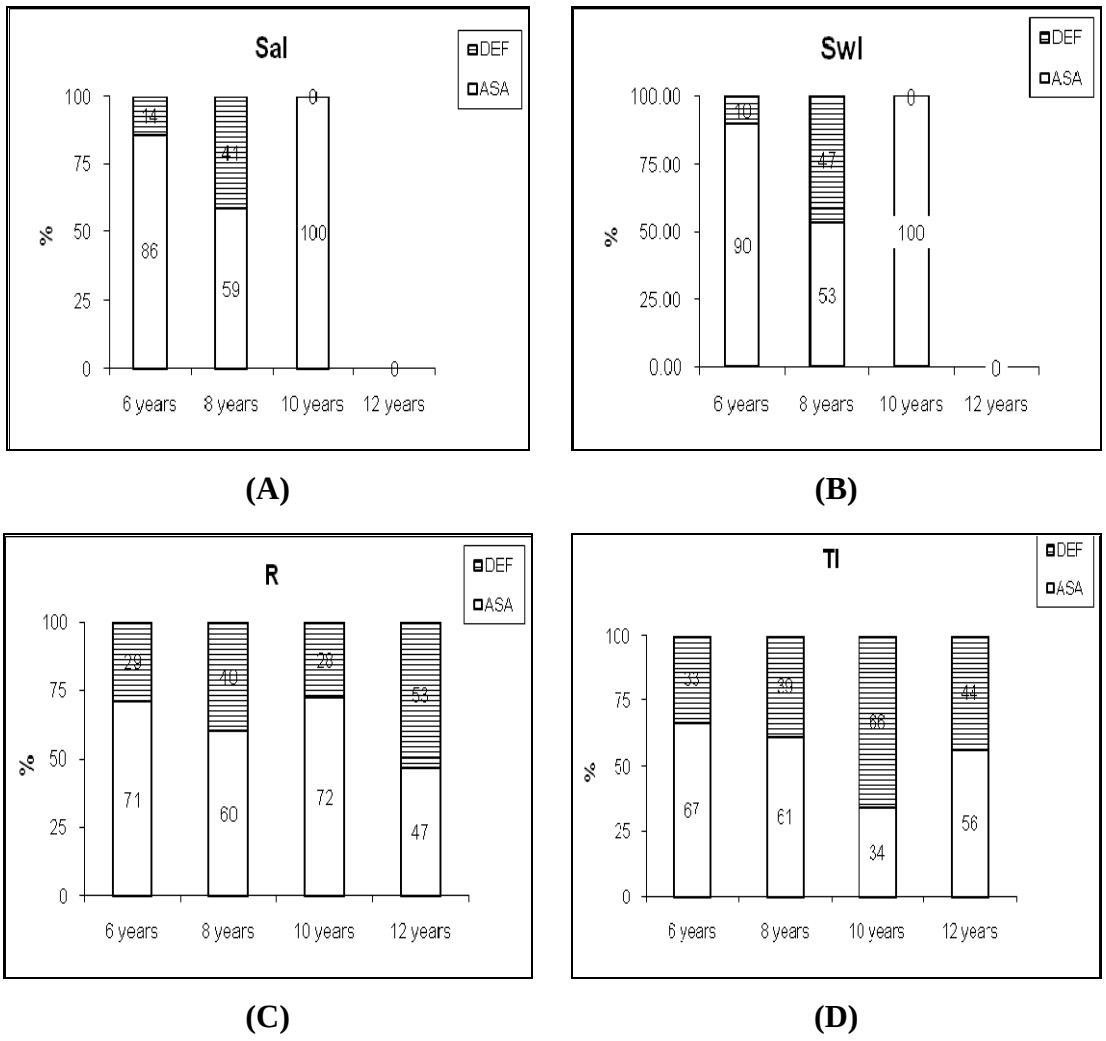


Figure 14 Proportion of guilds between ASA and DEF in each study sites (A): SaI; sallying insectivore (r_s=*-0.40,P=0.60*), (B): SwI; sweeping insectivore (r_s=*-0.40,P=0.60*), (C): R;Raptor(r_s=*-0.40,P=0.60*) and D: (TI); terrestrial insectivore (r_s=*-0.80,P=0.20*).

The vegetation changes may, however, affect different species or broad feeding guilds in different ways (Raman *et al*., 1998). The result indicated that abundances of forest canopy and sub canopy user (aboreal frugivores, aboreal insectivore/frugivore, foliage-gleaning insect, insectivore/nectarivore, bark-gleaning insectivore and faunivore/frugivore) tended to show increasing correlation with successional age. The marked change in foliage profile and forest stature during succession stages is likely to attract colonization by canopy insectivores as it was

reported in other studies (Browman *et al.* 1990). Foliage-gleaning and bark-gleaning insectivores are also related positively increasing availability of foraging substrate (leave and tree) and presumably abundance of food resources, as indicated by the correlation with successional age. For arboreal insectivores and omnivores, structural aspects may have more influence by providing opportunities for foraging and hunting (Terborgh, 1985). This may be explained that why more species of understorey insectivores tended to occur in the intermediate successional stages, where much of foliage volume was concentrated between 0- 15 m from the ground. This result was in accordance to the studies of Round and Brockelman (1998) and Johns (1986).

In a shifting cultivation landscape of India, Raman *et al*. (1998) concluded that the increasing of tree density, woody plant species richness, and forest stages of late-successional forest attracted canopy insectivores, frugivores, and bark gleaners preferentially use this habitat. Floristic composition of habitat may impinge more on directly plant-dependent guilds, such as frugivores, nectarivores and granivores. More species of frugivores (*e.g.,* barbets, hornbills, bulbuls.) and insectivore/nectarivore occurred in mature forest stages than in early succession. This can be described to the higher plant species richness and abundance of plant species in same families such as Moracease, Lauraceae and Myristicacease which are important for frugivorous and nectarivorous bird in mature stages (Raman *et al*., 1998; Raman and Sukumar, 2002).

The 4 species of sallying and sweeping insectivore were not found from 10-12 years follow sites where canopy is closed and have no space for feeding areas. This findings support earlier study that many bird species associated with the early scrub stage of succession were already absent from forest sites after five to ten years disturbance (Raman *et al*., 1998; Smith *et al*.2001; Raman and Sukumar, 2002). Thus, it appears that a rapid recolonization of successional habitat by forest birds occurs in this; however, most of the bird species were common to all forest stages, but several species occurred only in late-successional habitat. It is suggested that earlier stages of secondary growth are not suitable for all birds of the region.

Vertical stratification of the bird assemblage between the ASA and the DEF

Only the data from direct observations were used in this part of study. A total of 170 were found during the study, with 119 and 133 species being observed in ASA and DEF respectively. The full lists of species are provided (Appendix Table 18). Fifty five bird species were only detected in the DEF such as Great Hornbill (GRHB), Brown Hornbill (BRHB), Banded Kingfisher (BDKF) and Greater Necklaced Laughingthrush (GNLT). Nineteen bird species were only dectected in ASA such as Ashy Woodswallow (ASWS), Spotted Dove (SPDO), Black-shouldered Kite (BSKI), and Pied Bushchat (PIBC).

The results indicated that the diversity index (*H'*) in each stratum ranged from 1.194 in the upper 25 m above the ground of ASA and 3.743 in the 5-10 m of DEF (Figure 15). The overall *H'* showed a high value in the middle strata, between the second stratrum (1-5 m) up to forth stratum (15-20). Nevertheless, the *H'* in the seventh stratrum (> 25 m) of ASA was the lowest but the *H'* in the first stratum (on the ground level) of DEF was lowest.

Comparisons of the *H'* in a same stratum between the ASA and the DEF sites indicated that the *H'* in the ASA tended to be lower than the *H'* in the DEF and was significantly lower ($P<0.05$) except at the ground level ($P>0.05$) (Figure 15).

The correlated changes of bird community and vegetation type were demonstrated by many studies in temperate and tropical forests. The bird diversity increases with the increasing complex of vertical stature and the forest types (Mac Arthur and MacAthur1961; Karr and Roth, 1971).

Based on the species diversity data, it was found that the ASA supports less species than the DEF. The general findings of this study reflected the same results those found elsewhere (Johns, 1986; Ohno and Ishida, 1997; Round and Brockelman, 1998). John (1989) suggested that undisturbed forest provided two most important factors concerning food supply and microclimate, particularly in the understorey for avifauna. Also, Welford (2000) indicated that the number of bird species recorded in each

successively older abandoned pasture is higher than the young abandoned field but only half of the number of species recorded in the undisturbed forest site was recorded in the most mature pasture. In shifting cultivation bird species richness, abundance and diversity, increased rapidly and asymptotically during succession stages and the vegetation recovery as shown by positive correlations with fallow age (Raman *et al*., 1998).

Based on the *H΄* of the vertical data, it was found that the middle strata of the tropical forest accommodate many more species than either of the ground or the top canopy. The result agrees with many previous studies (e.g.Pearson (1975), Manopawitr (2000) and Walter (2002)). Due to its complex three-dimentional environment of the middle canopy, it offers a much greater array of foraging substrates (Pearson, 1977 and Winkler and Preleuther, 2001). This study supported the fact that it had greater proportion of canopy species than other groups.

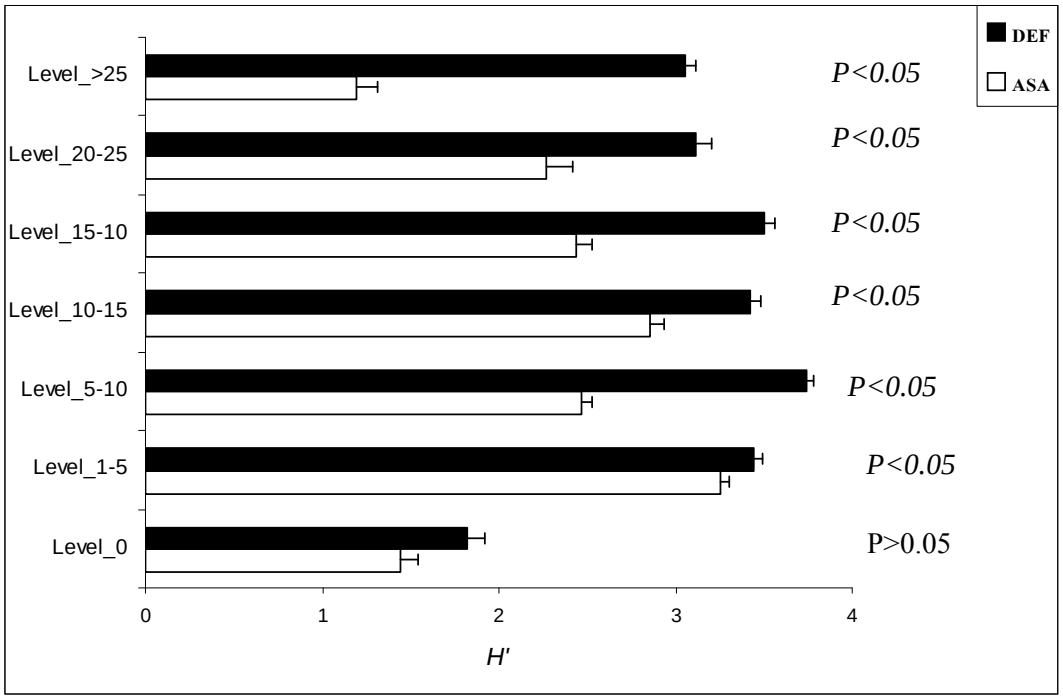


Figure 15 Vertical distribution of the Shanon-Wiener diversity index (± SD) in each levels between the abandoned settlement areas (ASA) and dry evergreen forest (DEF). The letter codes were explained in the text.

Similarity of the birds among vertical strata

The descriptive data on utilization the vertical stratum of each bird species in the two habitats were analysed using multivariate cluster analysis. In broad terms, the bird community in both ASA and DEF can be classified into three major groups: ground level group, lower canopy group (1-5 m in ASA and 1-15 m in DEF) and upper canopy group (5-25 m in ASA and 15-25 m in DEF) (See Figure 16 and Figure17). The ground level group was characterised by the birds that restricted to the ground level. For example, Barred Buttonquail (BRBT) was commoly found at the ground level of ASA and Red Junglefowl (RJFO) was commonly found only at the ground level of ASA and DEF (Appendix Table 18).

The lower canopy group of the ASA ranged from 1-5 m above the ground was used by Chestnut-capped Babbler (CCBB), Scaly-breasted Munia (SBMN), White-rumped Munia (WRNN), Dark-necked Tailorbird (DNTB), *etc*. In contrast, the lower canopy in the DEF ranged from 1-15 m above the ground was used by more diverse bird species composition. The upper canopy group of the ASA varied ranging from 5 m to >25 m above the ground had and more diverse bird species composition. In the upper canopy group of the DEF was ranged from 15 m to > 25 m above the ground and the common bird species were found i.e. sultan tit (STTI), oriental white-eye (OTWE), plain flowerpecker (PLFB) and wreathed hornbill (WTHB). (See Figure 16 and 17).

Bird community in vertical layers of both DEF and ASA were classified into three major groups: ground level group, lower canopy group and upper canopy group. Vertical segregation of bird species seemed to be more prominent in tropical zone; about 42% of the 182 species were restricted to the canopy (Winkler and Preleuther, 2001). Some feeding categories of Pearson's (1975) showed a clear vertical trend. Both insect and fruit feeding species were mainly observed on the ground level. Utilization of vertical strata was the primary factor separating major groups within the bird assemblage, and the use of different foraging sites was an important factor in finer scale of niche differentiation (Manoprawitr, 2000). Although many utilize the same vertical layer and site; however, they were ecologically separated by their morphology. The larger body and bill of Red Junglefowl

(RJFO) probably segreates them from the Barred Buttonquail (BRBT) on the ground of ASA by enabling them to take larger food. The result of this study showed that pattern of the vertical strata of bird assemblages was a significant factor to niche separation.

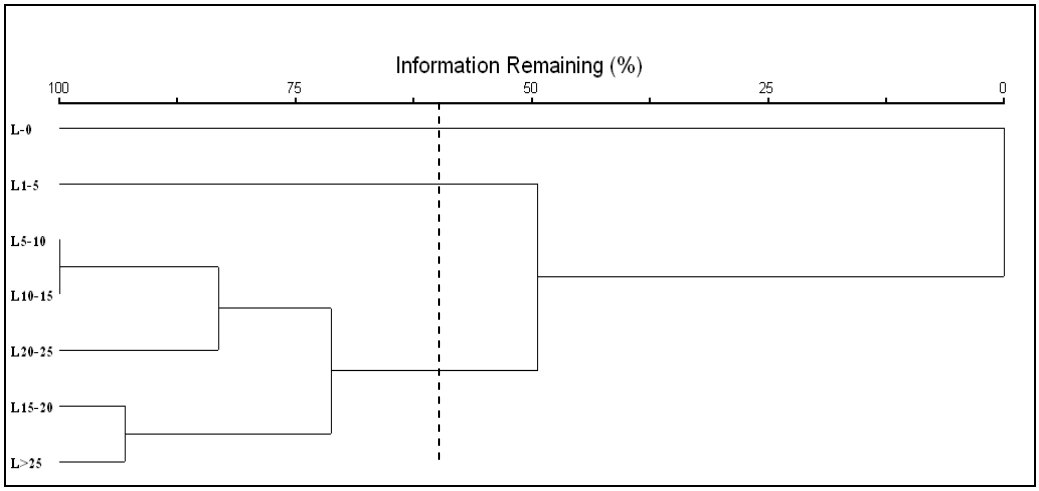


Figure 16 Cluster analysis illustrating the group of bird community of the 7 vertical strata in the abandoned settlement areas (ASA). The letter codes were explained in the text.

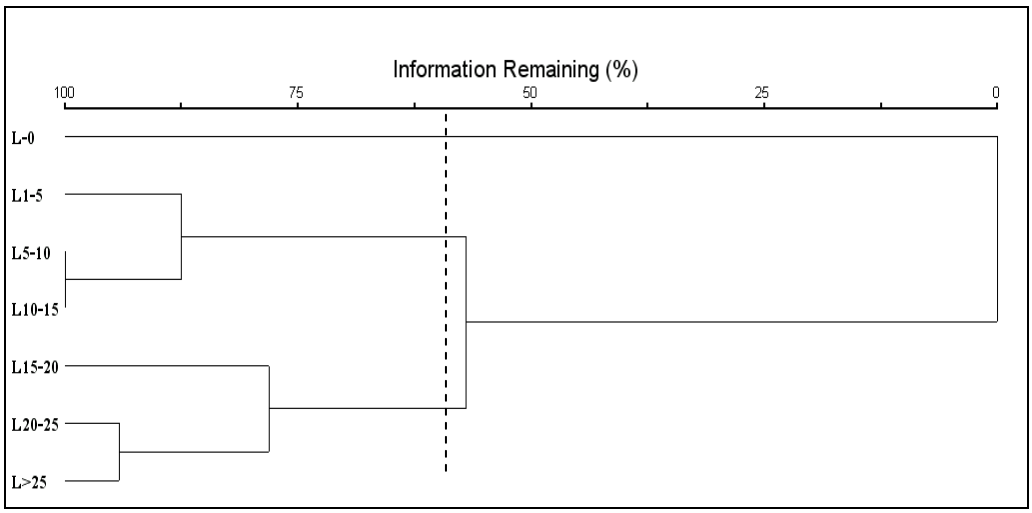


Figure 17 Cluster analysis illustrating the group of bird community of the 7 vertical strata in the dry evergreen forest (DEF). The letter codes were explained in the text.

Specialisation in vertical habitat

Using the number of strata that each species was detected and the relative amount of time in each stratum, the *H′* value was calculated. It described how diverse the feeding strategy of each species was and how evenly they distributed their foraging effort along the vertical strata. Essentially, the *H′* described the degree of specialization in foraging stategy and the habitat type for each species. The *H′* value of each bird species in both habitats were illustrated in Figure 18 and 19 (ASA and DEF respectively). There was a steady gradient from relative specialised species (low *H′* value) to relatively generalised species (high *H′* value). The higher standard deviation (SD) means the higher degree of gerneralisation in the vertical strata utilization. In general, more generalised species were found more than specialised species in this area. The chestnut-capped babbler (CCBB), rufescent prinia (RCPN), buff-breasted babbler (BBBB) and yellow-bellied prinia (YBPN) were the most specialised species and the scarlet minivet (SCMN), asian fairy bluebird (AFBL), mountain imperial pigeon (MIPG) and black-crested bulbul (BCBU) were the most generalised species in the ASA. The Common tailorbird (CMTB), rosy minivet (RSMV), rufous-throated partridge (RTPT) and Blyth's leaf warbler (BLWB) were the most specialised species and the great barbet (GRBA), greater racket-tailed drongo (GRDR), black bulbul (BLBU) and asian fairy bluebird (AFBL) were the most generalised species in the DEF. The ground-dwelling species were the only group that showed a higher degree of specialisation in their selection of vertical structure (see in Appendix Table 18). barred buttonquail (BRBT) was the most specialised species in the ASA and red junglefowl (RJFO) was the most specialised species in the ASA and DEF.

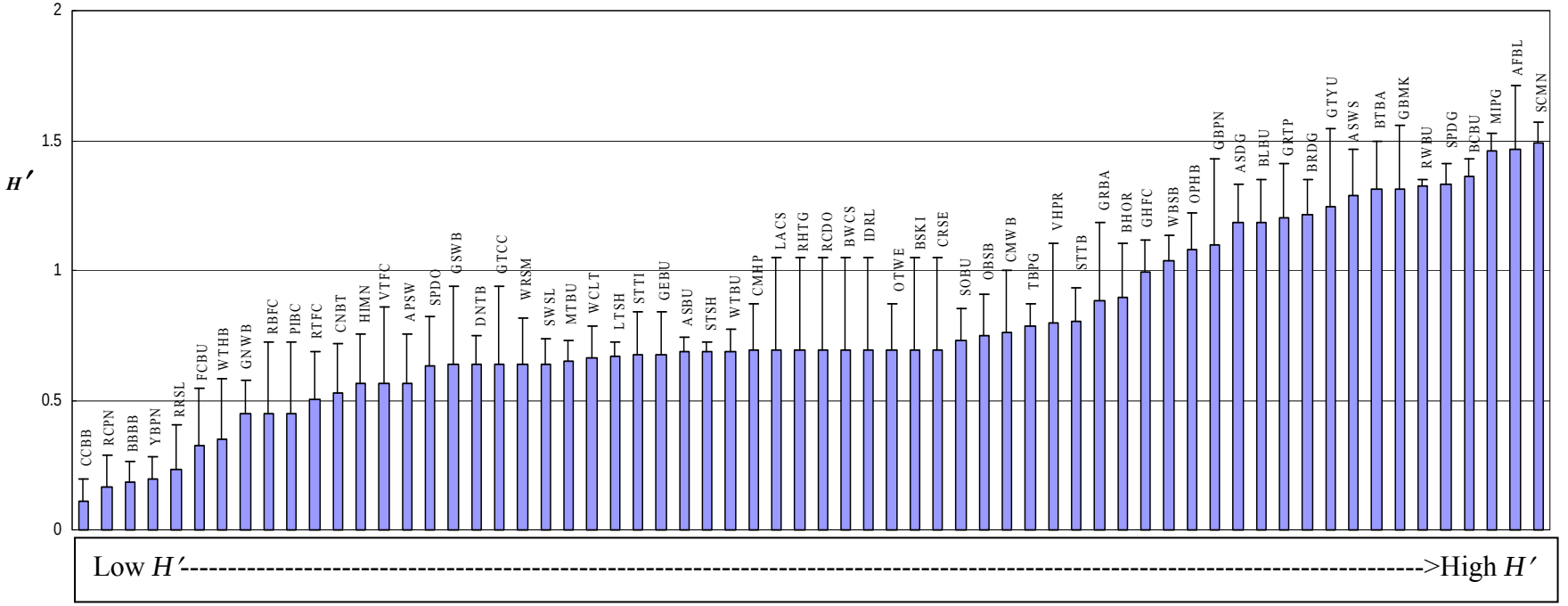


Figure 18 The Shanon-Wiener diversity index (*H′*) (± SD) of each bird species in the abandoned settlement area. (species abbreviation defined in Appendex Table 18); low *H′*= generalised species and high *H′*= specialised species

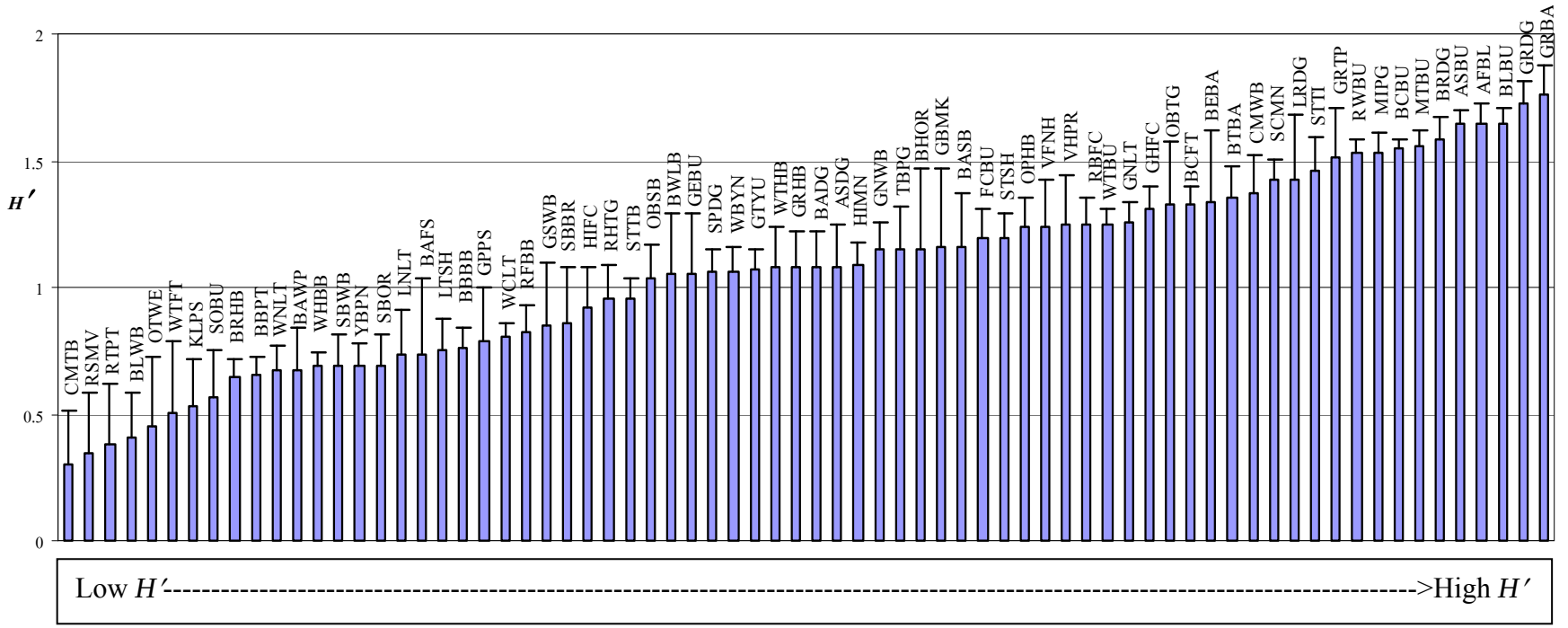


Figure 19 The Shanon-Wiener diversity index (H') ($\pm$ SD) of each bird species in the dry evergreen forest. (species abbreviation defined in Appendex Table 18); low H'= generalised species and high H'= specialised species

Vertical distribution of tropical birds appeared to be the most important factor in separating species into broad pattern (Pearson, 1977). Also Manoprawitr (2000) concluded that bird morphology and foraging modes appeared to be ecologically important in understanding the differential use of resources. The studies the foraging ecology of birds in lowland rainforest in North Queensland by (Manoprawitr, 2000) found that vertical distribution of birds played a crucial role in tropical ecosystems by dispersing seeds, pollinating flowers, and controlling insect populations. The previous studies provided a good example of how the understory community may not be a good representation of the local community as a whole.

This study provided vital information revealing patterns of assemblage structure and majors factors in maintanance of species diversity. Further research should focus on determining resource use pattern of these birds, and investigating the effect of forest fragmentation on their movements. The study demonstrated that the bird diversity clearly showed a recovery pattern after human resettlement. This study also suggested that limiting human disturbances as much as possible can allow create maximum avian diversity to recover.

Bird-habitat relationships

The relationship among bird communities and the set of vegetative characteristics was effectively identified using CCA . The analysis concerned only resident birds and selected seven habitat characteristics (Table 2). The concerning characteristics are :

1. Tree density (Tree_den)
2. Salping density (Salp_den)
3. Seedling density (Seed_den)
4. Density of tree with DBH < 55 cm (D < 55)
5. Density of tree with DBH > 55 cm (D > 55)
6. Density of tree with hight < 15 cm (H < 15)
7. Density of tree with hight > 15 cm (H < 55)

The CCA procedure procedure recommended three dimensions for the final solution.The percent of variance explained the by first, the second and third axes were 22.7 %, 16.2 %, and 14.8% respectively (Table 8). The results give signigficant of eigen value and species-environment collelations in the three axes (Monte Carlo test with 1000 random; $P<0.05$). Two 2-D plots represented by two of the axes with the hightest variance explained were graphed showing the study points for each habitat type (Figure 20) and the species points (Figure 21). The seven vegetation structural variables indicated that a complete set of environmental variables adequately explains the variation in species data (see Table 8 ; Figure 20 and 21). The determinants of the first axis are 6 variables having the highest (intraset) correlations, namely Tree_den, Seed_den, D < 55, D > 55, H < 15 and H < 55 (R= -0.828, -0.295, -0.796, -0.531, -0.833 and -0.686 respectively) (see Table 8). Only the salping density (Salp_den) showed a weak intraset correlations (R< 0.1) with both the first and the second ordination axes, thus they are excluded from the ordination diagram (Table 8). A gradient of increasing vegetation structural complexity is evident from right to left of the diagram.Thus the first axis indexed forest structural and floristic traits. The bird assemblages of the 6 - 10 years old in ASA (6_YEARS, 8_YEARS and 10_YEARS) appeared on the right of the first axis. They showed an opposite side from vegetation structural complexity, on the contrary, bird assemblages from DEF and 12 years old of ASA falled on the left which positively associated with increasing vegetation structural complexity. Bird communities were classified into two broad scales, along with first axis: (1) open- secondary or successional group (6_YEARS, 8_YEARS and 10_YEARS) was positively correlated with first axis and (2) mature forest group (DEF_6, DEF_8, DEF_12, 12_YEARS and DEF_10) was negatively correlated with first axis (Figure 20). The analyses on the relationship of 193 resident species with the habitat factors, the variation of species assemblages can be partitioned as show in Figure 20 and 21.

Table 8 Summary statistics showing the Eigenvalue, variance in species and Kendall correlation coefficient of bird communities and vegetation variables data represented by the final three axes of the CCA ordination and *P-value* from Monte Carol test with each axis.

	Axis 1	**Axis 2**	**Axis 3**
Eigenvalue	0.163	0.116	0.106
Variance in species data % of variance explained	22.7	16.2	14.8
Cumulative % explained	22.7	38.9	53.7
Kendall (Rank) Correlaton; Spp-Envt	1.000	1.000	1.000
***P-value* from Monte Carol test (n=1,000)**			
Eigenvalues	0.002	0.003	0.007
Species-environment correlations	0.019	0.012	0.005
Intraset correlations between the vegetation structural variables (*R*)			
Tree_den	-0.828	-0.429	-0.160
Sap_den	-0.028	-0.072	-0.660
Seed_den	-0.295	-0.428	-0.561
D<55	-0.796	-0.516	-0.173
D>55	-0.531	-0.453	-0.412
H<15	-0.833	-0.448	-0.146
H>15	-0.686	-0.375	-0.426

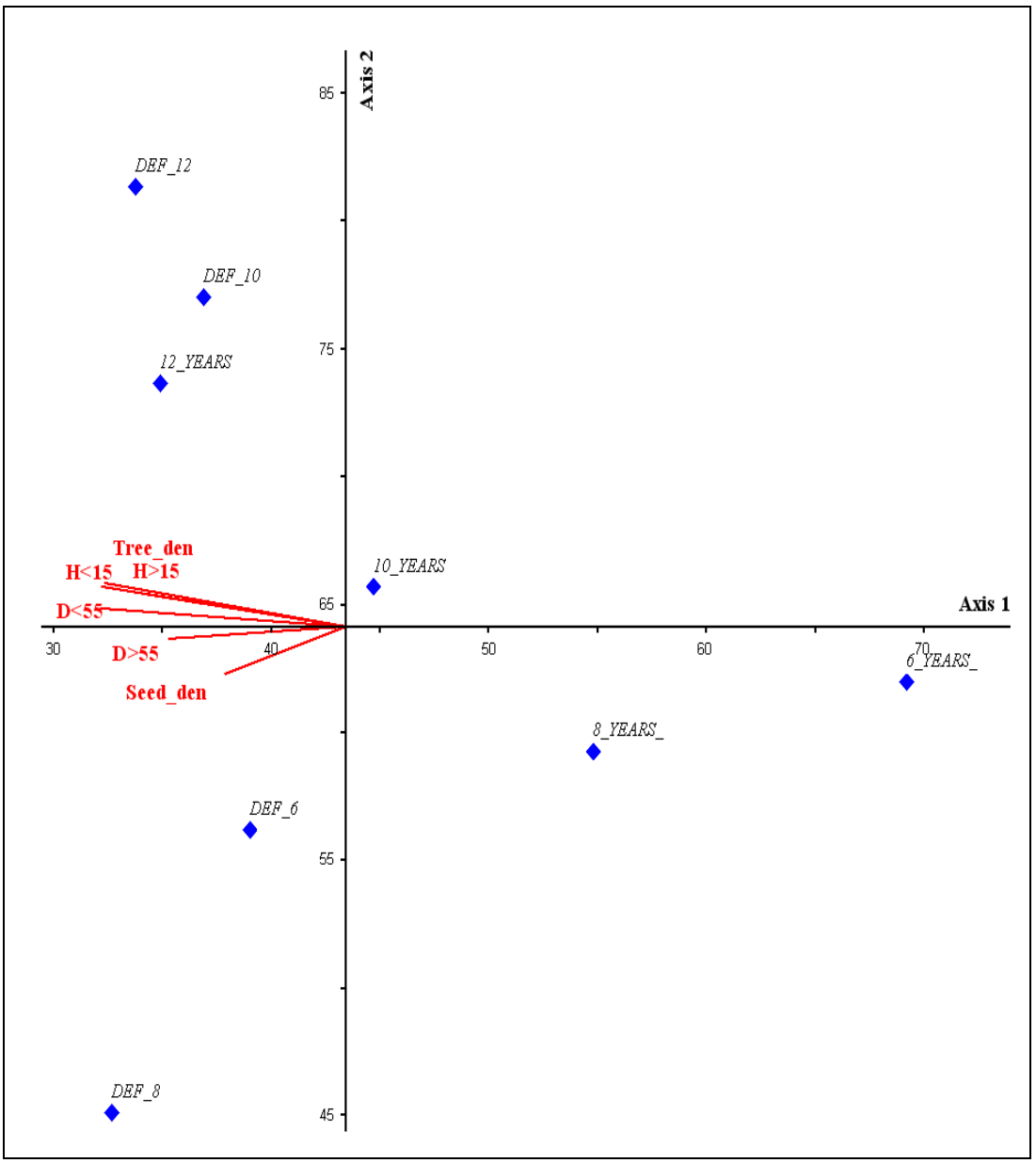


Figure 20 Ordination biplot depicting the first and third axes of the Canonical Correspondence Analysis of the species assemblages. Landscape metrics are represented by lines and their acronyms (see text).

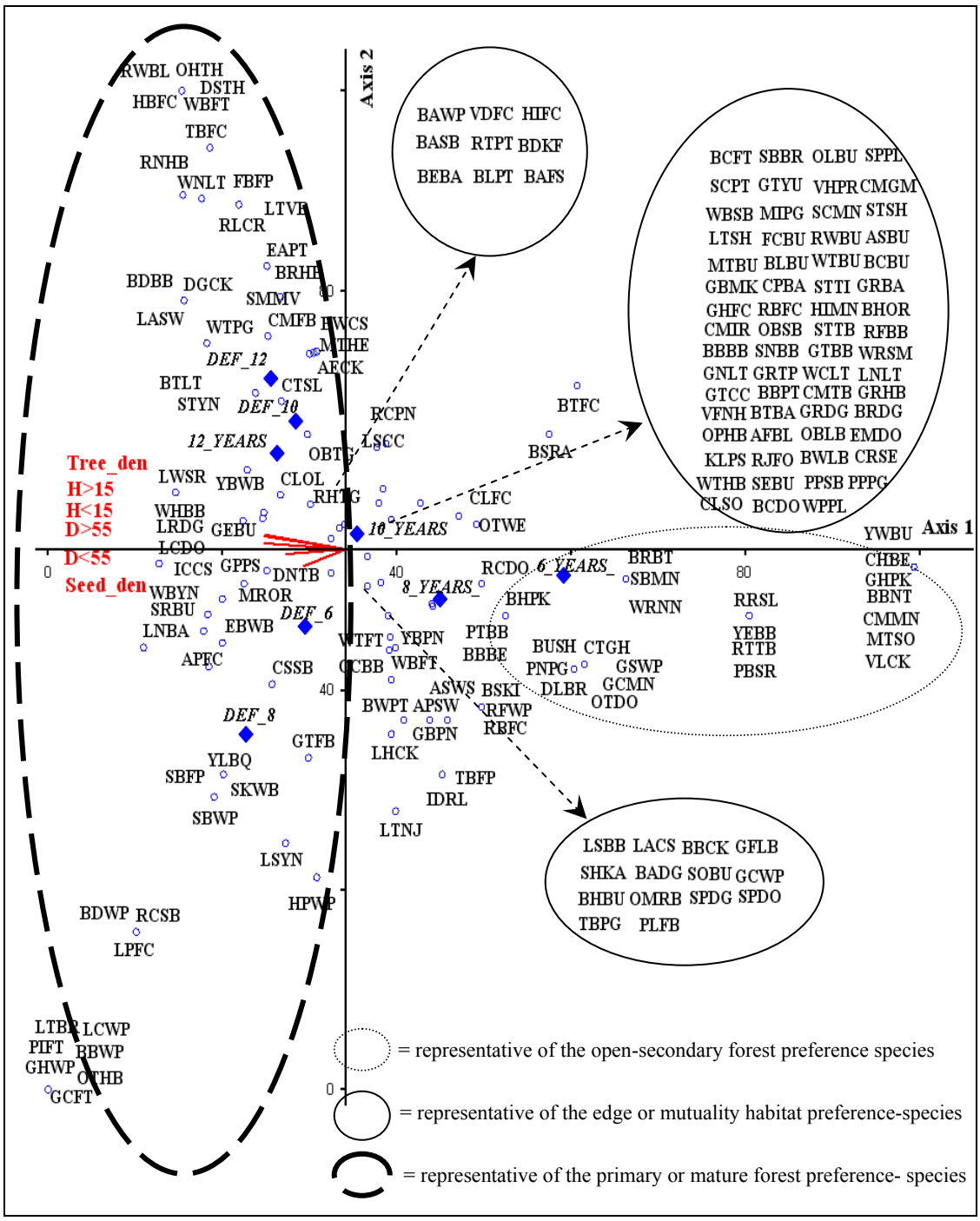


Figure 21 Ordination biplot depicting the first and third axes of the Canonical Correspondence Analysis of the species assemblages. Landscape metrics are represented by lines and their acronyms (see text), and species locations by their code, as indicated in Appendix Table 17.

1. Open-secondary forest preference -species had a positively correlation with the first axis which placed on the right side of the diagram. These species had high positively correlation , such species were (Figure 21); Yellow-vented Bulbul (YWBU), Chestnut-headed Bee-eater (CHBE), Grey-headed Parakeet (GHPK), Brown-backed Needletail (BBNT), Common Myna (CMMN), Mountain Scops Owl (MTSO) and Violet Cuckoo (VLCK).

2. Edge or mutuality habitat preference-species of the resident species had low correlation value with the first axis and it mostly appeared on the middle of the diagram. The species having nealy zero correlation were (Figure 21); Plain Flowerpecker (PLFB), Barred Cuckoo Dove (BCDO), Collared Scops Owl (CLSO), Pompadour Green Pigeon (PPPG), Streak-eared Bulbul (SEBU), Crimson Sunbird (CSSB) and Yellow-legged Buttonquail (YLBQ).

3. Primary or mature forest preference- resident species had negative correlation with the first axis and showed on the left of diagram. The species with high negative correlation were (Figure 21); Dark-sided Thrush (DSTH), Orange-headed Thrush OHTH, White-throated Fantail(WTFT), Hainan Blue Flycatcher(HBFC), Tickell's Blue Flycatcher (TBFC), Rufous-necked Hornbill(RNHB) and White-necked Laughingthrush (WNLT).

Even though each species, or group of species, had its own was of interaction with the forest succession according to the difference in habitat selection, foraging behavior, dietary adaptability or sensitivity to microclimatic conditions. The principle findings of this study are that ASA, 6-12 years old, have markedly different bird assemblages. Increasing in successional stage of the forest, bird species composition increase in similarity with primary forest. Successional changes leading to similarly of bird species composition in mature climax forest have been report from forests in tropical Asia (Johns, 1989; Raman *et al*., 1998; Raman, 2001; Raman and Sukumar, 2002).The present study is perhaps one of the first in Thailand including in the mainland of South East Asia that documents the patterns of changes in tropical forest

bird communities during the succession of abandoned settlement areas using a range of sites spanning early succession to old-growth stages. The rapid recovery of bird community attributes alongs with the increasing of age successional habitat, suggested that the bird community was tracking forest recovery. Evidence for the hypothesis that the forest bird community tracks the recovery of the recovery of forest vegetations found in the significant positive correlation between bird community attributes and CCA first axis, the vegetation component representing forest development and woody plant succession. The role of habitat attributes was also evident in the results that the similarity of bird community was directly related to their physiognomic and floristic structure. During succession, however, it is not only the habitat structural aspect that show rapid development-floristic changes also occur. The relative importance of floristic as against physiognomic changes in determining bird past studies (Rotenberry and Wiens, 1980). Besides several factors may contribute to the distribution and abundance of birds in disturbance forest *e. g.*, origin of floristic composition, intensity of disturbance and physic on site. My results indicated quantitatively that the greater of the structure and physiognomic of floristic similarity of sites with primary forest were found. The similarity in bird composition with primary forest became higher. This suggests that forest birds readily colonize habitats with structural and floristic characteristics approaching primary forest conditions to regain the predisturbance composition over time.

CONCLUSION AND RECOMMENDATION

1. The vegetation data from 100 X 100 m^2 sample plots in 4 undisturbed evergreen forest communities contained 280 plants species with 38,173 individual stems. For trees over 4.5 cm in diameter at breast height (dbh), there was 210 species with 3,957 individuals. The plant communities in the ASA still did not have the same composition as those in the primary forest (dry evergreen forest). Tree communities could be divided into three groups according to time since abandoned: undisturbed forest with old-growth succession, mid-succession (10-12 years old of ASA) and early- succession (6-8 years old of ASA). In this case, the process of forest succession should take longer than 12 years for reach to DEF.

2. Two hundred forty-five bird species were recorded during this study. They were composed of 52 migratory and 193 resident bird species from all seasons. These included 171, 132 and 200 species from 6-8 years old, 10-12 years old of ASA and DEF respectively. Across all transects, 20% of all migrant species (34 spp.) and 80% of all resident species (170 spp.) were detected in 6-8 years old of ASA, 24% of all migrant species (41 spp.) and 76% of all resident species (132 spp.) were detected in 10-12 years old of ASA and 20% of migrant species (39 spp.) and 80% of resident species (161 spp.) were found in DEF. The number of bird species in DEF was clearly higher than all ASA. The H' index in the DEF (4.274) was significantly higher ($P<0.05$) than in the 6-8 years old (3.726) and 10-12 years old (4.144) of ASA. The evenness and *H1* in the DEF were also higher than in the ASA.

3. Similarity index of bird species composition between DEF and ASA ranged from low similarity between undisturbed DEF and the 6 years abandoned site, but the increased for 8 and 10 years sites respectively. However, the similarity index in the same site showed high variation across the seasonal change, particulary in 12- years old site, the value ranged from 0.450 in rainy season to 0.651 in summer. The mean comparison of similarity index between 6- years old site were significantly lower than 8 and 10 years sites and 12- years old site was statistically significant . As the follow ages, the bird community convered

toward the primary forest bird community in an asymptotic fashion. The similarity index of bird community changed rapidly from the 6- years old to the 8- years old. There were significant positive relationship between *H′* and age since abandonment. It indicates that the diversity of bird population increase with an increasing of the diversity of plant community.

4. Bird communities could be divided into two groups between the undisturbed forest with 12 years old of ASA and 8-10 years old in successional stage of ASA.The main results indicated that bird community in small areas of ASA 12- years old had the same species composition as in undisturbed dry evergreen forest.

5. Twelve feeding guilds and the number of bird species in six guild groups were positively coordinated with successional age: aboreal frugivores, aboreal insectivore/frugivore, aboreal faunivore/frugivore, insectivore/nectarivore, terrestrial insectivore and terrestrial insectivore/frugivore. The others were negative correlation. Sallying insectivore guild, a group of swift and swallow bird, showed significantly negative correlation with successional age. The abundance of six guild groups were positive with successional age: *i.e.*, bark-gleaning insectivore, faunivore/frugivore, insectivore/frugivore and terrestrial insectivore/frugivore. Only the foliage-gleaning and terrestrial frugivore guilds had significantly negative correlation with successional age.

6. The bird diversity increased with the increasing complex of vertical stature and the forest types. It was found that a vertical stratum of the ASA supports less species than the DEF. Bird community in the vertical layers of both ASA and DEF can be classified into three major groups: ground level group, lower canopy group (1-5 m in ASA and 1-15 m in DEF) and upper canopy group (5-25 m in ASA and 15-25 m in DEF).

7. According to the relationship among resident bird communities and the set of vegetative characteristics, three groups were defined *i.e.*, open-secondary forest preference, edge or mutuality habitat preference and Primary or mature forest preference.

8. The study demonstrated that plant community and bird species had a clear recovery pattern in abandoned sites after removing human settlement. Recommendations are given such as limitation on human disturbances to allow a change for maximum avian diversity to recover. Effective management for maintaining habitat diversity should be implemented to the abandoned settlement sites in the protected area. Therefore, protected areas in Thaialnd still have both of 2 conditions; people who still live inside and free from human settlement. This knowledge can apply for management purposes, guidelines are proposed as follows:

For protected areas after removed people out already. The practically management should be consideration in to 2 main points *i.e.,* one-to speed up the recovery process of ecosystem, native tree must be planted in the abadoned settlement areas and two-for maintainable habitat diversity, the activities *i.e.,* controlled fire or selected cutting tree shoul be apply for the restrain or control of progress plant succession to primary forest.

For reach up the objective achievement in protected areas management, especially in wildlife sanctuaries still have people live inside, practically management should be implementation *i.e.,* limit human disturbances as much as possible, wildlife poaching and logging must be stopped. If it necessitate to protect a source of unique biodiversity, one of alternative ways, it shoud be resettlement out of protected areas.

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APPENDIX

Appendix Table 1 Relative density (RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the DEF plot at 12 years old site (DEF_12).

No.	Thai name	Species	RD	RF	RDo	IVI
1	พระเจ้าห้าพระองค์	*Dracontomelum dao* (Blanco) Merr. & Rolfe	0.180	0.258	28.356	28.793
2	กระลังตังช้าง	*Dendrocnide sinuata* (Bl.) Chew	12.029	7.603	1.483	21.115
3	ไคร้	*Glochidion* sp.	7.361	6.314	1.553	15.229
4	ขางปอย	*Alchonea rugosa* (Lour) M. - A.	8.348	3.608	1.109	13.066
5	-	*Litsea laeta*	5.117	4.768	1.978	11.863
6	เน่าใน	*Irex umbellulata* Loes	0.898	1.160	8.482	10.539
7	ไทรใบเล็ก	*Ficus* sp.	0.180	0.258	8.711	9.149
8	กำย	*Polyalthia parviflora*	3.591	3.995	0.608	8.194
9	มะซัก	*Sapindus emarginatus* Wall.	1.706	2.191	3.632	7.528
10	ขมินต้น	*Alseodaphne* sp.	1.885	1.804	3.383	7.072
11	สอยดาว	*Mallotus paniculatus* Muell. Arg	3.052	2.835	0.399	6.286
12	ปออีเก้ง	*Pterocymbium javanicum* R. Br.	1.167	1.546	3.286	5.999
13	หน่วยนกงุม	*Beilschmiedia gammieana* King ex Hook. f.	1.975	2.706	1.130	5.811
14	สะทิบ	*Phoebe paniculata* Nees	2.244	2.577	0.986	5.807
15	ขีหนอนคาย	*Celtis tetrandra* Roxb.	1.706	2.320	1.765	5.790
16	ตะพุนเผ่า	*Vitex quinata* Williams var. puberula Mold	0.808	1.031	3.848	5.686
17	ลำไยป่า	*Paranephelium longifoliolatum* Lec.	1.975	2.320	0.981	5.276
18	พริกไทดง	*Aporusa planchoniana* Paill. ex Muell.	2.873	2.062	0.252	5.186
19	ลำป้าง	*Pterospermum diversifolium* bl.	0.718	0.902	2.811	4.432
20	มณฑาดอย	*Talauma hodgsonii* Hook. f. & Thoms.	1.526	1.546	1.261	4.333
21	ยางน่อง	*Antiaris toxicaria* Lesch.	1.346	1.933	0.800	4.079
22	เต้าเลือม	*Macaranga indiaca* Wight	1.795	1.804	0.356	3.956
23	ตาเสือขาว	*Dysoxylum cyrfobotryum* Miq.	0.808	1.031	2.084	3.923
24	จันดง	*Diospyros dasyphylla* Kurz	1.706	1.933	0.207	3.845
25	มะไฟลิง	*Baccaurea kunstleri* King ex Gage	0.987	1.289	1.491	3.767
26	ปอตองแตบ	*Macaranga denticulata* Muell. Arg.	1.257	1.418	0.748	3.423
27	สมอพิเภก	*Terminalia bellerica* Roxb.	0.269	0.387	2.364	3.020
28	หว้าหิน	*Eugenia* sp.	0.898	1.289	0.808	2.995
29	ก่อนำ	*Lithocarpus annamensis* A. Camus	0.718	0.515	1.752	2.985
30	หนวดปลาหมึกเขา	*Schefflera* sp.	1.346	1.160	0.282	2.788
31	ผาแป้ง	*Solanum erianthum* D. Don	1.526	1.031	0.204	2.761
32	สังหยู	*Polyalthia* sp.	0.808	1.160	0.642	2.609
33	สำเภา	*Chaetocarpus castanocarpus* Thw.	0.987	1.160	0.375	2.522
34	ยางบง	*Persea kurzii* Kosterm.	0.987	1.289	0.101	2.377
35	หางหนู	*Diospyros* sp.	0.898	1.289	0.150	2.336
36	เขยตาย	*Glycosmis pentaphylla* Corr.	0.898	1.289	0.080	2.266
37	เหมือดจี้ดง	*Memecylon* sp.	0.898	1.160	0.141	2.199
38	คำแสด	*Mallotus philippensis* (Lam.) Muell. Arg.	0.628	0.902	0.667	2.198
39	มือพระนารายณ์	*Shefflera* sp.	0.987	1.031	0.109	2.128
40	หมักฟักดง	*Apodytes* sp.	0.628	0.773	0.468	1.869
	etc.		20.287	24.356	10.156	54.799
	Total		100.000	100.000	100.000	300.000

Appendix Table 2 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the DEF plot at 10 years old site (DEF_10).

No.	Thai name	Species	RD	RF	RDo	IVI
1	นางเลว	*Cyathocalys martabanicus* Hook. f. Th.	12.184	8.612	4.950	25.746
2	ไทรใบใหญ่	*Ficus* sp.	0.843	0.239	22.281	23.364
3	ตาเสือขาว	*Dysoxylum cyrfobotryum* Miq.	5.998	5.144	6.368	17.510
4	เหมือดจี้ดง	*Memecylon* sp.	7.404	6.100	2.225	15.729
5	มะป่วน	*Alphonsea* sp.	3.655	4.187	6.131	13.973
6	ก่อเดือย	*Castanopsis acuminatissima* Rehd.	0.937	1.077	8.382	10.396
7	มะค้งดง	*Ostodes paniculata* Blume	4.217	2.751	2.051	9.020
8	คอแลน	*Nephelium hypoleucum* Kurz	3.655	3.708	1.433	8.796
9	ยมหอม	*Toona ciliata* M. Roem.	1.312	1.675	5.076	8.062
10	ลำไยป่า	*Paranephelium longifoliolatum* Lec.	2.530	2.751	2.292	7.574
11	กระเบาน้ำ	*Hydnocarpus kurzii* (King) Warb.	2.062	2.153	2.895	7.110
12	เขยตาย	*Glycosmis pentaphylla* Corr.	3.374	3.110	0.374	6.858
13	ตันหมี	*Horsfieldia wallchii* Warb.	2.249	2.512	1.551	6.312
14	ขี้หนอนคาย	*Celtis tetrandra* Roxb.	1.406	1.675	1.975	5.055
15	เข็มดอกขาว	*Ixora ebarbata* Craib	2.249	2.392	0.203	4.845
16	ก่าย	*Polyalthia parviflora*	2.156	2.033	0.306	4.495
17	สะทิบ	*Phoebe paniculata* Nees	1.781	2.153	0.503	4.436
18	จันทร์ชะมด	*Aglaia pyramidata* Hance	1.968	1.914	0.533	4.415
19	หน่วยนกงุม	*Beilschmiedia gammieana* King ex Hook. f.	1.781	1.794	0.671	4.246
20	กระอวม	*Aronychia pedunculata* Miq.	1.687	2.033	0.514	4.235
21	ไคร้	*Glochidion* sp.	1.874	2.033	0.162	4.070
22	นวล	*Garcinia merguensis* Wight	1.312	1.435	0.757	3.504
23	ตาเสือ	*Aphanamixis polystachya* Parker	0.843	0.598	1.978	3.420
24	ชมพู่น้ำ	*Eugenia siamensis* Craib	1.406	1.675	0.280	3.360
25	กล้วย	*Polyalthia lateriflora* (Dl.) King	1.312	1.675	0.274	3.261
26	รัก	*Melanochyla bracteata* King	1.031	0.837	1.203	3.072
27	เข็มใหญ่	*Timonius flavescens* (Jack) Bak.	0.843	0.837	1.232	2.913
28	ผักหวาน	*Meliantha suavis* Pierre	1.312	1.316	0.247	2.875
29	ยมหิน	*Chukrasia velutina* Wight & Arn.	0.750	0.837	1.232	2.819
30	หว้าขี้นก	*Eugenia* sp.	1.125	1.316	0.360	2.800
31	พญารากดำ	*Diospyros rubra* Lec.	1.031	1.316	0.294	2.641
32	หว้าหิน	*Eugenia* sp.	0.656	0.718	1.209	2.582
33	อบเชย	*Cinnamomum iners* Bl.	0.937	1.196	0.446	2.579
34	ยางน่อง	*Antiaris toxicaria* Lesch.	0.843	0.957	0.723	2.524
35	สีเสื้อ	*Casaeria fletuosa* Craib	1.031	1.077	0.306	2.413
36	เข็มจันทนา	*Tarena hoaensis* Pitard	1.031	1.196	0.181	2.408
37	ลำป้าง	*Pterospermum diversifolium* bl.	0.375	0.359	1.545	2.279
38	สะตอป่า	*Parkia leiophylla* Kurz	0.281	0.359	1.366	2.006
39	ส้านใหญ่	*Dillenia obovata* (Bl.) Hoogl.	0.187	0.239	1.395	1.822
40	เม่าดง	*Antidesma bunius* (L.) Spreng.	0.375	0.478	0.967	1.820
	etc.		17.994	21.531	13.128	52.654
	Total		100.000	100.000	100.000	300.000

Appendix Table 3 Relative density (RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the DEF plot at 8 years old site (DEF_8).

No.	Thai name	Species	RD	RF	RDo	IVI
1	สะทิบ	*Phoebe paniculata* Nees	3.962	4.186	10.513	18.660
2	ลำไยป่า	*Paranephelium longifoliolatum* Lec.	5.402	5.271	5.121	15.795
3	ยมหิน	*Chukrasia velutina* Wight & Arn.	3.721	3.256	6.475	13.453
4	ขมิ้นต้น	*Alseodaphne* sp.	1.921	1.705	9.577	13.203
5	พังแหร	*Trema angustifolia* Bl.	4.442	3.876	3.793	12.110
6	ขี้หนอนคาย	*Celtis tetrandra* Roxb.	3.241	3.411	5.374	12.026
7	ตาเสือ	*Aphanamixis polystachya* Parker	1.441	1.860	7.432	10.733
8	ไทรใบเล็ก	*Ficus* sp.	0.120	0.155	9.299	9.574
9	หงอนไก่ดง	*Harpullia cupanoides* Roxb.	3.721	3.411	2.219	9.351
10	มะคังดง	*Ostodes paniculata* Blume	3.361	2.481	2.192	8.034
11	ขางปอย	*Alchonea rugosa* (Lour) M. - A.	4.562	2.016	1.056	7.633
12	ก๋าย	*Polyalthia parviflora*	3.121	3.411	0.700	7.232
13	ตะพุนเฒ่า	*Vitex quinata* Williams var. puberula Mold	2.881	2.946	1.200	7.027
14	โพหน่วย	*Litsea* sp.	0.600	0.775	4.707	6.082
15	-	*Trema* sp.	2.761	2.326	0.368	5.455
16	นางเลว	*Cyathocalys martabanicus* Hook. f. Th.	2.281	2.481	0.318	5.079
17	หมักฟักดง	*Apodytes* sp.	1.681	2.016	1.357	5.054
18	มือพระนารายณ์	*Shefflera* sp.	1.921	2.016	0.549	4.485
19	เทพทาโร	*cinnamomum porrectum* (Roxb.)	1.321	0.775	2.027	4.123
20	ปอแตง	*Colona* sp.	2.041	1.705	0.250	3.996
21	ลอขน	*Mallotus barbatus* Muell. Arg.	1.921	1.705	0.320	3.946
22	เหมือดจีดง	*Memecylon* sp.	1.561	1.705	0.344	3.610
23	ก่วมขาว	*Acer oblongum* Wall. ex DC.	0.360	0.465	2.572	3.398
24	พังแหรใหญ่	*Trema orientalis* (Linn.) Bl.	1.801	1.240	0.278	3.319
25	กระลังตังช้าง	*Dendrocnide sinuata* (Bl.) Chew	1.441	1.395	0.318	3.153
26	กอมขม	*Picrasma javanica* Bl.	1.441	1.395	0.135	2.971
27	หมากขี้อ้าย	*Cryptocarya pallens* Kosterm	0.240	0.310	2.221	2.771
28	ยมหอม	*Toona ciliata* M. Roem.	1.200	1.085	0.435	2.720
29	ก่อนำ	*Lithocarpus annamensis* A. Camus	0.840	0.930	0.866	2.637
30	ยมป่า	*Ailanthus triphysa* Alston	0.360	0.465	1.639	2.465
31	คอแลน	*Nephelium hypoleucum* Kurz	0.960	1.240	0.106	2.307
32	มะไฟลิง	*Baccaurea kunstleri* King ex Gage	0.960	0.930	0.357	2.248
33	ตะครำ	*Garuga pinnata* Roxb.	0.840	1.085	0.320	2.245
34	พระเจ้าร้อยท่า	*Heteropanax fragrans* Seem.	1.080	0.930	0.203	2.214
35	อบเชย	*Cinnamomum iners* Bl.	0.960	1.085	0.067	2.113
36	ค่าหด	*Engelhardtia spicata* Bl.	0.120	0.155	1.805	2.080
37	ปอเกล็ดแรด	*Sterculia macrophylla* Vent.	0.960	0.930	0.116	2.007
38	หว้าขีนก	*Eugenia* sp.	0.600	0.775	0.584	1.960
39	สังเครียดก้อง	*Aglaia* sp.	0.600	0.775	0.385	1.761
40	ผาแป้ง	*Solanum erianthum* D. Don	0.720	0.930	0.110	1.760
	etc.		26.531	30.388	12.293	69.211
	Total		100.000	100.000	100.000	300.000

Appendix Table 4 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the DEF plot at 6 years old site (DEF_6).

No.	Thai name	Species	RD	RF	RDo	IVI
1	ก๋าย	*Polyalthia parviflora*	16.543	10.437	6.209	33.189
2	ลำไยป่า	*Paranephelium longifoliolatum* Lec.	4.772	5.078	9.357	19.207
3	เหมือดจีดง	*Memecylon* sp.	8.696	7.475	1.950	18.121
4	ไทรใบใหญ่	*Ficus* sp.	0.742	0.141	12.197	13.080
5	กระหนานปลิง	*Pterospermum littorale* Craib	2.863	3.526	6.587	12.976
6	ตะพุนเฒ่า	*Vitex quinata* Williams var. puberula Mold	1.591	1.975	6.509	10.074
7	หงอนไก่ดง	*Harpullia cupanoides* Roxb.	2.545	2.680	3.943	9.168
8	กระลังตังช้าง	*Dendrocnide sinuata* (Bl.) Chew	4.772	3.103	1.093	8.968
9	ขี้หนอนคาย	*Celtis tetrandra* Roxb.	2.545	3.103	2.995	8.643
10	มะไฟลิง	*Baccaurea kunstleri* King ex Gage	2.121	2.680	2.748	7.549
11	หว้าขี้นก	*Eugenia* sp.	2.439	2.821	1.862	7.121
12	ยมหอม	*Toona ciliata* M. Roem.	2.227	2.821	1.723	6.771
13	สอยดาว	*Mallotus paniculatus* Muell. Arg	3.075	2.539	0.969	6.583
14	มะดูก	*Siphonodon celasterineus* Griff	2.227	2.539	1.412	6.177
15	ยมหิน	*Chukrasia velutina* Wight & Arn.	1.166	1.128	3.082	5.377
16	อบเชยใบมน	*Neolitsea* sp.	1.697	0.846	2.793	5.336
17	-	*Capparis kerrii*	1.803	1.834	0.989	4.625
18	ผาแป้ง	*Solanum erianthum* D. Don	2.227	1.834	0.250	4.310
19	มะคังดง	*Ostodes paniculata* Blume	0.954	1.269	1.381	3.605
20	เต้าหลวง	*Macaranga gigantea* Muell. Arg.	1.485	1.693	0.417	3.594
21	สังหยู	*Polyalthia* sp.	1.485	1.693	0.391	3.568
22	อบเชย	*Cinnamomum iners* Bl.	0.848	1.128	1.568	3.545
23	พันจำ	*Vatica odorata* Syming	1.060	1.269	0.837	3.167
24	นางเลว	*Cyathocalys martabanicus* Hook. f. Th.	1.166	1.410	0.421	2.998
25	กอมขม	*Picrasma javanica* Bl.	1.273	1.269	0.424	2.966
26	มะป่วน	*Alphonsea* sp.	0.318	0.282	2.067	2.667
27	มะกอก	*Spondias pinnata* (Linn. f.) Kurz	0.424	0.564	1.656	2.644
28	ประดงเลือด	*Linociera* sp.	1.166	1.269	0.126	2.562
29	กระอวม	*Aronychia pedunculata* Miq.	0.742	0.846	0.824	2.412
30	ปรู๋	*Alangium salvifolium* Wang.	0.848	1.128	0.429	2.405
31	หางหนู	*Diospyros* sp.	0.848	1.128	0.348	2.325
32	เติม	*Bischofia javanica* Bl.	0.212	0.282	1.726	2.220
33	ลอขน	*Mallotus barbatus* Muell. Arg.	0.954	0.987	0.190	2.131
34	พลองขี้ควาย	*Menecylon caeruleum* Jack	1.060	0.846	0.202	2.109
35	พระเจ้าห้าพระองค์	*Dracontomelum dao* (Blanco) Merr. & Rolfe	0.106	0.141	1.822	2.069
36	-	*Litsea verticillata*	0.742	0.987	0.074	1.804
37	เม่าดง	*Antidesma bunius* (L.) Spreng.	0.424	0.564	0.796	1.784
38	ยางบง	*Persea kurzii* Kosterm.	0.318	0.423	0.958	1.699
39	ซ้อ	*Gmelina arborea* Roxb.	0.212	0.282	1.146	1.640
40	จันดง	*Diospyros dasyphylla* Kurz	0.530	0.705	0.373	1.609
	etc.		18.770	23.272	15.159	57.201
	Total		100.000	100.000	100.000	300.000

Appendix Table 5 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the ASA plot at 12 year old site (12year_1).

No.	Thai name	Species	RD	RF	RDo	IVI
1	ปอกะสา	*Broussonetia papyrifera* Vent.	29.574	22.490	35.287	87.352
2	เต้าเลื่อม	*Macaranga indiaca* Wight	7.234	9.639	17.171	34.043
3	พังแหร	*Trema angustifolia* Bl.	5.106	4.819	7.347	17.272
4	ปอยาบ	*Colona flagrocarpa* (Clarke) Craib.	6.170	5.622	3.672	15.465
5	มะฝ่อ	*Trevia nudiflora* Linn.	6.383	5.622	2.913	14.918
6	ขีเหล็กเลือด	*Cassia fimoriensis* Dc.	3.191	4.819	2.779	10.790
7	มะซัก	*Sapindus emarginatus* Wall.	4.255	4.819	1.705	10.780
8	มะม่วง	*Mangifera indica* Linn.	1.064	0.803	8.393	10.260
9	ส้มปอย	*Acacia concinna* (Willd.) DC.	3.830	4.418	1.224	9.472
10	มะเยา	*Jatropha curcas* Linn.	4.894	1.606	1.711	8.211
11	ซ้อ	*Gmelina arborea* Roxb.	2.340	3.614	1.391	7.346
12	ผาแป้ง	*Solanum erianthum* D. Don	2.340	3.213	0.958	6.511
13	ปรู๋	*Alangium salvifolium* Wang.	2.128	2.410	0.490	5.027
14	ฝรั่ง	*Psidium guajava* Linn.	1.702	1.606	1.571	4.880
15	นางแย้มป่า	*Clerodendrum viscosum* Vent.	1.702	2.410	0.579	4.691
16	ไข่ปลา	*Debregeasia* sp.	1.702	0.803	2.021	4.527
17	โคลงเคลง	*Melastoma villosum* Lodd.	2.128	1.606	0.591	4.325
18	กำลังเสือโคร่ง	*Zizyphus attopoensis* Pierre	1.702	1.606	0.799	4.108
19	ลำป้าง	*Pterospermum diversifolium* bl.	1.489	1.606	0.415	3.511
20	เสลาเปลือกหนา	*Lagerstroemia tomentosa* Presl	0.851	0.803	1.084	2.738
21	มันปู	*Glochidion wallichianum* Muell. Arg.	1.277	0.402	0.763	2.442
22	พลับพลา	*Microcos piniculata* Linn	0.426	0.803	0.921	2.150
23	โพหน่วย	*Litsea* sp.	0.426	0.803	0.912	2.141
24	หนามคนทา	*harrisonia perforata* (Blanco) Merr.	0.638	1.205	0.154	1.997
25	ยมหิน	*Chukrasia velutina* Wight & Arn.	0.426	0.803	0.673	1.902
26	ยางบง	*Persea kurzii* Kosterm.	0.638	0.803	0.365	1.807
27	พังแหรใหญ่	*Trema orientalis* (Linn.) Bl.	0.426	0.803	0.418	1.647
28	ตะพุนแม่า	*Vitex quinata* Williams var. puberula Mold	0.426	0.803	0.377	1.606
29	เพกา	*Oroxylum indicum* (L.) Vent.	0.638	0.402	0.436	1.476
30	สะทิบ	*Phoebe paniculata* Nees	0.426	0.803	0.182	1.411
31	กระลังตังช้าง	*Dendrocnide sinuata* (Bl.) Chew	0.426	0.803	0.166	1.395
32	มณฑาดอย	*Talauma hodgsonii* Hook. f. & Thoms.	0.213	0.402	0.767	1.381
33	สะตอป่า	*Parkia leiophylla* Kurz	0.426	0.803	0.100	1.328
34	ฉนวน	*Dalbergia nigrescens* Kurz	0.426	0.402	0.127	0.954
35	เหมือดคนดง	*Helicia* sp.	0.213	0.402	0.292	0.906
36	ทองหลางป่า	*Erythriha subumbrans* Merr.	0.213	0.402	0.247	0.861
37	สังเครียดก้อง	*Aglaia* sp.	0.213	0.402	0.239	0.854
38	เม่าดง	*Antidesma bunius* (L.) Spreng.	0.213	0.402	0.188	0.803
39	แดงน่า	*Glochidion* sp.	0.213	0.402	0.088	0.702
40	มะหลอด	*Elaeagnus latifolia* Linn.	0.213	0.402	0.088	0.702
	etc.		1.702	3.213	0.395	5.310
	Total		100.000	100.000	100.000	300.000

Appendix Table 6 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the ASA plot at 12 year old site (12year_2).

No.	Thai name	Species	RD	RF	RDo	IVI
1	เต้าเลื่อม	*Macaranga indiaca* Wight	15.348	12.556	21.620	49.524
2	ปอกะสา	*Broussonetia papyrifera* Vent.	12.230	11.211	19.733	43.174
3	พังแหร	*Trema angustifolia* Bl.	3.597	4.036	17.324	24.957
4	ปอยาบ	*Colona flagrocarpa* (Clarke) Craib.	8.393	9.417	3.287	21.097
5	มะเดือปล้อง	*Ficus hispida* Linn. f.	7.674	5.830	7.096	20.600
6	กำลังเสือโคร่ง	*Zizyphus attopoensis* Pierre	7.194	6.278	6.782	20.254
7	ปรู๋	*Alangium salvifolium* Wang.	8.873	6.726	2.007	17.607
8	ฝรั่ง	*Psidium guajava* Linn.	7.194	5.830	3.103	16.127
9	มะซัก	*Sapindus emarginatus* Wall.	3.837	5.381	1.174	10.392
10	มะฝ่อ	*Trevia nudiflora* Linn.	2.878	4.036	1.284	8.198
11	ขี้เหล็กเลือด	*Cassia fimoriensis* Dc.	2.158	3.139	1.244	6.541
12	นางแย้มป่า	*Clerodendrum viscosum* Vent.	2.398	2.691	0.646	5.735
13	ส้มโอ	*Citrus maxima* (Burm. f.) Merr.	1.918	0.897	1.707	4.522
14	ทองหลางป่า	*Erythriha subumbrans* Merr.	0.719	1.345	1.631	3.695
15	สะทิบ	*Phoebe paniculata* Nees	1.199	2.242	0.164	3.605
16	โคลงเคลง	*Melastoma villosum* Lodd.	1.679	1.345	0.238	3.262
17	สอยดาว	*Mallotus paniculatus* Muell. Arg	0.959	1.345	0.548	2.852
18	ส้มป่อย	*Acacia concinna* (Willd.) DC.	1.199	1.345	0.182	2.726
19	ยมหอม	*Toona ciliata* M. Roem.	0.480	0.897	1.323	2.700
20	ผาแป้ง	*Solanum erianthum* D. Don	0.719	1.345	0.629	2.694
21	ดีคน	*Micromelum* sp.	1.918	0.448	0.310	2.677
22	ตะพุนเผ่า	*Vitex quinata* Williams var. puberula Mold	0.959	1.345	0.343	2.648
23	เสลาเปลือกหนา	*Lagerstroemia tomentosa* Presl	0.240	0.448	1.827	2.516
24	ขางน้ำผึ้ง	*Claoxylon* sp.	0.719	1.345	0.202	2.267
25	มะเฒียงน้ำ	*Aesculus assamica* Griff.	0.719	0.897	0.514	2.130
26	มะหวด	*Lepisanthes rubiginosa* (Roxb.) Leenh.	0.480	0.897	0.546	1.923
27	ยางน่อง	*Antiaris toxicaria* Lesch.	0.240	0.448	1.089	1.778
28	เติม	*Bischofia javanica* Bl.	0.240	0.448	0.931	1.620
29	มะหาด	*Artocarpus lakoocha* Roxb.	0.719	0.448	0.449	1.617
30	ยมหิน	*Chukrasia velutina* Wight & Arn.	0.240	0.448	0.507	1.195
31	สะตอป่า	*Parkia leiophylla* Kurz	0.240	0.448	0.342	1.031
32	คันแหลน	*Psydrax nitidum* (Craib) Wang	0.240	0.448	0.327	1.015
33	ก่วมขาว	*Acer oblongum* Wall. ex DC.	0.480	0.448	0.071	0.999
34	ลำพูป่า	*Duabanga grandiflora* (Roxb. ex DC.) Walp.	0.240	0.448	0.281	0.970
35	พลับพลา	*Microcos piniculata* Linn	0.240	0.448	0.210	0.899
36	ปอเกล็ดแรด	*Sterculia macrophylla* Vent.	0.240	0.448	0.095	0.783
37	หมักฟักดง	*Apodytes* sp.	0.240	0.448	0.085	0.773
38	ยางบง	*Persea kurzii* Kosterm.	0.240	0.448	0.054	0.742
39	สังเครียดก้อง	*Aglaia* sp.	0.240	0.448	0.039	0.728
40	มะกอกพราน	*Turpinia pomifera* DC.	0.240	0.448	0.028	0.716
	etc.		0.240	0.448	0.027	0.715
	Total		100.000	100.000	100.000	300.000

Appendix Table 7 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the ASA plot at 12 year old site (12year_3).

No.	Thai name	Species	RD	RF	RDo	IVI
1	โพหน่วย	*Litsea* sp.	13.843	12.931	10.681	37.455
2	ปอกะสา	*Broussonetia papyrifera* Vent.	9.917	12.500	6.392	28.809
3	ขีเหล็กเลือด	*Cassia fimoriensis* Dc.	9.917	6.034	12.378	28.330
4	พังแหร	*Trema angustifolia* Bl.	6.612	3.448	17.833	27.893
5	สะทิบ	*Phoebe paniculata* Nees	2.273	2.586	20.440	25.299
6	โคลงเคลง	*Melastoma villosum* Lodd.	10.331	9.914	2.222	22.466
7	มะฝ่อ	*Trevia nudiflora* Linn.	5.579	7.759	2.870	16.207
8	เต้าเลื่อม	*Macaranga indiaca* Wight	4.339	5.172	2.574	12.086
9	มะซัก	*Sapindus emarginatus* Wall.	4.339	4.310	3.166	11.815
10	ไข่ปลา	*Debregeasia* sp.	5.372	2.586	3.276	11.234
11	ลำไยป่า	*Paranephelium longifoliolatum* Lec.	3.719	3.448	1.871	9.038
12	ปอยาบ	*Colona flagrocarpa* (Clarke) Craib.	2.066	3.017	3.072	8.156
13	ส้มป่อย	*Acacia concinna* (Willd.) DC.	3.099	2.155	1.919	7.173
14	ลำป้าง	*Pterospermum diversifolium* bl.	1.860	2.155	0.451	4.465
15	ฝรั่ง	*Psidium guajava* Linn.	1.653	2.155	0.391	4.199
16	เทพทาโร	*cinnamomum porrectum* (Roxb.)	1.033	1.293	1.603	3.930
17	-	*Trema* sp.	1.653	1.293	0.565	3.511
18	ทองหลางป่า	*Erythriha subumbrans* Merr.	0.826	0.862	0.820	2.508
19	ผาแป้ง	*Solanum erianthum* D. Don	0.826	1.293	0.247	2.366
20	สะแกแสง	*Cananga latifolia* Finet & Gagnep.	0.207	0.431	1.726	2.364
21	ยางบง	*Persea kurzii* Kosterm.	1.033	0.862	0.434	2.329
22	ก๋าย	*Polyalthia parviflora*	1.033	0.862	0.400	2.295
23	กำลังเสือโคร่ง	*Zizyphus attopoensis* Pierre	0.826	0.862	0.446	2.135
24	มือพระนารายณ์	*Shefflera* sp.	0.826	0.862	0.298	1.987
25	ขมิ้นต้น	*Alseodaphne* sp.	0.413	0.862	0.357	1.632
26	พริกไทดง	*Aporusa planchoniana* Paill. ex Muell.	0.620	0.862	0.143	1.625
27	หัสคุณ	*Clausena excavata* Burm. f.	0.413	0.862	0.342	1.617
28	-	*Litsea laeta*	0.413	0.431	0.698	1.542
29	สะเดาช้าง	*Acrocarpus fraxinifolius* Wight & Arn.	0.207	0.431	0.513	1.151
30	ก่วมขาว	*Acer oblongum* Wall. ex DC.	0.413	0.431	0.263	1.107
31	สมอพิเภก	*Terminalia bellerica* Roxb.	0.207	0.431	0.367	1.004
32	อบเชย	*Cinnamomum iners* Bl.	0.413	0.431	0.143	0.987
33	ปรู๋	*Alangium salvifolium* Wang.	0.413	0.431	0.128	0.972
34	ยมหอม	*Toona ciliata* M. Roem.	0.413	0.431	0.111	0.955
35	ตาเป็ดเขา	*Ardisia kerrii* Craib	0.413	0.431	0.082	0.926
36	ขีหนอนคาย	*Celtis tetrandra* Roxb.	0.207	0.431	0.141	0.779
37	ไทรใบใหญ่	*Ficus* sp.	0.207	0.431	0.138	0.776
38	ยางโอน	*Polyalthia viridis* craib	0.207	0.431	0.072	0.710
39	-	*Capparis kerrii*	0.207	0.431	0.068	0.706
40	พังแหรใหญ่	*Trema orientalis* (Linn.) Bl.	0.207	0.431	0.066	0.704
	etc.		1.446	3.017	0.292	4.756
	Total		100.000	100.000	100.000	300.000

Appendix Table 8 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the ASA plot at 10 year old site (10year_1).

No.	Thai name	Species	RD	RF	RDo	IVI
1	กระลังตังช้าง	*Dendrocnide sinuata* (Bl.) Chew	10.655	6.995	3.403	21.053
2	เทพทาโร	*cinnamomum porrectum* (Roxb.)	0.331	0.546	19.712	20.590
3	พระเจ้าห้าพระองค์	*Dracontomelum dao* (Blanco) Merr. & Rolfe	0.265	0.437	18.482	19.184
4	มะฝ่อ	*Trevia nudiflora* Linn.	1.059	1.639	14.424	17.123
5	ตาเสือขาว	*Dysoxylum cyrfobotryum* Miq.	7.081	5.246	3.449	15.776
6	ก๋าย	*Polyalthia parviflora*	5.625	5.246	1.201	12.072
7	ตองผ้า	*Sumbaviopsis* sp.	6.684	4.699	0.622	12.006
8	ปอเลียงมัน	*Berrya ammonilla* Roxb.	4.567	4.590	2.103	11.259
9	ขางปอย	*Alchonea rugosa* (Lour) M. - A.	6.420	1.639	1.981	10.040
10	ปออีเก้ง	*Pterocymbium javanicum* R. Br.	0.794	0.984	6.753	8.531
11	ตะพุนเฒ่า	*Vitex quinata* Williams var. puberula Mold	2.184	2.623	2.624	7.431
12	ต้างใหญ่	*Trevesia palmata* Vis.	3.177	2.514	0.460	6.150
13	สะทิบ	*Phoebe paniculata* Nees	1.985	2.295	1.616	5.896
14	สะเดาช้าง	*Acrocarpus fraxinifolius* Wight & Arn.	2.118	2.514	1.223	5.854
15	ลำไยป่า	*Paranephelium longifoliolatum* Lec.	1.919	2.842	0.614	5.374
16	พญารากดำ	*Diospyros rubra* Lec.	2.316	2.514	0.378	5.208
17	ยางโอน	*Polyalthia viridis* craib	1.985	2.732	0.469	5.187
18	สมพง	*Tetrameles nudiflora* R. Br.	1.191	0.765	3.130	5.087
19	มณฑาดอย	*Talauma hodgsonii* Hook. f. & Thoms.	1.985	1.749	1.167	4.901
20	ชมพู่เสม็ด	*Aglaia rubiginosa* (Hiern) Pamell	1.919	2.404	0.184	4.508
21	นางเลว	*Cyathocalys martabanicus* Hook. f. Th.	1.787	2.295	0.230	4.312
22	ยมหอม	*Toona ciliata* M. Roem.	1.191	1.749	1.371	4.311
23	ช้าแป้น	*Callicarpa arborea* Roxb.	2.052	1.967	0.171	4.190
24	มะดูก	*Siphonodon celasterineus* Griff	1.125	1.530	1.487	4.142
25	ไทรใบใหญ่	*Ficus* sp.	0.066	0.109	3.670	3.845
26	กอมขม	*Picrasma javanica* Bl.	1.588	2.077	0.138	3.803
27	คอแลน	*Nephelium hypoleucum* Kurz	1.721	1.639	0.244	3.604
28	หัสคุณ	*Clausena excavata* Burm. f.	1.390	2.077	0.125	3.592
29	มะคังดง	*Ostodes paniculata* Blume	1.324	1.749	0.470	3.542
30	เขยตาย	*Glycosmis pentaphylla* Corr.	1.324	1.967	0.217	3.508
31	ขี้หนอนคาย	*Celtis tetrandra* Roxb.	1.191	1.421	0.846	3.458
32	กล้วย	*Polyalthia lateriflora* (Dl.) King	1.456	1.530	0.424	3.410
33	ยางบง	*Persea kurzii* Kosterm.	1.456	1.530	0.118	3.104
34	ไคร้	*Glochidion* sp.	1.059	1.311	0.098	2.468
35	ปอยาบ	*Colona flagrocarpa* (Clarke) Craib.	0.728	1.093	0.550	2.371
36	ดันหมี	*Horsfieldia wallchii* Warb.	0.927	1.202	0.127	2.255
37	ขมิ้นต้น	*Alseodaphne* sp.	1.125	0.437	0.560	2.122
38	มะเฉียงนำ	*Aesculus assamica* Griff.	0.794	0.984	0.258	2.036
39	หางหนู	*Diospyros* sp.	0.728	1.093	0.106	1.927
40	เติม	*Bischofia javanica* Bl.	0.265	0.437	1.016	1.718
	etc.		12.442	16.831	3.780	33.053
	Total		100.000	100.000	100.000	300.000

Appendix Table 9 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the ASA plot at 10 year old site (10year_2).

No.	Thai name	Species	RD	RF	RDo	IVI
1	มะเดื่ออุทุมพร	*Ficus racemosa* Linn.	22.222	16.149	22.644	61.015
2	มะฝ่อ	*Trevia nudiflora* Linn.	10.811	9.938	9.964	30.713
3	ซ้อ	*Gmelina arborea* Roxb.	4.805	5.590	12.298	22.693
4	เพกา	*Oroxylum indicum* (L.) Vent.	4.805	6.211	6.408	17.424
5	ปอแตง	*Colona* sp.	5.105	3.106	6.929	15.140
6	มะเดื่อปล้อง	*Ficus hispida* Linn. f.	5.706	3.106	6.219	15.030
7	ปอกะสา	*Broussonetia papyrifera* Vent.	3.904	1.863	4.599	10.366
8	มะหาด	*Artocarpus lakoocha* Roxb.	3.904	3.727	2.108	9.738
9	ก่อเดือย	*Castanopsis acuminatissima* Rehd.	0.901	0.621	5.957	7.479
10	มะซัก	*Sapindus emarginatus* Wall.	2.703	2.484	1.238	6.426
11	แคฝอย	*Stereospermum cylindricum* Pierre ex P. Dop	2.102	3.106	0.911	6.119
12	โพหน่วย	*Litsea* sp.	1.502	2.484	1.980	5.966
13	เต้าเลื่อม	*Macaranga indiaca* Wight	1.502	2.484	1.554	5.540
14	เสลาเปลือกหนา	*Lagerstroemia tomentosa* Presl	1.802	2.484	1.254	5.540
15	ปรู๋	*Alangium salvifolium* Wang.	1.502	2.484	1.413	5.399
16	ส้มป่อย	*Acacia concinna* (Willd.) DC.	2.102	2.484	0.809	5.395
17	ยางน่อง	*Antiaris toxicaria* Lesch.	1.502	1.863	1.199	4.564
18	ช้าแป้น	*Callicarpa arborea* Roxb.	1.802	1.863	0.596	4.261
19	ลำป้าง	*Pterospermum diversifolium* bl.	1.502	1.863	0.627	3.992
20	ไอ	*Bridelia* sp.	1.802	1.242	0.894	3.938
21	หัสคุณ	*Clausena excavata* Burm. f.	1.502	1.242	0.666	3.409
22	เต้าหลวง	*Macaranga gigantea* Muell. Arg.	1.201	1.242	0.674	3.118
23	รัก	*Melanochyla bracteata* King	0.901	0.621	1.513	3.035
24	ถ่านไฟผี	*Diospyros montana* Roxb.	1.201	1.242	0.511	2.954
25	ขี้หนอนคาย	*Celtis tetrandra* Roxb.	1.201	0.621	0.973	2.796
26	มะผด	*Rhus chinensis* Muell.	0.901	1.242	0.401	2.544
27	มะกล่ำต้น	*Adenanthera pavonina* Linn.	1.201	0.621	0.536	2.359
28	ปอเลียงมัน	*Berrya ammonilla* Roxb.	0.601	1.242	0.326	2.168
29	กระอวม	*Aronychia pedunculata* Miq.	0.601	1.242	0.270	2.113
30	เขลง	*Dialium cochinchinense* Areere	0.601	1.242	0.266	2.109
31	สะทิบ	*Phoebe paniculata* Nees	0.601	1.242	0.244	2.087
32	ลอขน	*Mallotus barbatus* Muell. Arg.	0.601	1.242	0.243	2.086
33	พังแหร	*Trema angustifolia* Bl.	0.300	0.621	0.749	1.670
34	อินทวา	*Persea* sp.	0.601	0.621	0.334	1.556
35	ตาเสือขาว	*Dysoxylum cyrfobotryum* Miq.	0.601	0.621	0.321	1.542
36	มือพระนารายณ์	*Shefflera* sp.	0.601	0.621	0.263	1.485
37	คำแสด	*Mallotus philippensis* (Lam.) Muell. Arg.	0.601	0.621	0.183	1.404
38	ตาเป็ดเขา	*Ardisia kerrii* Craib	0.300	0.621	0.280	1.201
39	ทองหลางป่า	*Erythriha subumbrans* Merr.	0.300	0.621	0.236	1.157
40	ขนุนป่า	*Artocarpus rigidus* Bl.	0.300	0.621	0.159	1.080
	etc.		3.303	6.832	1.249	11.385
	Total		100.000	100.000	100.000	300.000

Appendix Table 10 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the tree species (DBH>4.5 cm) from the ASA plot at 10 year old site (10year_3)**.**

No.	Thai name	Species	RD	RF	RDo	IVI
1	มะฝ่อ	*Trevia nudiflora* Linn.	12.403	13.253	5.123	30.779
2	ส้มป่อย	*Acacia concinna* (Willd.) DC.	15.504	7.229	5.062	27.795
3	สะเดาช้าง	*Acrocarpus fraxinifolius* Wight & Arn.	5.426	6.024	13.190	24.640
4	ตะเคียนเฒ่า	*Sapium discolor* Muell. Arg.	2.326	2.410	17.615	22.350
5	พังแหร	*Trema angustifolia* Bl.	3.876	4.819	9.920	18.615
6	ช้อ	*Gmelina arborea* Roxb.	3.876	6.024	6.344	16.244
7	มะเดืออุทุมพร	*Ficus racemosa* Linn.	6.202	3.614	5.212	15.028
8	ตะพุนเฒ่า	*Vitex quinata* Williams var. puberula Mold	6.202	6.024	2.475	14.701
9	มะหาด	*Artocarpus lakoocha* Roxb.	3.101	4.819	2.301	10.221
10	ก่วมขาว	*Acer oblongum* Wall. ex DC.	4.651	3.614	0.988	9.254
11	กระทุ่มนา	*Mitragyna javanica* Koord and Vahl.	3.101	3.614	2.260	8.975
12	ขี้หนอนคาย	*Celtis tetrandra* Roxb.	0.775	1.205	6.900	8.880
13	ปอแตง	*Colona* sp.	3.101	1.205	3.886	8.192
14	ตาเสือขาว	*Dysoxylum cyrfobotryum* Miq.	1.550	2.410	3.959	7.919
15	มะคังดง	*Ostodes paniculata* Blume	2.326	2.410	1.953	6.689
16	มะกา	*Bridelia ovata* Decne	3.101	2.410	0.686	6.197
17	หัสคุณ	*Clausena excavata* Burm. f.	1.550	2.410	0.782	4.742
18	หว้าหิน	*Eugenia* sp.	0.775	1.205	2.639	4.619
19	ยมหิน	*Chukrasia velutina* Wight & Arn.	1.550	2.410	0.626	4.586
20	คำแสด	*Mallotus philippensis* (Lam.) Muell. Arg.	1.550	2.410	0.394	4.354
21	มะขามป้อม	*Phyllanthus emblica* Linn.	0.775	1.205	2.037	4.017
22	-	*Trema* sp.	2.326	1.205	0.366	3.896
23	กระหนานปลิง	*Pterospermum littorale* Craib	1.550	1.205	0.870	3.625
24	มะกอกพราน	*Turpinia pomifera* DC.	1.550	1.205	0.646	3.401
25	สะทิบ	*Phoebe paniculata* Nees	1.550	1.205	0.445	3.200
26	ก่อนำ	*Lithocarpus annamensis* A. Camus	0.775	1.205	0.697	2.677
27	เพกา	*Oroxylum indicum* (L.) Vent.	0.775	1.205	0.457	2.437
28	ผาแป้ง	*Solanum erianthum* D. Don	0.775	1.205	0.369	2.349
29	เต้าหลวง	*Macaranga gigantea* Muell. Arg.	0.775	1.205	0.324	2.304
30	ปอตองแตบ	*Macaranga denticulata* Muell. Arg.	0.775	1.205	0.259	2.239
31	ฝรั่ง	*Psidium guajava* Linn.	0.775	1.205	0.259	2.239
32	เต้าเลื่อม	*Macaranga indiaca* Wight	0.775	1.205	0.194	2.174
33	มะชัก	*Sapindus emarginatus* Wall.	0.775	1.205	0.194	2.174
34	เหมือดคนดง	*Helicia* sp.	0.775	1.205	0.174	2.154
35	อบเชย	*Cinnamomum iners* Bl.	0.775	1.205	0.144	2.124
36	เติม	*Bischofia javanica* Bl.	0.775	1.205	0.133	2.113
37	มือพระนารายณ์	*Shefflera* sp.	0.775	1.205	0.117	2.097
	Total		100.000	100.000	100.000	300.000

Appendix Table 11 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the 40 most tree species (DBH>4.5 cm) from the ASA plot at 8 year old site (8year_1).

No.	Thai name	Species	RD	RF	RDo	IVI
1	ยางอินเดีย	*Ficus elastica* Roxb. ex Hornem.	0.270	0.613	82.810	83.693
2	ละหุ่ง	*Ricinus communis* Linn.	33.784	23.313	1.003	58.099
3	ผาแป้ง	*Solanum erianthum* D. Don	15.135	12.270	1.184	28.589
4	กระทุ่ม	*Anthocephalus chinensis* Rich. ex Walp.	5.946	8.589	4.360	18.895
5	ลำพูป่า	*Duabanga grandiflora* (Roxb. ex DC.) Walp.	6.486	6.748	3.485	16.720
6	มะเดื่อปล้อง	*Ficus hispida* Linn. f.	4.595	4.908	0.353	9.855
7	มะม่วง	*Mangifera indica* Linn.	3.514	4.294	0.374	8.182
8	ปอกะสา	*Broussonetia papyrifera* Vent.	2.973	3.681	0.290	6.944
9	ส้มโอ	*Citrus maxima* (Burm. f.) Merr.	2.162	1.840	0.060	4.063
10	ตะพุนแม่า	*Vitex quinata* Williams var. puberula Mold	1.892	1.840	0.142	3.874
11	ลำไยป่า	*Paranephelium longifoliolatum* Lec.	2.162	1.227	0.443	3.832
12	แดงนำ	*Glochidion* sp.	1.622	1.840	0.228	3.690
13	สมพง	*Tetrameles nudiflora* R. Br.	1.351	1.227	1.101	3.680
14	แคหางค่าง	*Fernandoa adenophylla* (Wall. ex G. Don)	1.081	1.840	0.201	3.122
15	นางแย้มป่า	*Clerodendrum viscosum* Vent.	1.081	1.840	0.042	2.963
16	ส้มป่อย	*Acacia concinna* (Willd.) DC.	1.622	1.227	0.079	2.928
17	มะซัก	*Sapindus emarginatus* Wall.	1.081	1.227	0.046	2.354
18	โพหน่วย	*Litsea* sp.	0.811	1.227	0.181	2.219
19	มะหวด	*Lepisanthes rubiginosa* (Roxb.) Leenh.	0.541	1.227	0.333	2.101
20	มะคังดง	*Ostodes paniculata* Blume	0.541	1.227	0.134	1.902
21	ฝาละมี	*Alangium* sp.	1.081	0.613	0.052	1.747
22	มะนาว	*Citrus aurantifolia* (Christm. & Porz.) Swing.	0.811	0.613	0.045	1.470
23	สะทิบ	*Phoebe paniculata* Nees	0.811	0.613	0.036	1.461
24	ก่อเดือย	*Castanopsis acuminatissima* Rehd.	0.541	0.613	0.280	1.434
25	กระอวม	*Aronychia pedunculata* Miq.	0.270	0.613	0.395	1.279
26	ก่วมขาว	*Acer oblongum* Wall. ex DC.	0.270	0.613	0.384	1.268
27	ขีหนอนคาย	*Celtis tetrandra* Roxb.	0.541	0.613	0.109	1.263
28	เลือดแรด	*Knema globularia* Warb	0.270	0.613	0.369	1.253
29	ยมหอม	*Toona ciliata* M. Roem.	0.541	0.613	0.082	1.236
30	กำลังเสือโคร่ง	*Zizyphus attopoensis* Pierre	0.541	0.613	0.072	1.226
31	ชมพู่นำ	*Eugenia siamensis* Craib	0.541	0.613	0.051	1.205
32	พังแหร	*Trema angustifolia* Bl.	0.270	0.613	0.299	1.182
33	มะหาด	*Artocarpus lakoocha* Roxb.	0.270	0.613	0.289	1.173
34	ส้มเขียวหวาน	*Citrus reticulata* Blanco	0.541	0.613	0.012	1.166
35	ขนุน	*Artocarpus heterophyllus* Lamk.	0.270	0.613	0.177	1.061
36	เสลาเปลือกหนา	*Lagerstroemia tomentosa* Presl	0.270	0.613	0.160	1.044
37	ยมหิน	*Chukrasia velutina* Wight & Arn.	0.270	0.613	0.084	0.968
38	ก่อตลับ	*Quercus romsbottomii* A. Camus	0.270	0.613	0.075	0.959
39	มะเดื่ออุทุมพร	*Ficus racemosa* Linn.	0.270	0.613	0.062	0.946
40	คอแลน	*Nephelium hypoleucum* Kurz	0.270	0.613	0.031	0.914
	etc.		2.432	5.521	0.083	8.037
	Total		100.000	100.000	100.000	300.000

Appendix Table 12 Relative density (RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the tree species (DBH>4.5 cm) from the ASA plot at 8 year old site (8year_2).

No.	Thai name	Species	RD	RF	RDo	IVI
1	ซ้อ	*Gmelina arborea* Roxb.	16.667	33.333	84.738	134.738
2	โพหน่วย	*Litsea* sp.	41.667	16.667	9.679	68.013
3	ส้มป่อย	*Acacia concinna* (Willd.) DC.	25.000	16.667	2.846	44.513
4	ส้านใหญ่	*Dillenia obovata* (Bl.) Hoogl.	8.333	16.667	1.717	26.717
5	ปอเลียงฝ้าย	*Kydia calycina* Roxb.	8.333	16.667	1.020	26.020
	Total		100.000	100.000	100.000	300.000

Appendix Table 13 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the tree species (DBH>4.5 cm) from the ASA plot at 8 year old site (8year_3).

No.	Thai name	Species	RD	RF	RDo	IVI
1	ปอกะสา	*Broussonetia papyrifera* Vent.	21.951	27.273	15.971	65.195
2	ซ้อ	*Gmelina arborea* Roxb.	14.634	9.091	37.171	60.896
3	เพกา	*Oroxylum indicum* (L.) Vent.	19.512	18.182	16.850	54.544
4	แคหัวหมู	*Markhamia stipulata* Seem.	14.634	9.091	12.766	36.491
5	แคดอกขาว	*Dolichandrone serrulata* (DC) Seem.	9.756	4.545	3.991	18.293
6	เติม	*Bischofia javanica* Bl.	4.878	9.091	4.279	18.248
7	ปอเลียงมัน	*Berrya ammonilla* Roxb.	4.878	9.091	2.714	16.683
8	มะกอก	*Spondias pinnata* (Linn. f.) Kurz	4.878	4.545	1.862	11.285
9	อบเชยใบมน	*Neolitsea* sp.	2.439	4.545	2.414	9.398
10	แคฝอย	*Stereospermum cylindricum* Pierre ex P. Dop	2.439	4.545	1.981	8.965
	Total		100.000	100.000	100.000	300.000

Appendix Table 14 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the tree species (DBH>4.5 cm) from the ASA plot at 6 year old site (6year_1).

ลำดับที่	ชื่อไทย	ชื่อวิทยาศาสตร์	RD	RF	RDo	IVI
1	ปอมืน	*Colona floribunda* (Kurz) Craib	34.247	24.324	20.299	78.870
2	นางแย้มป่า	*Clerodendrum viscosum* Vent.	17.123	9.459	4.164	30.746
3	ซ้อ	*Gmelina arborea* Roxb.	8.219	12.162	9.069	29.450
4	ละหุ่ง	*Ricinus communis* Linn.	11.644	13.514	3.074	28.231
5	เม่าดง	*Antidesma bunius* (L.) Spreng.	0.685	1.351	21.501	23.537
6	ตีนเป็ดเขา	*Alstonia glaucescens* (K. Sch.) Mona	0.685	1.351	12.636	14.672
7	มะเดือปล้อง	*Ficus hispida* Linn. f.	6.849	4.054	3.326	14.230
8	ปอเลียงมัน	*Berrya ammonilla* Roxb.	2.740	5.405	5.231	13.377
9	ส้านใหญ่	*Dillenia obovata* (Bl.) Hoogl.	2.740	5.405	1.552	9.697
10	ยมหิน	*Chukrasia velutina* Wight & Arn.	0.685	1.351	7.341	9.378
11	ทองหลางป่า	*Erythriha subumbrans* Merr.	2.055	1.351	4.284	7.691
12	ส้มป่อย	*Acacia concinna* (Willd.) DC.	2.055	4.054	1.539	7.648
13	ลาย	*Microcos paniculata* Linn.	2.055	1.351	3.278	6.684
14	หนาดใหญ่	*Blumea balsamifera* (L.) DC.	2.055	4.054	0.458	6.567
15	โพหน่วย	*Litsea* sp.	2.055	2.703	0.920	5.677
16	ปีบ	*Pauldopia* sp.	0.685	1.351	0.351	2.387
17	มะหวด	*Lepisanthes rubiginosa* (Roxb.) Leenh.	0.685	1.351	0.248	2.284
18	แดงนำ	*Glochidion* sp.	0.685	1.351	0.240	2.276
19	ก่วมขาว	*Acer oblongum* Wall. ex DC.	0.685	1.351	0.196	2.232
20	เก็ดแดง	*Dalbergia donnaiensis* Pierre	0.685	1.351	0.162	2.199
21	ปอยาบ	*Colona flagrocarpa* (Clarke) Craib.	0.685	1.351	0.132	2.168
	Total		100.000	100.000	100.000	300.000

Appendix Table 15 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the tree species (DBH>4.5 cm) from the ASA plot at 6 year old site (6year_2).

ลำดับที่	ชื่อไทย	ชื่อวิทยาศาสตร์	RD	RF	RDo	IVI
1	หนาดใหญ่	*Blumea balsamifera* (L.) DC.	31.579	31.579	15.424	78.582
2	ปอเลียงมัน	*Berrya ammonilla* Roxb.	10.526	10.526	43.161	64.214
3	นางแย้มป่า	*Clerodendrum viscosum* Vent.	15.789	15.789	5.815	37.394
4	แดงน้ำ	*Glochidion* sp.	10.526	10.526	7.761	28.813
5	ละหุ่ง	*Ricinus communis* Linn.	10.526	10.526	4.042	25.094
6	เพกา	*Oroxylum indicum* (L.) Vent.	5.263	5.263	8.245	18.772
7	ปอเกล็ดแรด	*Sterculia macrophylla* Vent.	5.263	5.263	6.967	17.493
8	โพหน่วย	*Litsea* sp.	5.263	5.263	5.657	16.183
9	ปอมืน	*Colona floribunda* (Kurz) Craib	5.263	5.263	2.929	13.455
	Total		100.000	100.000	100.000	300.000

Appendix Table 16 Relative density(RD), relative frequency (RF), relative dominace (RDo) and importance value index (IVI) of the tree species (DBH>4.5 cm) from the ASA plot at 6 year old site (6year_3)

ลำดับที่	ชื่อไทย	ชื่อวิทยาศาสตร์	RD	RF	RDo	IVI
1	ซ้อ	*Gmelina arborea* Roxb.	41.667	42.857	77.934	162.458
2	ส้มป่อย	*Acacia concinna* (Willd.) DC.	25.000	14.286	6.760	46.046
3	ปอเลียงมัน	*Berrya ammonilla* Roxb.	16.667	14.286	10.388	41.340
4	ละหุ่ง	*Ricinus communis* Linn.	8.333	14.286	2.539	25.158
5	ปอเกล็ดแรด	*Sterculia macrophylla* Vent.	8.333	14.286	2.378	24.997
	Total		100.000	100.000	100.000	300.000

Appendix Table 17 List of bird species in the abandoned settlement area(ASA) and dry evergreen forest(DEF).

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
1	นกปรอดหัวโขน Red-whiskered Bulbul	*Pycnonotus jocosus* (Linnaeus) 1758.	RWBU	R	AIF	1140	582	409	2131	NT	-
2	นกปรอดเหลืองหัวจุก Black-crested Bulbul	*Pycnonotus melanicterus* (Gmelin) 1789.	BCBU	R	AIF	250	337	690	1277	-	-
3	นกปรอดโอ่งหน้าผากเทา White-throated Bulbul	*Alophoixus flaveolus* (Gould) 1836.	WTBU	R	AIF	63	126	708	897	-	-
4	นกกะรางหัวหงอก White-crested Laughingthrush	*Garrulax leucolophus* (Hardwicke) 1815.	WCLT	R	FGI	135	95	618	848	-	-
5	นกปรอดสีขี้เถ้า Ashy Bulbul	*Hemixos flavala* (Blyth) 1845.	ASBU	R	AIF	56	596	166	818	-	-
6	นกปรอดหัวสีเขม่า Sooty-headed Bulbul	*Pycnonotus aurigaster* (Vieillot) 1818.	SOBU	R	AIF	178	127	209	514	-	-
7	นกมูม Mountain Imperial Pigeon	*Ducula badia* (Raffles) 1822.	MIPG	R	AF	174	97	234	505	-	-
8	นกตั้งล้อ Great Barbet	*Megalaima virens* (Boddaert) 1783.	GRBA	R	AIF	137	82	282	501	-	-
9	นกพญาไฟใหญ่ Scarlet Minivet	*Pericrocotus flammeus* (Forster) 1781.	SCMN	R	FGI	55	127	315	497	-	-
10	นกโพระดกคอสีฟ้า Blue-throated Barbet	*Megalaima asiatica* (Latham) 1790.	BTBA	R	AIF	79	92	284	455	-	-
11	นกปรอดดำ Black Bulbul	*Hypsipetes leucocephalus* (Gmelin) 1789.	BLBU	R	AIF	78	87	286	451	-	-
12	นกกินแมลงป่าอกสีน้ำตาล Buff-breasted Babbler	*Pellorneum tickeli* Blyth, 1859.	BBBB	R	FGI	71	85	290	446	-	-
13	นกกระจิบหญ้าท้องเหลือง Yellow-bellied Prinia	*Prinia flaviventris* (Delessert) 1840.	YBPN	R	FGI	256	83	76	415	-	-
14	นกปลีกล้วยลาย Streaked Spiderhunter	*Arachnothera magna* (Hodgson) 1837.	STSH	R	IN	89	68	239	396	-	-
15	นกกะลิงเขียดสีเทา Grey Treepie	*Dendrocitta formosae* Swinhoe, 1863.	GRTP	R	FGI	78	71	218	367	-	-
16	นกแซงแซวสีเทา Ashy Drongo	*Dicrurus leucophaeus* Vieillot, 1817.	ASDG	M	FGI	95	51	212	358	-	-
17	นกกะรางสร้อยคอเล็ก Lesser Necklaced Laughingthrush	*Garrulax monileger* (Hodgson) 1836.	LNLT	R	FGI	6	84	254	344	-	-
18	นกกระจิบหญ้าคิ้วขาว Hill Prinia	*Prinia atrogularis* (Moore) 1854.	HIPN	R	FGI	95	89	127	311	-	-
19	นกปรอดภูเขา Mountain Bulbul	*Hypsipetes mcclellandii* Horsfield, 1840.	MTBU	R	AIF	10	48	240	298	-	-
20	นกระวังไพรปากเหลือง White-browed Scimitar Babbler	*Pomatorhinus schisticeps* Hodgson, 1836.	WBSB	R	FGI	124	35	130	289	-	-
21	นกกินแมลงอกเหลือง Striped Tit Babbler	*Macronous gularis* (Horsfield) 1822.	STTB	R	FGI	53	73	162	288	-	-
22	นกแซงแซวหงอนขน Spangked Drongo	*Dicrurus hottentottus* (Linnaeus) 1766.	SPDG	R	FGI	59	104	110	273	-	-
23	นกเขียวคราม Asian Fairy Bluebird	*Irena puella* (Latham) 1790.	AFBL	R	FGI	18	42	202	262	-	-
24	นกมุ่นรกตาขาว Brown-cheeked Fulvetta	*Alcippe poioicephala* (Jerdon) 1844.	BCFT	R	FGI	7	133	115	255	-	-
25	นกกินแมลงคอลาย Spot-necked Babbler	*Stachyris striolata* (Muller) 1835.	SNBB	R	FGI	7	122	125	254	-	-

Appendix Table 17 (Continued)

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
26	นกแซงแซวเล็กเหลือบ Bronzed Drongo	*Dicrurus aeneus* Vieillot, 1817.	BRDG	R	FGI	56	67	129	252	-	-
27	นกตีทอง Coppersmith Barbet	*Megalaima haemacephala* (Muller) 1776.	CPBA	R	AIF	64	44	123	231	-	-
28	นกกินแมลงหน้าผากน้ำตาล Rufous-fronted Babbler	*Stachyris rufifrons* Hume, 1873.	RFBB	R	FGI	63	72	91	226	-	-
29	นกกระจิ๊ดเขียวปีกสองแถบTwo-barred Warbler	*Phylloscopus plumbeitarsus* Swinhoe, 1861	TBWB	M	FGI	29	71	108	208	-	-
30	นกปลีกล้วยเล็ก Little Spiderhunter	*Arachnothera longirostra* (Latham) 1790.	LTSH	R	IN	63	25	116	204	-	-
31	นกปรอดหัวตาขาว Flavescent Bulbul	*Pycnonotus flavescens* Blyth, 1845.	FCBU	R	AIF	22	96	76	194	-	-
32	นกกระติ๊ดขี้หมู Scaly-breasted Munia	*Lonchura punctulata* (Linnaeus) 1758.	SBMN	R	AF	64	125	0	189	NT	-
33	นกกะรางสร้อยคอใหญ่ Greater Necklaced Laughingthrush	*Garrulax pectoralis* (Gould) 1836.	GNLT	R	FGI	8	36	144	188	-	-
34	นกกระทาดงอกสีน้ำตาล Bar-backed Partridge	*Arborophila brunneopectus* (Blyth) 1855.	BBPT	R	TIF	24	30	128	182	NT	-
35	นกกิ้งโครงแกลบหัวเทา Chestnut-tailed Starling	*Sturnus malabaricus* (Gmelin) 1789.	CTSL	R/M	AF	0	172	1	173	-	-
36	นกกินแมลงกระหม่อมแดง Chestnut-capped Babbler	*Timalia pileata* Horsfield, 1821.	CCBB	R	FGI	128	22	18	168	-	-
37	นกแว่นสีเทา,นกแว่นเหนือ Grey Peacock Pheasant	*Polyplectron bicalcaratum* (Linnaeus) 1758.	GPPS	R	TIF	20	24	118	162	-	-
38	ไก่ป่า Red Junglefowl	*Gallus gallus* (Linnaeus) 1758.	RJFO	R	TF	42	27	88	157	-	-
39	นกแซงแซวหางบ่วงใหญ่ Greater Racket-tailed Drongo	*Dicrurus paradiseus (Linnaeus) 1766.*	GRDG	R	FGI	24	23	108	155	-	-
40	นกจับแมลงหัวเทา Grey-headed Canary Flycatcher	*Culicicapa ceylonensis (Swainson) 1820.*	GHFC	R	FGI	4	13	121	138	-	-
41	นกขมิ้นหัวดำใหญ่ Black-hooded Oriole	*Oriolus xanthornus (Linnaeus) 1758.*	BHOR	R	FGI	33	35	65	133	-	-
42	นกแก๊ก นกแกง Oriental Pied Hornbill	*Anthracoceros albirostris (Shaw and Nodder) 1807.*	OPHB	R	FF	31	25	76	132	-	-
43	นกกระจิ๊ดธรรมดา นกกระจิ๊ดตะโพกเขียว Yellow-browed Warbler	*Phylloscopus inornatus (Blyth) 1842.*	CMWB	M	FGI	37	25	68	130	-	-
44	นกหกเล็กปากแดง Vernal Hanging Parrot	*Loriculus vernalis (Sparrman) 1787.*	VHPR	R	AF	14	37	77	128	-	-
45	นกกระปูดใหญ่ Greater Coucal	*Centopus sinensis (Stephens) 1815.*	GTCC	R	TI	80	10	37	127	-	-
46	นกเขาเปล้าธรรมดา นกเขาเปล้า Thick-billed Green Pigeon	*Treron curvirostra (Gmelin) 1789.*	TBPG	R	AF	41	8	77	126	-	-
47	นกจับแมลงจุกดำ Black-naped Monarch	*Hypothymis azurea (Boddaert) 1783.*	RBFC	R	FGI	8	20	85	113	-	-
48	นกกินปลีอกเหลือง Olive-backed Sunbird	*Nectarinia jugularis (Linnaeus) 1766.*	OBSB	R	IN	38	49	24	111	-	-
49	นกกะรางอกสีน้ำตาลไหม้ White-necked Laughingthrush	*Garrulax strepitans Blyth, 1855.*	WNLT	R	FGI	0	56	53	109	-	-
50	นกกินแมลงคอเทา Grey-throated Babbler	*Stachyris nigriceps Blyth, 1844.*	GTBB	R	FGI	15	25	62	102	-	-

Appendix Table 17 (Continued)

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
51	นกกระจ้อยวงตาสีทอง Golden-spectacled Warbler	*Seicercus burkii (Burton) 1836.*	GSWB	M	FGI	20	23	51	94	-	-
52	นกพญาปากกว้างอกสีเงิน Silver-breasted Broadbill	*Serilophus lunatus (Gould) 1834.*	SBBR	R	FGI	19	10	63	92	-	-
53	นกเด้าลมหลังเทา Grey Wagtail	*Motacilla cinerea Tunstall, 1771.*	GRWT	M	TI	0	35	54	89	-	-
54	นกบั้งรอกใหญ่ Green-billed Malkoha	*Phaenicophaeus tristis (Lesson) 1830.*	GBMK	R	FGI	16	21	48	85	-	-
55	นกยางกรอกพันธุ์จีน Chinese Pond Heron	*Ardeola bacchus (Bonaparte) 1855.*	CPHR	M	P	0	46	37	83	-	-
56	นกแซงแซวหางบ่วงเล็ก Lesser Racket-tailed Drongo	*Dicrurus remifer (Temminck) 1823.*	LRDG	R	FGI	0	37	44	81	-	-
57	นกเสือแมลงหัวขาว White-hooded Babbler	*Gampsorhynchus rufulus Blyth, 1844.*	WHBB	R	FGI	0	21	58	79	-	-
58	นกกางเขนดง White-rumped Shama	*Copsychus malabaricus (Scopoli) 1788.*	WRSM	R	FGI	19	8	49	76	-	-
59	นกติดสุลต่าน Sultan Tit	*Melanochlora sultanea (Hodgson) 1837.*	STTI	R	FGI	4	32	38	74	-	-
60	นกกระจิบหญ้าอกเทา Grey-breasted Prinia	*Prinia hodgsonii Blyth, 1844.*	GBPN	R	FGI	12	48	14	74	-	-
61	นกขุนทอง Hill Myna	*Gracula religiosa Linnaeus, 1758.*	HIMN	R	AF	7	21	44	72	NT	-
62	นกกระจิบหญ้าสีข้างแดง Rufescent Prinia	*Prinia rufescens Blyth, 1847.*	RCPN	R	FGI	33	27	11	71	-	-
63	นกหัวขวานใหญ่หงอนเหลือง Greater Yellownape	*Picus flavinucha Gould, 1834.*	GTYU	R	BGI	13	5	52	70	-	-
64	นกกาฝากสีเรียบ Plain Flowerpecker	*Dicaeum concolor Jerdon, 1840.*	PLFB	R	AF	4	60	4	68	-	-
65	นกปรอดคอลาย Stripe-throated Bulbul	*Pycnonotus finlaysoni Strickland, 1844.*	SRBU	R	AIF	0	39	29	68	-	-
66	นกไต่ไม้หน้าผากก่ามะหยี่ Velvet-fronted Nuthatch	*Sitta frontalis Swainson, 1820.*	VFNH	R	BGI	11	21	35	67	-	-
67	นกกก นกกาฮัง Great Hornbill	*Buceros bicornis Linnaeus, 1758.*	GRHB	R	FF	9	15	43	67	NT	LR
68	นกเขนน้อยปีกแถบขาว Bar-winged Flycatcher-shrike	*Hemipus picatus (Sykes) 1832.*	BAFS	R	FGI	6	38	21	65	-	-
69	นกเขาไฟ Red Collared Dove	*Streptopelia tranquebarica (Hermann) 1804.*	RCDO	R	TF	1	21	42	64	-	-
70	นกพญาไฟเล็ก Small Minivet	*Pericrocotus cinnamomeus (Linnaeus) 1766.*	SMMV	R	FGI	0	27	37	64	-	-
71	นกกระจิ๊ดหางขาวใหญ่ Blyth's Leaf Warbler	*Phylloscopus reguloides (Blyth) 1842.*	BLWB	M	FGI	0	26	38	64	-	-
72	นกขุนแผนหัวแดง Red-headed Trogon	*Harpactes erythrocephalus (Gould) 1834.*	RHTG	R	FGI	1	5	56	62	-	-
73	นกระวังไพรปากยาว Large Scimitar Babbler	*Pomatorhinus hypoleucos (Blyth) 1844.*	LSBB	R	FGI	13	12	36	61	-	-
74	นกเฉี่ยวดงหางสีน้ำตาล Large Woodshrike	*Tephrodornis gularis (Raffles) 1822.*	LWSR	R	FGI	0	26	35	61	-	-
75	นกจับแมลงคอแดง Red-throated Flycatcher	*Ficedula parva (Bechstein) 1792.*	RTFC	M	FGI	7	18	34	59	-	-

Appendix Table 17 (Continued)

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
76	นกเปล้าหางพลั่ว Wedge-tailed Green Pigeon	*Treron sphenura (Vigors) 1832.*	WTPG	R	AF	0	44	13	57	-	-
77	ไก่ฟ้าหลังเทา Kalij Pheasant	*Lophura leucomelanos (Latham) 1790.*	KLPS	R	TIF	10	12	34	56	-	-
78	นกกระทาดงแข้งเขียว Scaly-breasted Partridge	*Arborophila charltonii (Eyton) 1845.*	SCPT	R	TIF	6	12	37	55	-	LR
79	นกแว่นตาขาวข้างแดง Chestnut-flanked White-eye	*Zosterops erythropleurus Swinhoe, 1863.*	CFWE	M	FGI	0	23	30	53	-	-
80	นกแอ่นพง Ashy Woodswallow	*Artamus fuscus Vieillot, 1817.*	ASWS	R	SaI	41	1	11	53	-	-
81	นกกระจิบธรรมดา นกกระจิบสวน Common Tailorbird	*Orthotomus sutorius (Pennant) 1769.*	CMTB	R	FGI	5	33	14	52	-	-
82	นกพญาไฟสีกุหลาบ Rosy Minivet	*Pericrocotus roseus (Vieillot) 1818.*	RSMV	M	FGI	0	11	40	51	-	-
83	นกกระจิ๊ดขาสีเนื้อ Pale-legged Leaf Warbler	*Phylloscopus tenellipes Swinhoe, 1860.*	PAWB	M	FGI	3	25	23	51	-	-
84	นกปรอดทอง Black-headed Bulbul	*Pycnonotus atriceps (Temminck) 1822.*	BHBU	R	AIF	5	21	22	48	-	-
85	นกกระจ้อยคอขาว Yellow-bellied Warbler	*Abroscopus superciliaris (Blyth) 1859.*	YBWB	R	FGI	2	10	36	48	-	-
86	นกเค้าแคระ Collared Owlet	*Glaucidium brodiei (Burton) 1836.*	CLOL	R	R	0	12	33	45	-	-
87	นกกระจิ๊ดคิ้วดำท้องเหลือง Sulphur-breasted Warbler	*Phylloscopus ricketti (Slater) 1897.*	SBWB	M	FGI	2	6	37	45	-	-
88	นกจับแมลงสีน้ำตาล Asian Brown Flycatcher	*Muscicapa dauurica Pallas, 1811.*	VTFC	M	FGI	2	26	16	44	-	-
89	นกเขาเขียว Emerald Dove	*Chalcophaps indica (Linnaeus) 1758.*	EMDO	R	TF	6	8	30	44	-	-
90	นกสาลิกาเขียว Common Green Magpie	*Cissa chinensis (Boddaert) 1783.*	CMGM	R	FGI	4	6	34	44	-	-
91	นกแอ่นตาล Asian Palm Swift	*Cypsiurus balasinensis (Gray) 1829.*	APSW	R	SwI	15	0	29	44	-	-
92	นกกะรางคอดำ นกซอฮู้ Black-throated Laughingthrush	*Garrulax chinensis (Scopoli) 1786.*	BTLT	R	FGI	0	1	40	41	NT	-
93	นกโพระดกหน้าผากดำ Blue-eared Barbet	*Megalaima australis (Horsfield) 1821.*	BEBA	R	AIF	2	4	35	41	-	-
94	นกขมิ้นน้อยธรรมดา นกขมิ้นสวน Common Iora	*Aegithina tiphia (Linnaeus) 1758.*	CMIR	R	FGI	11	8	20	39	-	-
95	นกภูหงอนท้องขาว White-bellied Yuhina	*Yuhina zantholeuca (Blyth) 1844.*	WBYN	R	FGI	0	11	28	39	-	-
96	นกปรอดเล็กตาขาว Grey-eyed Bulbul	*Iole propinqua (Oustalet) 1903.*	GEBU	R	AIF	2	22	13	37	-	-
97	นกกระทาดงคอสีแสด Rufous-throated Partridge	*Arborophila rufogularis (Blyth) 1850.*	RTPT	R	TIF	2	11	24	37	NT	-
98	นกกระปูดเล็ก Lesser Coucal	*Centropus bengalensis (Gmelin) 1788.*	LSCC	R	TI	3	20	13	36	-	-
99	นกเงือกสีน้ำตาล Brown Hornbill	*Anorrhinus tickelli (Blyth) 1855.*	BRHB	R	FF	0	5	31	36	NT	LR
100	นกกินปลีหางยาวคอดำ Black-throated Sunbird	*Aethopyga saturata (Hodgson) 1836.*	BASB	R	IN	1	18	16	35	-	-
101	นกเขาใหญ่ นกเขาหลวง Spotted Dove	*Streptopelia chinensis (Scopoli) 1786.*	SPDO	R	TF	17	6	11	34	-	-

Appendix Table 17 (Continued)

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
102	นกยอดหญ้าสีดำ นกขี้หมา Pied Bushchat	*Saxicola caprata (Linnaeus) 1766.*	PIBC	M	FGI	11	9	13	33	-	-
103	นกกางเขนบ้าน Oriental Magpie Robin	*Copsychus saularis (Linnaeus) 1758.*	OMRB	R	FGI	11	10	10	31	-	-
104	นกแว่นตาขาวสีทอง Oriental White-eye	*Zosterops palpebrosus (Temminck) 1824.*	OTWE	R	FGI	8	2	21	31	-	-
105	นกนางแอ่นตะโพกแดง Red-rumped Swallow	*Hirundo daurica Linnaeus, 1776.*	RRSL	R/M	SwI	30	0	0	30	-	-
106	นกแต้วแล้วสีน้ำเงิน Blue Pitta	*Pitta cyanea Blyth, 1843.*	BLPT	R	TI	1	8	21	30	-	-
107	นกหัวขวานจิ๋วท้องลาย Speckled Piculet	*Picumnus innominatus Burton, 1836.*	SPPL	R	BGI	6	6	17	29	-	-
108	นกกระติ๊ดตะโพกขาว White-rumped Munia	*Lonchura striata (Linnaeus) 1766.*	WRNN	R	AF	28	0	1	29	-	-
109	นกขี้เถ้าใหญ่ Large Cuckooshrike	*Coracina macei (Lesson) 1831.*	LACS	R	FGI	4	5	19	28	-	-
110	นกขมิ้นปากเรียว Slender-billed Oriole	*Oriolus tenuirostris Blyth, 1846.*	SBOR	M	FGI	1	13	13	27	-	-
111	เหยี่ยวรุ้ง Crested Serpent Eagle	*Spilornis cheela (Latham) 1790.*	CRSE	R	R	4	9	13	26	-	-
112	นกเงือกกรามช้าง นกกู่กี่ Wreathed Hornbill	*Aceros undulatus (Shaw) 1811.*	WTHB	R	FF	13	2	10	25	NT	-
113	นกเขียวก้านตองปีกสีฟ้า Blue-winged Leafbird	*Chloropsis cochinchinensis (Gmelin) 1788.*	BWLB	R	FGI	2	8	14	24	-	-
114	นกกะรางหัวขวาน Common Hoopoe	*Upupa epops Linnaeus, 1758.*	CMHP	M	FGI	18	3	2	23	-	-
115	นกจับแมลงคอน้ำตาลแดง Hill Blue Flycatcher	*Cyornis banyumas (Horsfield) 1821.*	HIFC	R	FGI	1	6	16	23	-	-
116	นกแก้วหัวแพร Blossom-headed Parakeet	*Psittacula roseata Biswas, 1951.*	BHPK	R	AF	16	0	7	23	NT	-
117	นกจาบปีกอ่อนสีกุหลาบ Common Rosefinch	*Carpodacus erythrinus (Pallas) 1770.*	CMRF	M	AF	9	13	0	22	-	-
118	นกคอทับทิม Siberian Rubythroat	*Luscinia calliope (Pallas) 1776.*	SRRT	M	FGI	21	0	0	21	-	-
119	นกเขียวก้านตองท้องสีส้ม Orange-bellied Leafbird	*Chloropsis hardwickii Jardine and Selby, 1830.*	OBLB	R	FGI	6	3	11	20	-	-
120	นกหัวขวานจิ๋วคิ้วขาว White-browed Piculet	*Sasia ochracea Hodgson, 1836.*	WPPL	R	BGI	11	4	5	20	-	-
121	นกกระจอกตาล Plain-backed Sparrow	*Passer flaveolus Blyth, 1844.*	PBSR	R	AF	20	0	0	20	-	-
122	นกปรอดเล็กสีไพลตาแดง Olive Bulbul	*Iole virescens Blyth 1845.*	OLBU	R	AIF	3	7	9	19	NT	-
123	นกหัวขวานสี่นิ้วหลังทอง Greater Flameback	*Chrysocolaptes lucidus (Scopoli) 1796.*	GTFB	R	BGI	2	0	17	19	-	-
124	นกเปล้าหน้าเหลือง Pompadour Green Pigeon	*Treron pompadora (Gmelin) 1789.*	PPPG	R	AF	0	4	15	19	NT	-
125	นกขุนแผนอกสีส้ม Orange-breasted Trogon	*Harpactes oreskios (Temminck) 1823.*	OBTG	R	FGI	1	5	12	18	-	-
126	นกจับแมลงสีฟ้า Verditer Flycatcher	*Eumyias thalassina Swainson, 1838.*	VDFC	R	FGI	1	8	9	18	-	-
127	นกนางแอ่นบ้าน Barn Swallow	*Hirundo rustica Linnaeus, 1758.*	BASL	M	SwI	2	13	3	18	-	-

Appendix Table 17 (Continued)

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
128	นกหัวขวานแดงหลังลาย Bay Woodpecker	*Blythipicus pyrrhotis (Hodgson) 1837.*	BAWP	R	BGI	2	8	8	18	-	-
129	นกหัวขวานใหญ่สีเทา Great Slaty Woodpecker	*Mulleripicus pulverulentus (Temminck) 1826.*	GSWP	R	BGI	13	0	4	17	NT	-
130	นกแซงแซวหางปลา Black Drongo	*Dicrurus macrocercus (Vieillot) 1817.*	BADG	R	FGI	5	4	8	17	-	-
131	นกปรอดสวน Streak-eared Bulbul	*Pycnonotus blanfordi Jerdon, 1862.*	SEBU	R	AIF	0	0	16	16	-	-
132	เหยี่ยวแมลงปอขาแดง Collared Falconet	*Microhierax caerulescens (Linnaeus) 1758.*	CLFC	R	R	14	0	1	15	-	-
133	นกจู๋เต้นคิ้วยาว Eyebrowed Wren Babbler	*Napothera epilepidota (Temminck) 1827.*	EBWB	R	TI	0	11	4	15	-	-
134	นกกินแมลงตาเหลือง Yellow-eyed Babbler	*Chrysomma sinense (Gmelin) 1789.*	YEBB	R	FGI	14	0	0	14	-	-
135	นกจาบปีกอ่อนสีตาล Chestnut Bunting	*Emberiza rutila Pallas, 1776.*	CNBT	M	AF	3	10	1	14	-	-
136	นกกระเต็นลาย Banded Kingfisher	*Lacedo pulchella (Horsfield) 1821.*	BDKF	R	P	1	2	11	14	-	-
137	นกจาบดินอกลาย Puff-throated Babbler	*Pellorneum ruficeps Swainson, 1832.*	PTBB	R	TI	10	1	2	13	-	-
138	นกหัวขวานสีตาล Rufous Woodpecker	*Celeus brachyurus (Vieillot) 1818.*	RFWP	R	BGI	2	1	10	13	-	-
139	นกกระจิ๊ดขั้วโลกเหนือ Arctic Warbler	*Phylloscopus borealis (Blasius) 1858.*	ACWB	M	FGI	1	1	11	13	-	-
140	นกกระจิ๊ดปากหนา Radde's Warbler	*Phylloscopus schwarzi (Radde) 1863.*	RDWB	M	FGI	0	8	5	13	-	-
141	นกจับแมลงสีน้ำตาลแดง Ferruginous Flycatcher	*Muscicapa ferruginea (Hodgson) 1845.*	FNFC	M	FGI	2	0	10	12	-	-
142	นกอีแพรดคอขาว White-throated Fantail	*Rhipidura albicollis (Vieillot) 1818.*	WTFT	R	FGI	3	0	9	12	-	-
143	นกอีแพรดคิ้วขาว White-browed Fantail	*Rhipidura aureola* Lesson, 1830.	WBFT	R	FGI	3	2	7	12	VU	-
144	นกขมิ้นท้ายทอยดำ Black-naped Oriole	*Oriolus chinensis* Linnaeus, 1766.	BNOR	M	FGI	0	6	5	11	-	-
145	นกคัคคูลาย Banded Bay Cuckoo	*Cacomantis sonneratii* (Latham) 1790.	BBCK	R	FGI	4	3	4	11	-	-
146	นกเขียวก้านตองหน้าผากสีทอง Golden-fronted Leafbird	*Chloropsis aurifrons* (Temminck) 1829.	GFLB	R	FGI	3	1	7	11	-	-
147	นกกระจิ๊ดหัวมงกุฎ Eastern Crowned Warbler	*Phylloscopus coronatus* (Temminck and Schlegel) 1847.	ECWB	M	FGI	0	11	0	11	-	-
148	นกกิ้งโครงปีกลายจุด Spot-winged Starling	*Saroglossa spiloptera* (Vigors) 1831.	SWSL	M	AF	0	6	4	10	VU	-
149	นกแซวสวรรค์ Asian Paradise-flycatcher	*Terpsiphone paradisi* (Linnaeus) 1758.	APFC	R/M	FGI	0	2	8	10	-	-
150	นกพญาไฟสีเทา Ashy Minivet	*Pericrocotus divaricatus* (Raffles) 1822.	ASMV	M	FGI	0	2	7	9	-	-
151	นกหัวขวานเล็กหงอนเหลือง Lesser Yellownape	*Picus chlorolophus* Vieillot, 1818.	LSYN	R	BGI	1	0	8	9	-	-
152	นกเอี้ยงถ้ำ Blue Whistling Thrush	*Myiophonus caeruleus* (Scopoli) 1786.	BWTH	M	TI	0	2	7	9	-	-

Appendix Table 17 (Continued)

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153	นกขมิ้นแดง Maroon Oriole	*Oriolus traillii* (Vigors) 1832.	MROR	R	FGI	1	2	5	8	-	-
154	นกจาบคาหัวสีส้ม Chestnut-headed Bee-eater	*Merops leschenaulti* Vieillot, 1817.	CHBE	R	SaI	8	0	0	8	-	-
155	นกตะขาบทุ่ง Indian Roller	*Coracias benghalensis* (Linnaeus) 1758.	IDRL	R	SaI	5	0	3	8	-	-
156	นกพงคิ้วดำ Black-browed Reed Warbler	*Acrocephalus bistrigiceps* Swinhoe, 1860.	BBRW	M	FGI	3	1	4	8	-	-
157	นกอีเสือสีน้ำตาล Brown Shrike	*Lanius cristatus* Linnaeus, 1758.	BRSH	M	FGI	3	5	0	8	-	-
158	เหยี่ยวนกเขาพันธุ์จีน Chinese Sparrowhawk	*Accipiter soloensis* (Horsfield) 1821.	CNSH	M	R	0	3	5	8	-	-
159	นกคัคคูเหยี่ยวใหญ่ Large Hawk Cuckoo	*Hierococcyx sparverioides* (Vigors) 1832.	LHCK	R	FGI	2	1	4	7	-	-
160	นกจาบคาเคราน้ำเงิน Blue-bearded Bee-eater	*Nyctyornis athertoni* (Jardine and Selby) 1830.	BBBE	R	SaI	2	0	5	7	-	-
161	นกหัวขวานแดงลาย Banded Woodpecker	*Picus mineaceus* Pennant, 1769.	BDWP	R	BGI	0	0	7	7	-	-
162	นกเฉี่ยวบุ้งกลาง Indochinese Cuckooshrike	*Coracina polioptera* (Sharpe) 1879.	ICCS	R	FGI	0	1	6	7	-	-
163	นกเขนน้อยไซบีเรีย Siberian Blue Robin	*Luscinia cyane* (Pallas) 1776.	SRBR	M	FGI	2	1	3	6	-	-
164	นกจับแมลงคอขาวหน้าแดง Rufous-browed Flycatcher	*Ficedula solitaris* (Muller) 1835.	RBFC	R	FGI	2	0	4	6	-	-
165	นกตบยุงหางยาว Large-tailed Nightjar	*Caprimulgus macrurus* Horsfield, 1821.	LTNJ	R	SaI	2	0	4	6	-	-
166	นกเขาลายเล็ก Little Cuckoo Dove	*Macropygia ruficeps* (Temminck) 1834.	LCDO	R	TF	0	1	5	6	-	-
167	นกภูหงอนหัวน้ำตาลแดง Striated Yuhina	*Yuhina castaniceps* (Moore) 1854.	STYN	R	FGI	0	6	0	6	-	-
168	นกอีวาบตั๊กแตน Plaintive Cuckoo	*Cacomantis merulinus* (Scopoli) 1786.	PTCK	M	FGI	3	1	2	6	-	-
169	เหยี่ยวขาว Black-shouldered Kite	*Elanus caeruleus* (Desfontaines) 1789.	BSKI	R	R	4	0	2	6	-	-
170	นกเฉี่ยวบุ้งใหญ่ Black-winged Cuckooshrike	*Coracina melaschistos* (Hodgson) 1836.	BWCS	R	FGI	1	1	4	6	-	-
171	นกกาฝากปากหนา Thick-billed Flowerpecker	*Dicaeum agile* (Tickell) 1833.	TBFP	R	AF	3	0	2	5	-	-
172	นกคัคคูมรกต Asian Emerald Cuckoo	*Chrysococcyx maculatus* (Gmelin) 1788.	AECK	R	FGI	0	4	1	5	-	-
173	เหยี่ยวนกเขาชิครา Shikra	*Accipiter badius* (Gmelin) 1788.	SHKA	R	R	3	0	2	5	-	-
174	นกแว่นตาขาวหลังเขียว Japanese White-eye	*Zosterops japonicus* Temminck and Schlegel, 1847.	JPWE	M	FGI	3	0	2	5	-	-
175	เหยี่ยวภูเขา Mountain Hawk Eagle	*Spizaetus nipalensis* (Hodgson) 1836.	MTHE	R	R	1	2	2	5	NT	-
176	นกกินแมลงหัวสีทอง Golden Babbler	*Stachyris chrysaea* Blyth, 1844.	BDBB	R	FGI	0	4	0	4	-	-
177	นกกินปลีคอแดง Crimson Sunbird	*Aethopyga siparaja* (Raffles) 1822.	CSSB	R	IN	1	1	2	4	-	-

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178	นกจู๋เต้นเขาปูน Limestone Wren Babbler	*Napothera crispifrons* (Blyth) 1855.	LTVB	R	TI	0	0	4	4	VU	-
179	นกหัวขวานด่างแคระ Grey-capped Woodpecker	*Dendrocopos canicapillus* (Blyth) 1845.	GCWP	R	BGI	2	0	2	4	-	-
180	นกเดินดงสีคล้ำ Eyebrowed Thrush	*Turdus obscurus* Gmelin, 1789.	EBTH	M	TI	0	0	4	4	-	-
181	นกกระจิ๊ดเขียวคล้ำ Greenish Warbler & Two-barred	*Phylloscopus trochiloides* (Sundevall) 1837.	GNWB	M	FGI	2	0	2	4	-	-
182	นกกระจิ๊ดสีคล้ำ Dusky Warbler	*Phylloscopus fuscatus* (Blyth) 1842.	DKWB	M	FGI	1	3	0	4	-	-
183	นกกะลิง นกกะแล Grey-headed Parakeet	*Psittacula finschii* (Hume) 1874.	GHPK	R	AF	3	0	0	3	-	-
184	นกกินปลีแก้มสีทับทิม Ruby-cheeked Sunbird	*Anthreptes singalensis* (Gmelin) 1788.	RCSB	R	IN	0	0	3	3	-	-
185	นกคุ่มอกลาย Barred Buttonquail	*Turnix suscitator* (Gmelin) 1789.	BRBT	R	TF	2	1	0	3	-	-
186	นกจับแมลงเล็กขาวดำ Little Pied Flycatcher	*Ficedula westermanni* (Sharpe) 1888.	LPFC	R	FGI	0	0	3	3	-	-
187	นกจับแมลงอกสีฟ้า Hainan Blue Flycatcher	*Cyornis hainanus* (Ogilvie-Grant) 1900.	HBFC	R	FGI	0	2	1	3	-	-
188	นกพญาปากกว้างหางยาว Long-tailed Broadbill	*Psarisomus dalhousiae* (Jameson) 1836.	LTBR	R	FGI	0	0	3	3	-	-
189	นกหัวขวานแคระจุดรูปหัวใจ Heart-spotted Woodpecker	*Hemicircus canente* (Lesson) 1830.	HPWP	R	BGI	1	0	2	3	-	-
190	นกแอ่นใหญ่หัวตาขาว Brown-backed Needletail	*Hirundapus giganteus* (Temminck) 1825.	BBNT	R	SwI	3	0	0	3	-	-
191	เหยี่ยวนกกระจอกเล็ก Besra	*Accipiter virgatus* (Temminck) 1822.	BSRA	R	R	2	1	0	3	-	-
192	นกโพระดกธรรมดา นกโพระดกสวน Lineated Barbet	*Megalaima lineata* (Vieillot) 1816.	LNBA	R	AIF	0	0	3	3	-	-
193	นกกระจิ๊ดหางขาวเล็ก White-tailed Leaf Warbler	*Phylloscopus davisoni* (Oates) 1889.	WTWB	M	FGI	0	0	3	3	-	-
194	นกกาฝากอกสีเพลิง Fire-breasted Flowerpecker	*Dicaeum ignipectus* (Blyth) 1843.	FBFP	R	AF	0	0	2	2	-	-
195	นกกินปลีด่าม่วง Purple Sunbird	*Nectarinia asiatica* (Latham) 1790.	PPSB	R	IN	1	1	0	2	-	-
196	นกคัดคูด่าง Pied Cuckoo	*Clamator jacobnus* (Boddaert) 1783.	PICK	M	FGI	0	0	2	2	-	-
197	นกจับแมลงหลังสีเทา Slaty-backed Flycatcher	*Ficedula hodgsonii* (Verreaux) 1871.	SBFC	M	FGI	2	0	0	2	-	-
198	นกตะขาบดง Dollarbird	*Eurystomus orientalis* (Linnaeus) 1766.	DLBR	R	SaI	2	0	0	2	-	-
199	นกเขาพม่า Oriental Turtle Dove	*Streptopelia orientalis* (Latham) 1790.	OTDO	R	TF	2	0	0	2	-	-
200	นกพงปากหนา Thick-billed Warbler	*Acrocephalus aedon* (Pallas) 1776.	TBWR	M	FGI	1	1	0	2	-	-
201	นกเขาลายใหญ่ Barred Cuckoo Dove	*Macropygia unchall* (Wagler) 1827.	BCDO	R	TF	0	1	1	2	-	-
202	นกสีชมพูสวน Scarlet-backed Flowerpecker	*Dicaeum cruentatum* (Linnaeus) 1758.	SBFP	R	AF	0	0	2	2	-	-
203	นกหัวขวานด่างหัวแดงอกลาย Stripe-breasted Woodpecker	*Dendrocopos atratus* (Blyth) 1849.	SBWP	R	BGI	0	1	1	2	-	-

Appendix Table 17 (Continued)

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
204	นกหัวขวานสามนิ้วหลังทอง Common Flameback	*Dinopium javanense* (Ljungh) 1797.	CMFB	R	BGI	0	2	0	2	-	-
205	นกอัญชันป่าขาแดง Red-legged Crake	*Rallina fasciata* (Raffles) 1822.	RLCR	R	TI	0	2	0	2	NT	-
206	นกอีเสือหลังเทา Grey-backed Shrike	*Lanius tephronotus* (Vigors) 1831.	GBSH	M	FGI	1	1	0	2	-	-
207	นกอีแพรดแถบอกดำ Pied Fantail	*Rhipidura javanica* (Sparrman) 1788.	PIFT	R	FGI	0	0	2	2	-	-
208	นกเงือกคอแดง Rufous-necked Hornbill	*Aceros nipalensis* (Hodgson) 1829.	RNHB	R	FF	0	1	1	2	EN	VU
209	นกเปล้าคอสีม่วง Pink-necked Green Pigeon	*Treron vernans* (Linnaeus) 1771.	PNPG	R	AF	2	0	0	2	-	-
210	นกแต้วแล้วธรรมดา นกกอหลอ นกแต้วแล้วป่า Blue-winged Pitta	*Pitta moluccensis* (Muller) 1776.	BWPT	R/M	TI	1	0	1	2	-	-
211	นกกระจิบคอดำ Dark-necked Tailorbird	*Orthotomus atrogularis* Temminck, 1836.	DNTB	R	FGI	2	0	0	2	-	-
212	เหยี่ยวหน้าเทา Grey-faced Buzzard	*Butastur indicus* (Gmelin) 1788.	GFBZ	M	R	0	1	0	1	-	-
213	เหยี่ยวฮอบบีเอเชีย Oriental Hobby	*Falco severus* Horsfield, 1821.	OTHB	R	R	0	0	1	1	VU	-
214	นกกางเขนน้ำหัวขาว White-crowned Forktail	*Enicurus leschenaulti* (Vieillot) 1818.	WBFT	R	FGI	0	0	1	1	-	-
215	นกคัคคูแซงแซว Drongo Cuckoo	*Surniculus lugubris* (Horsfield) 1821.	DGCK	R/M	FGI	0	1	0	1	-	-
216	นกคัคคูสีม่วง Violet Cuckoo	*Chrysococcyx xanthorhynchus* (Horsfield) 1821.	VLCK	R/M	FGI	1	0	0	1	-	-
217	นกคัคคูหงอน Chestnut-winged Cuckoo	*Clamator coromandus* (Linnaeus) 1766.	CWCK	M	FGI	0	0	1	1	-	-
218	นกคุ่มอีดใหญ่ Yellow-legged Buttonquail	*Turnix tanki Blyth,* 1843.	YLBQ	R	TF	0	0	1	1	-	-
219	นกจับแมลงคอสีน้ำเงินเข้ม Blue-throated Flycatcher	*Cyornis rubeculoides* (Vigors) 1831.	BTFC	R	FGI	1	0	0	1	-	-
220	นกจับแมลงสีคล้ำ Dark-sided Flycatcher	*Muscicapa sibirica* Gmelin, 1789.	DSFC	M	FGI	1	0	0	1	-	-
221	นกจับแมลงอกสัมท้องขาว Tickell's Blue Flycatcher	*Cyornis tickelliae* Blyth, 1843.	TBFC	R	FGI	0	0	1	1	-	-
222	นกจาบคาคอสีฟ้า Blue-throated Bee-eater	*Merops viridis* Linnaeus, 1758.	BTBE	M	SaI	0	1	0	1	-	-
223	นกจาบฝนปีกแดง Rufous-winged Bushlark	*Mirafra assamica* Horsfield, 1840.	RWBL	R	TF	0	0	1	1	-	-
224	นกจู๋เต้นหางสั้น Streaked Wren Babbler	*Napothera brevicaudata (*Blyth) 1855.	SKWB	R	TI	0	0	1	1	-	-
225	นกปรอดหน้านวล Yellow-vented Bulbul	*Pycnonotus goiavier* (Scopoli) 1786.	YWBU	R	AIF	1	0	0	1	-	-
226	เหยี่ยวกิ้งก่าสีดำ Black Baza	*Aviceda leuphotes* (Dumont) 1820.	BLBZ	M	R	0	0	1	1	-	-
227	นกพงตั๊กแตนอกลาย Lanceolated Warbler	*Locustella lanceolata* (Temminck) 1840.	LCWB	M	FGI	1	0	0	1	-	-
228	นกมุ่นรกตาแดง Grey-cheeked Fulvetta	*Alcippe morrisonis* Swinhoe, 1863.	GCFT	R	FGI	0	0	1	1	-	-

Appendix Table 17 (Continued)

No.	Thai and common names	Species name	Name code	Biological Status[1]	Feeding guild[2]	Numer of bird detections from 3 sites				Conservation status[4]	
						6-8 years old	10-12 years old	DEF[3]	Total	ONEP	IUCN
229	นกยอดหญ้าสีเทา Grey Bushchat	*Saxicola ferrea* Gray, 1846.	GEBC	M	FGI	0	1	0	1	-	-
230	นกหัวขวานเขียวป่าไผ่ Laced Woodpecker	*Picus vittatus* Vieillot, 1818.	LCWP	R	BGI	0	0	1	1	-	-
231	นกหัวขวานเขียวหัวดำ Grey-headed Woodpecker	*Picus canus* Gmelin, 1788.	GHWP	R	BGI	0	0	1	1	-	-
232	นกหัวขวานด่างท้องดำ Black-and-buff Woodpecker	*Meiglyptes jugularis* (Blyth) 1845.	BBWP	R	BGI	0	0	1	1	-	-
233	นกอีเสือหลังแดง Burmese Shrike	*Lanius collurioides* Lesson, 1834.	BUSH	R	FGI	1	0	0	1	-	-
234	นกเค้ากู่ นกฮูก Collared Scops Owl	*Otus bakkamoena* Pennant, 1769.	CLSO	R	R	0	1	0	1	-	-
235	นกเค้าภูเขา Mountain Scops Owl	*Otus spilocephalus* (Blyth) 1846.	MTSO	R	R	1	0	0	1	-	-
236	นกเฉี่ยวดงธรรมดา นกเฉี่ยวดงคิ้วขาว Common Woodshrike	*Tephrodornis pondicerianus* (Gmelin) 1789.	LASW	R	FGI	0	1	0	1	-	-
237	นกเด้าดินสวน Olive-backed Pipit	*Anthus hodgsoni* Richmond, 1907.	OBPP	M	TI	0	1	0	1	-	-
238	นกเด้าลมดง Forest Wagtail	*Dendronanthus indicus* (Gmelin) 1789.	FRWT	M	TI	0	1	0	1	-	-
239	เหยี่ยวนกเขาหงอน Crested Goshawk	*Accipiter trivergatus* (Temminck) 1824.	CTGH	R	R	1	0	0	1	-	-
240	นกเดินดงเล็กปากยาว Dark-sided Thrush	*Zoothera marginata* Blyth, 1847.	DSTH	R	TI	0	0	1	1	-	-
241	นกเดินดงหัวสีส้ม Orange-headed Thrush	*Zoothera citrina* (Latham) 1790.	OHTH	R/M	TI	0	0	1	1	-	-
242	นกเอี้ยงสาลิกา Common Myna	*Acridotheres tristis* (Linnaeus) 1766.	CMMN	R	AIF	1	0	0	1	-	-
243	นกเอี้ยงหัวสีทอง Golden-crested Myna	*Ampeliceps coronatus* Blyth, 1842.	GCMN	R	AIF	1	0	0	1	-	-
244	นกแต้วแล้วหูยาว Eared Pitta	*Pitta phayrei* (Blyth) 1863.	EAPT	R	TI	0	0	1	1	-	-
245	นกกระจิ๊ดอกลายเหลือง Yellow-streaked Warbler	*Phylloscopus armandii* (Milne-Edwards) 1865.	YSWB	M	FGI	1	0	0	1	-	-

[1] Status derived from Lekagul and Round (1991); R=resident and M= Migrant

[2] Feeding guild ; AF=Arboreal frugivores; AIF =Arboreal insectivore/frugivore; BGI =Bark-gleaning insectivore; FF= Arboreal faunivore/frugivore; FGI = Foliage-gleaning insect ; R= Raptor including pisivore ; IN= Insectivore/nectarivore; SaI =Sallying insectivore ; SwI= Sweeping insectivore ; TF= Terrestrial insectivore; TI= Terrestrial insectivore and TIF= Terrestrial insectivore/frugivore

[3] DEF=dry evergreen forest

[4] Status of birds as pertains to ONEP= Office of Natural Resources and Environmental Policy and Planning (2005) and IUCN= the International Union for Conservation of Nature (2003)

Appendix Table 18 Bird species , mean level and Shanon-Wiener Index(*H'*) of 170 species in the abandoned settlement area and dry evergreen forest.

				ASA			DEF		
No.	**Thai name**	**Scientific name**	**CODE**	**Level**	***H'***	**Pop.***	**Level**	***H'***	**Pop.***
1	ไก่ฟ้าหลังเทา	*Lophura leucomelanos* (Latham) 1790.	KLPS	1	0	9	1	0.53	9
2	นกกระทาดงอกสีน้ำตาล	*Arborophila brunneopectus* (Blyth) 1855.	BBPT	1	0	8	1	0.65	71
3	ไก่ป่า	*Gallus gallus* (Linnaeus) 1758.	RJFO	1	0	8	1	0	23
4	นกหัวขวานแดงหลังลาย	*Blythipicus pyrrhotis* (Hodgson) 1837.	BAWP	1	0	1	3	0.67	5
5	นกปรอดเล็กสีไพลตาแดง	*Iole virescens* Blyth 1845.	OLBU	1	0	1	3	0	2
6	นกกะรางหัวขวาน	*Upupa epops* Linnaeus, 1758.	CMHP	1	0.69	4	-	-	-
7	นกคุ่มอกลาย	*Turnix suscitator* (Gmelin) 1789.	BRBT	1	0	2	-	-	-
8	นกจับแมลงคอน้ำตาลแดง	*Muscicapa ferruginea* (Hodgson) 1845.	HIFC	2	0	3	1	0.64	3
9	นกกระจิ๊ดขั้วโลกเหนือ	*Phylloscopus borealis* (Blasius) 1858.	ACWB	2	0	2	1	0.69	2
10	นกกระจิบหญ้าท้องเหลือง	*Prinia flaviventris* (Delessert) 1840.	YBPN	2	0.19	75	2	0.69	8
11	นกกินแมลงป่าอกสีน้ำตาล	*Pellorneum tickeli* Blyth, 1859.	BBBB	2	0.19	66	2	0.77	88
12	นกกระจิบธรรมดา	*Orthotomus sutorius* (Pennant) 1769.	CMTB	2	0	54	2	0.31	11
13	นกกินแมลงอกเหลือง	*Macronous gularis* (Horsfield) 1822.	STTB	2	0.8	34	2	0.96	77
14	นกกระจิบหญ้าสีข้างแดง	*Prinia rufescens* Blyth, 1847.	RCPN	2	0.16	26	2	0	10
15	นกกินปลีอกเหลือง	*Nectarinia jugularis* (Linnaeus) 1766.	OBSB	2	0.75	20	2	1.04	11
16	นกปรอดสีขี้เถ้า	*Hemixos flavala* (Blyth) 1845.	ASBU	2	0.69	16	2	1.65	72
17	นกกินแมลงคอเทา	*Stachyris nigriceps* Blyth, 1844.	GTBB	2	0	16	2	0	22
18	นกจับแมลงหัวเทา	*Culicicapa ceylonensis* (Swainson) 1820.	GHFC	2	0.99	15	2	1.31	73
19	นกจับแมลงคอแดง	*Ficedula parva* (Bechstein) 1792.	RTFC	2	0.5	10	2	0.64	3
20	นกปรอดโอ่งหน้าผากเทา	*Alophoixus flaveolus* (Gould) 1836.	WTBU	2	0.69	9	2	1.25	203
21	นกกินแมลงคอลาย	*Stachyris striolata* (Muller) 1835.	SNBB	2	0	9	2	0	15
22	นกหัวขวานจิ๋วคิ้วขาว	*Sasia ochracea* Hodgson, 1836.	WPPL	2	0	7	2	0.69	2
23	นกกางเขนดง	*Copsychus malabaricus* (Scopoli) 1788.	WRSM	2	0.64	6	2	0	8
24	นกกระจิบหญ้าอกเทา	*Prinia hodgsonii* Blyth, 1844.	GBPN	2	1.1	3	2	0	6
25	นกพงคิ้วดำ	*Acrocephalus bistrigiceps* Swinhoe, 1860.	BBRW	2	0	3	2	0	4
26	นกกินปลีหางยาวคอดำ	*Aethopyga saturata* (Hodgson) 1836.	BASB	2	0	1	2	1.16	11
27	นกกระจิ๊ดคิ้วดำท้องเหลือง	*Phylloscopus ricketti* (Slater) 1897.	SBWB	2	0	1	2	0.69	6
28	นกหัวขวานสีตาล	*Celeus brachyurus* (Vieillot) 1818.	RFWP	2	0	1	2	0	1

Appendix Table 18 (Continued)

No.	Thai name	Scientific name	CODE	ASA			DEF		
				Level	*H′*	Pop.*	Level[d]	*H′*	Pop.*
29	นกจับแมลงคอสีน้ำเงินเข้ม	*Cyornis rubeculoides* (Vigors) 1831.	BTFC	2	0	1	2	0	1
30	นกเขาเขียว	*Chalcophaps indica* (Linnaeus) 1758.	EMDO	2	0	1	2	0	5
31	นกปรอดหัวสีเขม่า	*Pycnonotus aurigaster* (Vieillot) 1818.	SOBU	2	0.73	29	3	0.56	8
32	นกกระจิ๊ดเขียวคล้ำ	*Phylloscopus trochiloides* (Sundevall) 1837.	GNWB	2	0.45	24	3	0.69	2
33	นกปลีกล้วยเล็ก	*Arachnothera longirostra* (Latham) 1790.	LTSH	2	0.67	23	3	0.75	27
34	นกกระจิ๊ดธรรมดา	*Phylloscopus inornatus* (Blyth) 1842.	CMWB	2	0.76	11	3	1.37	19
35	นกปรอดหัวตาขาว	*Pycnonotus flavescens* Blyth, 1845.	FCBU	2	0.33	10	3	1.2	28
36	นกพญาปากกว้างอกสีเงิน	*Serilophus lunatus* (Gould) 1834.	SBBR	2	0	2	3	0.86	18
37	นกขุนแผนหัวแดง	*Harpactes erythrocephalus* (Gould) 1834.	RHTG	2	0.69	2	3	0.96	19
38	นกมุ่นรกตาขาว	*Alcippe poioicephala* (Jerdon) 1844.	BCFT	2	0	1	3	1.33	34
39	นกแก๊ก	*Anthracoceros albirostris* (Shaw and Nodder) 1807.	OPHB	2	1.08	8	4	1.24	23
40	นกตะขาบทุ่ง	*Coracias benghalensis* (Linnaeus) 1758.	IDRL	2	0.69	2	4	0	1
41	นกภูหงอนท้องขาว	*Yuhina zantholeuca* (Blyth) 1844.	WBYN	2	0	1	4	1.06	14
42	นกกระจิ๊ดหางขาวใหญ่	*Phylloscopus reguloides* (Blyth) 1842.	BLWB	2	0	1	4	0.41	14
43	นกจับแมลงจุกดำ	*Hypothymis azurea* (Boddaert) 1783.	RBFC	2	0.45	6	5	1.25	26
44	นกติ๊ดสุลต่าน	*Melanochlora sultanea* (Hodgson) 1837.	STTI	2	0.67	5	5	1.46	22
45	นกกินแมลงกะหม่อมแดง	*Timalia pileata* Horsfield, 1821.	CCBB	2	0.11	44	-	-	-
46	นกกระติ๊ดขี้หมู	*Lonchura punctulata* (Linnaeus) 1758.	SBMN	2	0	32	-	-	-
47	นกกระติ๊ดตะโพกขาว	*Lonchura striata* (Linnaeus) 1766.	WRNN	2	0	15	-	-	-
48	นกกระจิบคอดำ	*Orthotomus atrogularis* Temminck, 1836.	DNTB	2	0.64	12	-	-	-
49	นกจาบปีกอ่อนสีตาล	*Emberiza rutila Pallas, 1776.*	CNBT	2	0.53	9	-	-	-
50	นกยอดหญ้าสีดำ	*Saxicola caprata* (Linnaeus) 1766.	PIBC	2	0.45	6	-	-	-
51	นกคอทับทิม	*Luscinia calliope* (Pallas) 1776.	SRRT	2	0	3	-	-	-
52	นกกระปูดเล็ก	*Centropus bengalensis* (Gmelin) 1788.	LSCC	2	0	3	-	-	-
53	นกกระจิ๊ดขาสีเนื้อ	*Phylloscopus tenellipes* Swinhoe, 1860.	PAWB	2	0	3	-	-	-
54	นกยอดหญ้าหัวดำ	*Saxicola torquata* (Linnaeus) 1766.	CMSC	2	0	2	-	-	-
55	นกจาบดินอกลาย	*Pellorneum ruficeps* Swainson, 1832.	PTBB	2	0	2	-	-	-
56	นกเค้าแคระ	*Glaucidium brodiei* (Burton) 1836.	CLOL	2	0	2	-	-	-

Appendix Table 18 (Continued)

No.	Thai name	Scientific name	CODE	ASA			DEF		
				Level	*H′*	Pop.*	Level[d]	*H′*	Pop.*
57	นกกางเขนบ้าน	*Copsychus saularis* (Linnaeus) 1758.	OMRB	2	0	2	-	-	-
58	นกกระจอกตาล	*Passer flaveolus* Blyth, 1844.	PBSR	2	0	2	-	-	-
59	นกอีเสือหลังเทา	*Lanius cristatus* Linnaeus, 1758.	GBSH	2	0	1	-	-	-
60	นกอีเสือหลังแดง	*Lanius collurioides* Lesson, 1834.	BUSH	2	0	1	-	-	-
61	นกจาบคาคอสีฟ้า	*Merops viridis Linnaeus, 1758.*	BTBE	2	0	1	-	-	-
62	นกคัดคูเหยี่ยวใหญ่	*Hierococcyx sparverioides* (Vigors) 1832.	LHCK	2	0	1	-	-	-
63	นกกินแมลงตาเหลือง	*Chrysomma sinense* (Gmelin) 1789.	YEBB	2	0	1	-	-	-
64	นกกินปลีดำม่วง	*Nectarinia asiatica* (Latham) 1790.	PPSB	2	0	1	-	-	-
65	นกจับแมลงสีคล้ำ	*Muscicapa sibirica* Gmelin, 1789.	DSFC	2	0	1	-	-	-
66	นกระวังไพรปากเหลือง	*Pomatorhinus schisticeps* Hodgson, 1836.	WBSB	3	1.04	20	2	0	15
67	นกตั้งล้อ	*Megalaima virens* (Boddaert) 1783.	GRBA	3	0.89	11	2	1.77	29
68	นกกะรางหัวหงอก	*Garrulax leucolophus* (Hardwicke) 1815.	WCLT	3	0.66	8	2	0.8	151
69	นกจับแมลงสีฟ้า	*Eumyias thalassina* Swainson, 1838.	VTFC	3	0.56	4	2	0.69	2
70	นกกระจ้อยวงตาสีทอง	*Seicercus burkii* (Burton) 1836.	GSWB	3	0.64	3	2	0.85	9
71	นกแซงแซวหางปลา	*Dicrurus macrocercus* (Vieillot) 1817.	BADG	3	0	2	2	1.08	8
72	นกกินแมลงหน้าผากน้ำตาล	*Stachyris rufifrons* Hume, 1873.	RFBB	3	0	1	2	0.82	33
73	นกหัวขวานจิ๋วท้องลาย	*Picumnus innominatus* Burton, 1836.	SPPL	3	0	1	2	0.56	4
74	นกปรอดเหลืองหัวจุก	*Pycnonotus melanicterus* (Gmelin) 1789.	BCBU	3	1.36	92	3	1.55	224
75	นกแซงแซวเล็กเหลือบ	*Dicrurus aeneus* Vieillot, 1817.	BRDG	3	1.22	40	3	1.59	59
76	นกปรอดดำ	*Hypsipetes leucocephalus* (Gmelin) 1789.	BLBU	3	1.18	27	3	1.65	97
77	นกโพระดกคอสีฟ้า	*Megalaima asiatica* (Latham) 1790.	BTBA	3	1.31	26	3	1.35	28
78	นกปลีกล้วยลาย	*Arachnothera magna* (Hodgson) 1837.	STSH	3	0.69	25	3	1.2	60
79	นกแซงแซวสีเทา	*Dicrurus leucophaeus* Vieillot, 1817.	ASDG	3	1.18	22	3	1.08	22
80	นกกะลิงเขียดสีเทา	*Dendrocitta formosae* Swinhoe, 1863.	GRTP	3	1.2	20	3	1.51	19
81	นกปรอดภูเขา	*Hypsipetes mcclellandii* Horsfield, 1840.	MTBU	3	0.65	17	3	1.55	96
82	นกเขียวคราม	*Irena puella* (Latham) 1790.	AFBL	3	1.47	14	3	1.65	50
83	นกปั้งรอกใหญ่	*Phaenicophaeus tristis* (Lesson) 1830.	GBMK	3	1.31	12	3	1.16	11
84	นกหกเล็กปากแดง	*Loriculus vernalis* (Sparrman) 1787.	VHPR	3	0.8	7	3	1.25	28

Appendix Table 18 (Continued)

No.	Thai name	Scientific name	CODE	ASA			DEF		
				Level	*H′*	Pop.*	Level[d]	*H′*	Pop.*
85	นกหัวขวานใหญ่หงอนเหลือง	*Mulleripicus pulverulentus* (Temminck) 1826.	GTYU	3	1.24	6	3	1.07	18
86	นกแซงแซวหางบ่วงใหญ่	*Dicrurus paradiseus* (Linnaeus) 1766.	GRDG	3	0	5	3	1.72	27
87	นกเขนน้อยปีกแถบขาว	*Hemipus picatus* (Sykes) 1832.	BAFS	3	0	1	3	0.74	8
88	นกปรอดหัวโขน	*Pycnonotus jocosus* (Linnaeus) 1758.	RWBU	3	1.32	851	4	1.53	114
89	นกแซงแซวหงอกขน	*Dicrurus hottentottus* (Linnaeus) 1766.	SPDG	3	1.33	105	4	1.06	133
90	นกขมิ้นหัวดำใหญ่	*Oriolus xanthornus* (Linnaeus) 1758.	BHOR	3	0.9	10	4	1.15	7
91	นกแว่นตาขาวสีทอง	*Zosterops palpebrosus* (Temminck) 1824.	OTWE	3	0.69	4	6	0.45	6
92	นกกาฝากสีเรียบ	*Dicaeum concolor* Jerdon, 1840.	PLFB	3	0	2	7	0	4
93	นกเขาใหญ่	*Streptopelia chinensis* (Scopoli) 1786.	SPDO	3	0.63	19	-	-	-
94	นกกิ้งโครงปีกลายจุด	*Saroglossa spiloptera* (Vigors) 1831.	SWSL	3	0.64	15	-	-	-
95	นกกระจิ๊ดหัวมงกุฎ	*Phylloscopus coronatus* (Temminck and Schlegel) 1847.	ECWB	3	0	4	-	-	-
96	นกกระปูดใหญ่	*Centopus sinensis* (Stephens) 1815.	GTCC	3	0.64	3	-	-	-
97	นกแอ่นใหญ่หัวตาขาว	*Hirundapus giganteus* (Temminck) 1825.	BBNT	3	0	3	-	-	-
98	นกเฉี่ยวบุ้งใหญ่	*Coracina melaschistos* (Hodgson) 1836.	BWCS	3	0.69	2	-	-	-
99	นกเขาไฟ	*Streptopelia tranquebarica* (Hermann) 1804.	RCDO	3	0.69	2	-	-	-
100	นกขมิ้นน้อยปีกสีเรียบ	*Aegithina lafresnayei* (Hartlaub) 1844.	GEIR	3	0	2	-	-	-
101	นกพญาไฟใหญ่	*Pericrocotus flammeus* (Forster) 1781.	SCMN	4	1.49	39	3	1.43	80
102	นกขุนทอง	*Gracula religiosa* Linnaeus, 1758.	HIMN	4	0.56	8	4	1.09	13
103	นกเขียวก้านตองปีกสีฟ้า	*Chloropsis cochinchinensis* (Gmelin) 1788.	BWLB	4	0	2	4	1.06	5
104	นกมูม	*Ducula badia* (Raffles) 1822.	MIPG	4	1.46	52	5	1.53	72
105	นกขี้เถ้าใหญ่	*Coracina macei* (Lesson) 1831.	LACS	4	0.69	2	5	0.64	3
106	นกนางแอ่นตะโพกแดง	*Hirundo daurica* Linnaeus, 1776.	RRSL	4	0.23	16	-	-	-
107	นกปรอดเล็กตาขาว	*Iole propinqua* (Oustalet) 1903.	GEBU	5	0.67	5	2	1.06	5
108	นกหัวขวานแดงลาย	*Picus mineaceus* Pennant, 1769.	BDWP	5	0	1	4	0	2
109	นกเขาเปล้าธรรมดา	*Treron curvirostra* (Gmelin) 1789.	TBPG	5	0.79	65	5	1.15	32
110	เหยี่ยวรุ้ง	*Spilornis cheela* (Latham) 1790.	CRSE	5	0.69	2	5	0	1
111	นกเงือกกรามช้าง	*Aceros undulatus* (Shaw) 1811.	WTHB	5	0.35	9	7	1.08	7
112	นกแอ่นพง	*Cypsiurus balasinensis* (Gray) 1829.	ASWS	5	1.29	11	-	-	-

Appendix Table 18 (Continued)

No.	Thai name	Scientific name	CODE	ASA			DEF		
				Level	*H′*	Pop.*	Level[d]	*H′*	Pop.*
113	นกแอ่นตาล	*Acridotheres tristis* (Linnaeus) 1766.	APSW	5	0.56	8	-	-	-
114	เหยี่ยวขาว	*Artamus fuscus* Vieillot, 1817.	BSKI	5	0.69	2	-	-	-
115	นกหัวขวานสี่นิ้วหลังทอง	*Chrysocolaptes lucidus* (Scopoli) 1796.	GTFB	5	0	2	-	-	-
116	เหยี่ยวนกเขาหงอน	*Accipiter trivergatus* (Temminck) 1824.	GRGH	5	0	1	-	-	-
117	นกสาลิกาเขียว	*Cissa chinensis* (Boddaert) 1783.	CMGM	6	0	3	3	0.56	4
118	นกตีทอง	*Megalaima haemacephala* (Muller) 1776.	CPBA	6	0	1	3	0.64	3
119	นกโพระดกหน้าผากดำ	*Megalaima australis* (Horsfield) 1821.	BEBA	6	0	1	4	1.33	5
120	นกนางแอ่นบ้าน	*Hirundo rustica* Linnaeus, 1758.	BASL	7	0	2	-	-	-
121	นกแว่นสีเทา	*Polyplectron bicalcaratum* (Linnaeus) 1758.	GPPS	-	-	-	1	0.79	13
122	นกตบยุงหางยาว	*Caprimulgus macrurus* Horsfield, 1821.	LTNJ	-	-	-	1	0.69	2
123	นกกระทาดงคอสีแสด	*Arborophila rufogularis* (Blyth) 1850.	RTPT	-	-	-	1	0.38	8
124	นกอัญชันป่าขาแดง	*Rallina fasciata* (Raffles) 1822.	RLCR	-	-	-	1	0	1
125	นกแต้วแล้วสีน้ำเงิน	*Pitta cyanea* Blyth, 1843.	BLPT	-	-	-	1	0	1
126	นกจู๋เต้นคิ้วยาว	*Napothera epilepidota* (Temminck) 1827.	EBWB	-	-	-	1	0	5
127	นกกะรางสร้อยคอเล็ก	*Garrulax monileger* (Hodgson) 1836.	LNLT	-	-	-	2	0.73	20
128	นกหัวขวานแคระจุดรูปหัวใจ	*Hemicircus canente* (Lesson) 1830.	HPWP	-	-	-	2	0.69	2
129	นกเขียวก้านตองหน้าผากสีทอง	*Chloropsis aurifrons* (Temminck) 1829.	GFLB	-	-	-	2	0.69	2
130	นกอีแพรดคอขาว	*Rhipidura albicollis* (Vieillot) 1818.	WTFT	-	-	-	2	0.5	5
131	นกจู๋เต้นหางสั้น	*Napothera brevicaudata* (Blyth) 1855.	SKWB	-	-	-	2	0	1
132	นกจู๋เต้นเขาปูน	*Napothera crispifrons* (Blyth) 1855.	LTVB	-	-	-	2	0	4
133	นกจับแมลงคอขาวหน้าแดง	*Ficedula solitaris* (Muller) 1835.	RBFC	-	-	-	2	0	1
134	นกขุนแผนอกสีส้ม	*Harpactes oreskios* (Temminck) 1823.	OBTG	-	-	-	2	1.33	6
135	นกขมิ้นน้อยธรรมดา	*Aegithina tiphia* (Linnaeus) 1758.	CMIR	-	-	-	2	1.04	4
136	นกกระเต็นลาย	*Lacedo pulchella* (Horsfield) 1821.	BDKF	-	-	-	2	0.69	2
137	นกไต่ไม้หน้าผากก่ามะหยี่	*Sitta frontalis* Swainson, 1820.	VFNH	-	-	-	3	1.24	23
138	นกเสือแมลงหัวขาว	*Gampsorhynchus rufulus* Blyth, 1844.	WHBB	-	-	-	3	0.69	15
139	นกเงือกสีน้ำตาล	*Anorrhinus tickelli* (Blyth) 1855.	BRHB	-	-	-	3	0.65	23
140	นกพญาไฟสีกุหลาบ	*Pericrocotus roseus* (Vieillot) 1818.	RSMV	-	-	-	3	0.35	9

Appendix Table 18 (Continued)

No.	Thai name	Scientific name	CODE	ASA			DEF		
				Level	*H′*	Pop.*	Level[d]	*H′*	Pop.*
141	นกกระจ้อยคอขาว	*Abroscopus superciliaris* (Blyth) 1859.	YBWB	-	-	-	3	0	8
142	นกหัวขวานด่างแคระ	*Dendrocopos canicapillus* (Blyth) 1845.	GCWP	-	-	-	3	0	2
143	นกเฉี่ยวดงหางสีน้ำตาล	*Tephrodornis gularis* (Raffles) 1822.	LASW	-	-	-	3	0	2
144	นกเขนน้อยไซบีเรีย	*Luscinia cyane* (Pallas) 1776.	SRBR	-	-	-	3	0	1
145	นกกาฝากอกสีเพลิง	*Dicaeum ignipectus* (Blyth) 1843.	FBFP	-	-	-	3	0	2
146	นกกระจิ๊ดปากหนา	*Phylloscopus schwarzi* (Radde) 1863.	RDWB	-	-	-	3	0	4
147	นกกก	*Buceros bicornis* Linnaeus, 1758.	GRHB	-	-	-	3	1.08	8
148	นกขมิ้นแดง	*Oriolus traillii* (Vigors) 1832.	MROR	-	-	-	3	1.04	4
149	นกกะรางสร้อยคอใหญ่	*Garrulax pectoralis* (Gould) 1836.	GNLT	-	-	-	3	1.26	33
150	นกแซวสวรรค์	*Terpsiphone paradisi* (Linnaeus) 1758.	APFC	-	-	-	3	1.1	3
151	นกขมิ้นปากเรียว	*Oriolus tenuirostris* Blyth, 1846.	SBOR	-	-	-	4	0.69	6
152	นกหัวขวานใหญ่สีเทา	*Mulleripicus pulverulentus* (Temminck) 1826.	GSWP	-	-	-	4	0	2
153	นกแว่นตาขาวข้างแดง	*Zosterops erythropleurus* Swinhoe, 1863.	CFWE	-	-	-	4	0	30
154	นกพญาปากกว้างหางยาว	*Psarisomus dalhousiae* (Jameson) 1836.	LTBR	-	-	-	4	0	1
155	นกเปล้าหางพลั่ว	*Treron sphenura* (Vigors) 1832.	WTPG	-	-	-	4	0	3
156	นกกะรางอกสีน้ำตาลไหม้	*Garrulax strepitans* Blyth, 1855.	WNLT	-	-	-	4	0.67	10
157	นกแซงแซวหางบ่วงเล็ก	*Dicrurus remifer* (Temminck) 1823.	LRDG	-	-	-	5	1.43	9
158	นกเขาลายเล็ก	*Macropygia ruficeps* (Temminck) 1834.	LCDO	-	-	-	5	0.69	2
159	นกพญาไฟเล็ก	*Pericrocotus cinnamomeus* (Linnaeus) 1766.	SMMV	-	-	-	5	0	1
160	นกปรอดทอง	*Pycnonotus atriceps* (Temminck) 1822.	BHBU	-	-	-	5	0	2
161	นกเดินดงสีคล้ำ	*Turdus obscurus* Gmelin, 1789.	EBTH	-	-	-	5	0	4
162	นกเฉี่ยวบุ้งกลาง	*Coracina polioptera* (Sharpe) 1879.	ICCS	-	-	-	5	0	1
163	นกเขียวก้านตองท้องสีส้ม	*Chloropsis hardwickii* Jardine and Selby, 1830.	OBLB	-	-	-	5	0	1
164	เหยี่ยวแมลงปอขาแดง	*Accipiter soloensis* (Horsfield) 1821.	CLFC	-	-	-	6	0	1
165	เหยี่ยวภูเขา	*Spizaetus nipalensis* (Hodgson) 1836.	MTHE	-	-	-	6	0	2
166	เหยี่ยวนกเขาชิครา	*Elanus caeruleus* (Desfontaines) 1789.	SHKA	-	-	-	6	0	1
167	นกมุ่นรกตาแดง	*Alcippe morrisonis* Swinhoe, 1863.	GCFT	-	-	-	6	0	1
168	นกโพระดกคางเหลือง	*Megalaima franklinii* (Blyth) 1842.	GTBA	-	-	-	7	0	1

Appendix Table 18 (Continued)

No.	Thai name	Scientific name	CODE	ASA			DEF		
				Level	*H′*	Pop.*	Level[d]	*H′*	Pop.*
169	นกพญาไฟสีเทา	*Pericrocotus divaricatus* (Raffles) 1822.	ASMV	-	-	-	7	0	2
170	นกปรอดคอลาย	*Pycnonotus striatus* (Blyth) 1842.	SRBU	-	-	-	7	0	1

* **number of bird detections by species**

CURRICULUM VITAE

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