BIOTROPIA Vol. 19 No. 2, 2012: 64 - 79

TROPICAL FOREST TYPES IN WEST PAPUA, THE PRESENCE OF FOREST WALLABY (*Dorcopsis muelleri*) AND HUMAN DISTURBANCE

SEPUS FATEM[1*] & KARLE V. SYKORA[2]

[1] *Environmental and Forest Conservation Laboratory,Forestry Faculty, Papua State University, Jl. Gunung Salju Amban Manokwari, Papua Barat-Indonesia, 98314*
[2] *Nature Conservation and Plant Science Group, Environmental Dept, Wageningen University and Research Centre, The Netherlands*

Received 20 March 2012/Accepted 08 October 2012

ABSTRACT

The vegetation in the Nuni Watershed area, part of a tropical lowland forest area in the northern part of Manokwari, West Papua, was classified with Twinspan. The area is important as a natural habitat of the forest wallaby. Four habitat types comprising 6 plant communities could be distinguished belonging to grassland, four different types of open forest and undisturbed primary closed forest. A vegetation table is presented and species composition is described. Each vegetation plot the presence of trails, wallaby droppings, food remains and signs of human disturbance, i.e. logging, hunting and gardening activity, and distance to settlement areas was noted. The presence of Wallabies could only be noted in grassland, open forest with only little logging activity, and in undisturbed closed forest. It is strongly correlated to distance from villages and negatively correlated to logging and hunting. The relation with food plant availability appears to be only low. The results indicate that vegetation structure, vegetation composition and food plant availability are less important than human disturbance. Regulations reducing the disturbance by logging and hunting are urgently needed.

Key words: Wallaby, plant communities, vegetation analysis, wildlife, tropical forest, Papua

INTRODUCTION

The island of New Guinea (Papua New Guinea and West Papua) occupies a phytogeographically important position between Asia and West Melanesia on one hand, and Australia and the Pacific on the other.

In West Papua, many ecosystems occur in a range from the coastal to the alpine zone of which the tropical forest is the dominant ecosystem. Mammalian species are numerous in the tropical forest ecosystems of West Papua. New Guinea hosts a unique fauna of mammals due to its geological history (Petocz 1989; Muller 2005),

* Corresponding author : sepus_fatem@yahoo.com

differing from other areas in Indonesia, but also other regions in the world (Petocz 1994; Flannery 1995). However, forest fragmentation, changes the environment, i.e. the physical conditions, tree species richness or tree structure (Carlot 2009) and plant demography (Borhidi 1998). Changes in the size, shape or configuration of a habitat as a result of fragmentation has an effect on populations of various animals, such as small mammals), bird sand arboreal marsupials (Connel 1978; Chave 2008). Menzies (1991), Petocz (1994), Flannery (1995) and Westerman *et al.* (2001) suggest that the diversity in endemic marsupials of New Guinea is higher than is reflected by current classifications. Their population status, habitat, vegetation structure and food composition should urgently be studied in order to better understand their ecological needs. This knowledge can be used as guidelines for ecological planning and management to avoid habitat destruction and decline of endemic marsupials.

The current status and ecology of the forest wallaby (*Dorcopsis muelleri*, Macropodidae) is insufficiently known. Our study site Manokwari (West Papua) is part of its distribution area. The vegetation of Manokwari has hardly been described. In this research we describe the vegetation composition of the vegetation types in the Nuni Watershed area in the northern part of Manokwari Regency, West Papua. Besides, we investigated the presence of the forest wallaby and its relation with vegetation, including food plant availability and human influence.

Our research is based on the following questions:

1. What plant communities occur in the area and how are they characterised by species composition, soil, human influence and structure?
2. What is the presence of the forest wallaby in the different plant communities?
3. How can differences in forest wallaby presence be explained?.

MATERIALS AND METHODS

The vegetation in the Nuni Watershed area, part of tropical lowland forest area in the northern part of Manokwari Regency, West Papua provinces was studied between February 4 and April 6, 2010. For a map showing the location see Appendix 1 (Internet appendix).

The vegetation composition and the wallaby presence was studied in 8 transects of 4 vegetation plots or relevés sized 50 x 50 m and one extra plot of 70 x 70 m, i.e. 33 plots in total. In order to have a wider range of forest types and possible densities of forest Wallabies, one extra plot of 70x70 was made. The bigger size did not, however, influence the plant species composition and wallaby presence. Due to the purpose for comparing, which plot more presence and covered macropodidae present. The transects were selected based on differences in forest type, hunting and logging intensity and distance from villages. Average distance between the plots was 50-70 m. The survey was done in primary forest, open forest and grassland, from the river bank upward to the top of the mountain.

Vegetation composition was recorded using the Braun-Blanquet method. Cover was estimated using the scale as modified by Barkman, Doing and Segal (1964). This scale was transformed into an ordinal 9 scale (Sykora 2009). Species, were identified according to Jhon (1997), Whitmore (1997); Paijmans (1976); Van Steenis C.G.G.J *et al.* (2005); Lekitto *et al.* (2008); C.G.G. J van Steenis (1989). Most of the identification was done directly in the field and only few species were identified in Herbarium of Papua State University, Manokwari-Indonesia.

The vegetation was classified using TWINSPAN (Hill & Gaugh 1980; Sýkora 2009; de Boer *et al.* 2009). The plant communities distinguished were named using two different and/or dominant species.

For each plot the presence of trails, wallaby droppings, food remains and signs of human disturbance, i.e. logging (number of tree stumps), hunting and gardening activity, and distance to settlement areas was noted. Hunting frequency per week/month/year was determined as well as the number of animals shot per hunting trip. The distance between settlement areas and the hunting areas was measured. The extent of the conversion of forests into gardens was registered by measuring the total garden area (m^2) and the distance to settlement area (m). The presence of Macropodidae species was recorded visually in each plot in the night, evening and morning. All strips were observed at the same time with two people per strip. For each plot the presence and cover (%) of food plant species was recorded.

The relation between vegetation composition and external variables like food avalability, anthropogenenic pressure and wallaby presence was studied using multivariate gradient analysis (Detrended Correspondence Analysis). Significance was tested by Monte Carlo Permutation Test.

RESULTS AND DISCUSSIONS

In this research we studied the habitat of forest wallaby (*Dorcopsis muelleri*) and its relation to vegetation composition. The plant communities in the different *D. muelleri* habitats were described. So far the habitat of the Macropodidae species has only been described in general terms (Menzies 1991; Petocz 1994; Flannery 1995). According to these authors Macropodidae, especially forest wallaby *Darcopsis muelleri,* occur from sea level up to an altitude of 400 m. Their habitats vary from flood plains, few gravel, bushy areas, rocky river banks to forested hills optimally to an altitude of 200 meter asl (Flannery 1995). However, habitat use and territory of this species has not yet been studied in more detail. The ecology of *Dorcopsis muelleri* has not been studied recently. Most research only focuses on tree kangaroos. The habitat used of forest wallaby is described.

Vegetation

A total of 258 plant species was recorded (245 angiosperms, 10 ferns allies, 3 gymnosperms, see Appendix 1). After TWINSPAN analysis, six plant communities were distinguished. Only four of these plant communities appeared to be used by *D. muelleri* as habitat. An overview is given of the habitat types and plant communities in which *D. muelleri* was found. The two plant communities where no activity of *D. muelleri* could be detected are described as well.

Habitats, plant communities and *D. muelleri* activity.

Grassland

This habitat type consists of a small thicket with grass species in combination with small herbs, woody herbs, shrubs and trees. The canopy is formed by small trees only and covers only 10 %. The herb layer is 90 cm high and there is no moss layer. The depth of the litter layer is only 1 cm.

It is represented by the *Imperata cylindrica* and *Ipomea aquatica* community which is characterised by 17 different species for habitat and food of forest wallaby. This habitat is characteristic of open sites: *Imperata* sp, *Ipomea batatas, Sacharum spontaneum, Neprolepsis biserata, Jussiaee octavilis, Malotus philipinensis, Piper aduncum, Macaranga mappa, Mimosa pudica, Muntingia callabura, Mucuna novaeguinesis, Puararai javanica, Spondias cytherea, Micania* sp. and *Zingiber* sp[2]. *Ipomea batatas*, *Zingiber* sp.[2], *Muntingia callabura* and *Mimosa pudica* provide food for forest wallabies.

Mostly the grass species such as *Imperata cylindrica* and *Sacharum spontaneum* are up to 1 m high. In Papua New Guinea, *Imperata cylindrica, Sacharum spontaneum*, *Sorghum nitidum* and *Phragmites karka,* common grass species of floodplains can grow up to 1-2 m high (Harkink 1987).

Grasslands grow all along the river basins and in small valleys, where they occur due to the fluctuating water levels resulting in temporary flooding, followed by drainage of the river banks. This grassland is presently the most common natural grassland of lowland tropical vegetation area in West Papua. This community is generally found on relatively flat (< 3°), temporarily flooded, sandy soil mixed with some gravel. As it occurs close to the river the sandy soil structure is crumbly, drainage is high and organic matter is lacking (Brookfield 1971; Petocz 1987; BPS 2009).

This habitat (Fig. 1) is mainly used by the forest wallaby as feeding area, but also for shelter and to drink and play. Trails and food remains were found of two individuals.

Figure 1. Typical river bank grassland consisting of sparse thicket, grasses and herbs. (Photo: SF Sepus Fatem)

This natural grassland, which can be very extensive (128 665 meters in one research site), is also used by animals like deer. Seventeen food plants were found with a mean cover of 2.1%.

OPEN FOREST

Two communities, the *Ficus robusta - Dendrochide* sp *community* and *Musa paradisiaca Callamus longipina* community, were distinguished in the open forest habitat, depending on the absence or presence of some logging activity.

Open forest transitional to grassland.

This habitat type, a transition between grassland and tall forest, is characterised by shrubs, climbing vines and woody vines, lianas and pioneer species combined with small trees (Fig. 2). The canopy cover is 47 % and the tree diameter is medium; besides some ferns and lianas occur. The herb layer is 51 cm high. It is commonly found surrounding the closed forest.

It is represented by the community *of Ficus robusta* and *Dendrochide* sp which is differentiated by *Hornstendia scottiana*, *Pandanus dubius*, *Derris alba*, *Sterculia shillinglawi*, *Ficus japonica*, *Carica papaya*, *Orioconide nitida*, *Endospernum moluccanum*, *Rhapidophora* sp, *Spathodea campanulata*, *Ficus* sp. 1, *Neolaleba atra*, *Durio zibethinus*, *Lancium domesticum*, *Cyatea molucanna*, *Mangifera indica*, *Dendrobium* sp, *Prinium* sp., *Callamus warbugii*, *Ananas comosus*, *Macaranga gigantea*, *Drymopholeus litigiosus*, *Cleytances* sp., *Ficus variegata* and *Cyatea molucanna*. Furthermore, *Ficus variegata, Mangifera indica, Sphatodea campanulata*, *Carica papaya, Ficus japonica*, *Ananas commosus* and *Lancium domesticum* were food plant wallaby in this habitat.

This forest type grows on hills at an altitude of approximately 40 meter above sea level. It occurs on inceptisols i.e. new immature, still developing soils with hardly any soil horizon. The depth of the solum is less than 2 m. The rock material in these sites mostly consists of sandstone and mudstone (Brookfield 1971; Petocz 1989; BPS 2009). The soil is covered with 2 cm of litter. The distance to the nearest village is about 6.5 km and anthropogenic pressure is low. Also the hunting frequency is very low (in average 1 time/month).

This forest type appears to be one of the main habitat types of *D. muelleri* due to the low human pressure and its importance as a feeding habitat. More than 5 individuals of forest wallaby were spotted and their dung and trails were observed. In average 12 (7-20) food plant species were found with a mean cover of 2.5 %.

Figure 2. Transition between river bank grassland and real forest (Photo : SF-Sepus Fatem)

Open forest after logging (successional forest)

Figure 3. Open forest after logging (Photo: SF-Sepus Fatem)

In this habitat type the process of secondary succession is clearly visible. Due to selective logging several trees with big diameter are still present. It is represented by three plant communities, the community of *Musa paradisiaca* and *Callamus longipina,* the community of *Diospyros hebecarpa-Lepinopsis ternatensis* and the *Smilax malacensis-Pandanus tectorius communit y* (Fig. 3).

The community of *Musa paradisiaca* and *Callamus longipina* is differentiated by *Musa paradisiaca, Callamus longipina, Palaquium lobbianum, Planconella obofata, Archidendron bogoriensis, Machinlaya celebia, Toona* sp, *Coleynea sperata, Fagraia rasemosa, Macaranga tesylata, Pigafetta filaris, Ficus tingtoria, Haplolobus selebica, Podocarpus blumei* and *Canarium indicum*. It is characterised by plants often seen some years after logging. *Musa paradisiaca* is a pioneer species, *Callamus longipina* and *Palaquium lobbianum* are light demanding and prefer open areas. The different species group is represented by plants indicative of high anthropogenic disturbance. Even though food plants like *Musa paradisiaca*, *Canarium indicum* and *Ficus tingtoria* are present no forest wallabies were registered.

Trees left over after logging have a height of 10-12 m, while tree of the regrowth reach 3-7 m. As the logging intensity was only low and the number of tree species selected to be cut was limited, the vegetation already started to restore after three years time. The average canopy cover is 48 %. The undergrowth is dominated by a species rich herb layer which is 90 cm tall, and by shrubs.

It grows on flat areas (average slope 7°) with an altitude between 38-45 m. asl, at a distance of about 4 km from the nearest village. The soil consits of an inceptisol, i.e. a new, still developing soil with a hardly developed soil horizon. The solum is not more than 1 m deep (Brookfield 1971; Petocz 1989; BPS 2009). The soil surface is covered by an average litter layer of 2 cm. Due to the flatness of the area, logging is easy and the forest on this site was logged some years ago.

This habitat type is used as feeding area by *D. muelleri* species. Four individuals of the forest wallaby and their trails, food remains and dung were noted.In average 14 (11-17) food plant species were registered with a mean cover of 2.7 %.

The community of *Diospyros hebecarpa-Lepinopsis ternatensis* is differentiated by *Diospyros hebecarpa, Lepinopsis ternatensis, Spatiostemon javensis, Clerodendron* sp, *Gluta* sp., *Premna corymbosa, Tetrameles nudiflora, Prunus arborea, Amorphopalus* sp*, Corimborchis* sp., *Aglaia spectabilis, Bambusa* sp., *Alectrion* sp., *Davallia solida, Harpulia* sp., *Branchin redgea, Lindsea repens, Streblus elongate, Rhapidophora* sp., *Duabanga molucanna, Giowa* sp., *Horsfieldia laevigata, Apostasia odorata, Ficus nodosa, Callamus* sp., *Ficus anulata, Ochrosia barbonica* and *Pangium edula.*

This vegetation is 10-40 m tall and mainly consists of species that remained after logging besides of newly settled trees and of some pioneer species. Canopy cover ranges between 40-50 %. Unlike other communities a moss layer is present. Mosses are growing on the rocks present under the canopy. The average height of the herb layer is 15 cm. The soil is covered with an average litter layer of 1 cm. It is characteristically developing 15-30 years after logging and grows at an altitude of 123 m at a distance of about 400 m from village. It is frequently found on mid slopes of moderately rocky sites (6-30%) consisting of limestone outcrops. Recently, this forest was intensively logged (>10 lumberjacks/day, 20 times/week).

Although on average 11 (5-19) food plants were registered with a mean cover of 2.4%, no trails, dung or food remains of *D. muelleri* could be observed.

The *Smilax malacensis-Pandanus tectorius* community is dominated by *Smilax malacensis* and is further differentiated by *Smilax malacensis, Pandanus tectorius, Garcinia picrorrhiza, Cayratia trifoliate, Mangivera minor, Endiandra* sp., *Ficus septica, Litsea ladermanii, Sterculia parkinsonii, Arenga microcarpa, Policyas nodosa, Cananga odorata, Adina nerifolius, Rhus taitensis, Lea acualeata, Pandanus polycarpa, Dianella ensifolia, Elaeocarpus angustifolius, Syzigium versteegi, Horsfeldia sylvestris, Ficus simisfera, Cerbera floribunda, Myristica gigantea, Actinodaphne nitida, Pterocimbium beccari, Syzigium* sp., *Archidendron parviflorum, Ficus pubescens, Ligodium circinatum, Davallia hymenophy, Disoxylum* sp., *Cyclopeltis crenata, Smilax malabatricum, Phacomeria speciosa, Alocasia zebrine, Aglaia simisifera, Sononia krasipen, Ficus aurantiaceae, Micania micantha, Nastus holtumianus, Gramatophylum papuana, Aserantium opositifolium, Terminalia complanata, Calocasia* sp and *Mastixiodendron pachyclados.*

In the last two communities about 15 species of food plant were found: *Ficus aurantiaceae, Ficus nodosa, Ficus septica, Ficus anulata, Ficus semisfera, Myristica gigantea, Horsfeldia laevigata, Premna corymbosa, Rhapidophora* sp., *Terminalia complanata, Syzigium* sp., *Ficus pubescens*, *Horsfeldia sylvestris*, *Mangivera minor* and *Syzigium versteegii*.

This forest has a canopy cover of 55 % and is characterized by climbing species and lianas like *Smilax malacensis*. The herb layer is 40 cm high and the moss layer is 1 cm.

Because of logging and the nearness of a logging road, this open forest is characterised by the presence of pioneer species. It grows at an altitude of 167 meter asl on hills with slopes of 8-20°. The landscape consists of undulating plateaus with humus or karstic mounds (BPS 2009). The soil is classified as an inceptisol on limestone (Brookfield 1971; Petocz 1989; BPS 2009) and covered by 1 cm of litter. The high calcium content of the soil indicates a pH which is sufficiently high to support the nutrient availability for the plants. The nearest distance to a village is about 700 m.

Although on average 12 (10-15) food plant species were registered with a mean cover of 2.7 % no trail, dung and other indications of forest wallaby presence could be observed.

UNDISTURBED ("PRIMARY") CLOSED FOREST

This habitat type is dominated by trees with big diameter. The size of the trees is variable, both small and big trees occur. The vegetation is further characterized by many lianas and other climbing species. Vegetation height is ranging from 5 to 40 m. The herb layer is 38 cm high. As canopy cover is high (80%), the undergrowth consists only of few small shrubs and herbs (Fig. 4).

This habitat is represented by the community of *Sommeria leucophylaa-Paraltropis glabra* which is differentiated by *Sommieria leucophylla*, *Alpinia* sp., *Paraltropis glabra*, *Buchanania arborescens*, *Adina* sp., *Garcinia latisima*, *Garcinia* sp., *Orania palindan*, *Pterocarpus indicus*, *Ficus benyamina*, *Intsia bijuga*, *Anthocepalus chinensis*, *Paracroton pendulous*, *Licuala* sp., *Parasarianthes falcataria*, *Baringtonia* sp., *Eudia* sp., *Hernandia ovigera*, *Popowia* sp., *Ficus pincorhiza*, *Alleuritis molucanna* and *Gymnacantera farcuhariana*.

Figure 4. Undisturbed("Primary") forest, one of habitat of wallaby (Photo: SF-Sepus Fatem)

It grows on flat valley floors with meandering rivers, at an altitude between 40-102 m asl. It is composed of plant species frequent on moderate slopes (15°) of stabile shaded ecosystems with flat topography. The soil can be classified as an inceptisol (Brookfield 1971; Petocz 1987; BPS 2009).

Ficus benyamina, Ficus pincorhizza, Intsia bijuga are food plants for the forest wallaby. Eight individuals of the forest wallaby and its dung and food remains were observed. In average 10 (6-12) food plant species were counted with a mean cover of 2.34 %.

COMMON DIFFERENTIATING PLANTS

Plants common for open to closed forest have a wide amplitude concerning light conditions and can grow both in light open forests and below the canopy of tall trees. Some have their optimum in shade while other species grow better in the presence of light. Species indicative of more shady conditions below taller vegetation, include *Selaginella martensii*, *Scindapsus pietus*, *Scindapsus euscuarius, Phylodendron* sp., *Meremia peltata* and *Asplenium nidus, Korthalzia zippelii*, *Amomum aculeatum* (Alhamid 1988; Maturbongs 2001; Asri 2005; Arijani 2006).

Octomeles sumatrana, *Pandanus* sp. and *Arthocarpus altilis* and *Homalium foetidium* are characteristic of open woody vegetation with and without partial shade; (Maturbongs 2001 and Asri 2005). This represents the ecotone between open forest and closed forest. This is supported by Asri (2005) in West Papua; Harkink (1987) in Papua New Guinea; and Meijaard *et al*. (2005) in Kalimantan. *Clomarippsidacae* sp., is the most dominant species in this habitat type, and has been found in our research to co-occur with some early pioneer species.

Sommeria leuchophylla, *Garcinia latisima*, *Pterocarpus indicus*, *Buchaninia arborenscens*, *Adina* sp. and *Orania palindan* are differentiating the primary forest, where human interference is only low or even absent.

Some species are commonly occurring in open to closed forest and in forest with former low logging intensity. The logged forest is restoring to later forest stages by succession. In this forest type some plant species facilitate the growth of other species by providing shade and protection. Here some species like; *Musa paradisiaca* and *Ficus tingtoria* provide food for herbivores, like macropodidae animals (Maturbongs 2001; Fatem *et al*. 2008).

Also open forest and logged forest have species in common. In these habitat types species grow fast in order to catch light, like *Callamus aruensis*, *Poliyalthia* sp., *Freycinetia scandens*. *Arthocarpus vresianus, Pometia corriacea* are food source for animals like *D. muelleri*.

Meremia peltata, one of the lianas, occurs in all distinguished plant communities. It suppresses tree regeneration and increases tree mortality. Lianas also influence competition between trees and thus they effect forest composition. Lianas are also a valuable food source for some animals as well as for local population of people. They enable canopy to canopy access for arboreal species (Bongers 2002).

Other species are common differentials for closed forest regenerated after logging. Also in this vegetation several lianas grow as pioneer species. The vegetation is further characterized by tall trees (10-40 m), like *Alstonia scholaris*, *Gnetum gnemon*, *Canarium dekamanum*, *Callamus cayensis*, *Pommetia acuminata*, *Syzigium malacensis* and *Prainea limpato.* This vegetation is found in the lowland forest area and close to villages and the coastal area. Besides, *Gnetum gnemon*, *Alstonia scholaris*, *Pometia acuminata* and *Canarium dekamanun* are species typical of lowland tropical vegetation as reported by Jhon (1997); Maturbongs (2001); Meijerd (2005); Kartikasari *et al.* (2012).

VEGETATION, DISTURBANCE AND WALLABY PRESENCE

Wallaby presence was observed in 4 of the 6 distinguished plant communities belonging to grassland, open forest with only little logging activity, and in undisturbed closed forest. It was however not registered from forests with clear influence of logging. *D. muelleri* appears to be very sensitive to human disturbance.

According to Detrended Correspondence Analysis (Fig. 5) the presence of the forest wallaby (Mac pre, Tra) is strongly correlated to distance from villages (r^2 respectively 0.69, 0.54) and negatively correlated to logging (Log perr^2 -0.79 and -0.60, Cut int r^2 -0.75 and - 0.65, Amostu r^2 -0.75 and -0.65) and hunting (Hunt int r^2 -0.32 and -0.28).

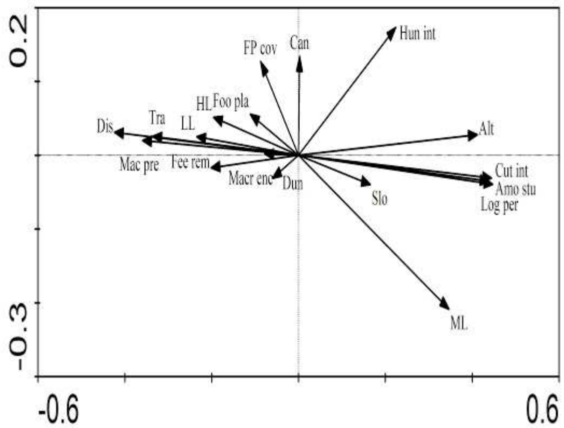

Figure 5. Ordination diagram showing the first two axes of a DCA analysis. The arrows represent the correlation with external variables, showing both the direction and the strength of the correlation (length of the arrow). Arrows in the same direction are positively correlated, opposite arrows are negatively correlated. Note; Hunting intensity (Hunt int), Altitude (Alt), Cutting intensity (Cut int), Amount of Stump (Amostu), Logging period (Log per), Slope (Slo), Moss layer (ML), Dung (Dun), *D. muelleri* encountered (Macrenc), Feeding remnant (Fee rem), *D. muelleri* present (Mac pre), Distance (Dis), Trail (Tra), Litter Layer (LL), Herb Layer (HL), Food plant species (Foo pla), Food Plant Cover (FP cov), Canopy cover % (Can).

The relation between wallaby presence and food plant availability appears to be only low (r^2 0,14 and 0,02).

As the structure and species composition of the 4 wallaby plant communities differs considerably, and food plants are present in all plant communities and as wallaby presence is highly correlated to human disturbance and has not been found in vegetation with human disturbance, our results indicate that vegetation structure, vegetation composition and food plant availability are less important than human disturbance.

CONCLUSIONS

Four plant communities are used by the forest wallaby for foraging and as their territory i.e. the *Imperata cylindrica, Ipomea aquatica* community, the community of *Ficus robusta, Dendrocnide* sp, the community of *Musa paradisiaca* and *Callamus longipina* and the community of *Sommeria leucophylaa-Paraltropis glabra* representing grassland, open and closed forest. It was not detected in the community of *Diospyros hebecarpa-Lepinopsis ternatensis* and the *Smilax malacensis-Pandanus tectorius* community representing logged forests. Even the presence of food plants did not guarantee the presence of forest wallabies.

D. muelleri species appear to be very sensitive to human disturbance. There is a strong negative relation between the presence of this species and on the other hand logging, distance to villages and hunting. Therefore, the habitat of this species should be protected and conserved by government regulations reducing the disturbance by logging and hunting. Other stake holders should be involved to create public support. Comunity based wildlife management can be used to reduce anthropogenic pressure.

Although this study gives a good description of the habitat and vegetation in which the wallaby has been found to forage, further more detailed research is needed to better understand the relation between wallaby presence, food preferences and human influence. Our study is descriptive and consequently only shows correlations. Although it clearly indicates the sensitivity of the forest wallaby for anthropogenic disturbance even if food plants are present, it is recommended to prove this relation experimentally for instance by reducing the anthropogenic influence in certain areas.

REFERENCES

Arijani, Setiadi D, Edi G, Ibnul Q. 2006.Vegetation analysis of the up-stream Cianjur watershed in Mount Gede-Pangrango National Park's. Biodiversitas. Volume 7.

Alhamid H. 1988. Studi Habitat dan Populasi Burung Cenderawasih kecil (*Paradisea minor-minor*, Shaw) di Areal Bekas Tebangan PT. Inhutani II Dalam Kawasan Cagar Alam Pegunungan Arfak Manokwari. [Skripsi]. Manokwari, Indonesia: Universitas Cenderawasih.

Badan Pusat Statistik Kabupaten Manokwari. 2008. Manokwari in Figures.

Badan Pusat Statistik Provinsi Papua. 2009. Papua in Figures.

Badan Pusat Statistik Provinsi Papua Barat. 2009. West Papua in Figures.

Bongers F. 2002. Methods to assess tropical rain forest canopy structure: an overview. Plant ecol 153: 263-27.

Bowles JE. 1991. Sifat-sifat fisik tanah dan geoteknis tanah. Bandung: Erlangga.

Borhidi A. 1998. Vegetation dynamics of the savannization process on Cuba. Vegetation 77:177-83.

Brookfield J. 1971. Soil Survey in Papua Land Report. Soil Laboratory, Agriculture Faculty, Cenderawasih University Manokwari.

Corlett RT. 2009. The Ecology of Tropical East Asia. Oxford University Press.

Connel JH. 1978. Diversity in tropical rain forest and coral reefs. Science 199:1302-10.

Chave J. 2008. Spatial variation in tree species composition across tropical forest: Pattern and process. Tropical forest community ecology. p 7-8. Willey Blackwell publishing.

de Boer F, Heitkonig IMA and van Langevelde F. 2009. Ecological Methods I. Resources Ecology Group. Wageningen University and Research Centre.

Fatem SM, Sawen D, Kilmmaskossu MSt.E. 2008. Dry Matter and Organic Value of Cuscus Diet in West Papua. Tiger Paper J 35(2).

Flannery TF. 1995. Mammals of New Guinea. Australian Museum. Revised and Updated Edition.

Hill MO, Gaugh HG Jr. 1980. TWINSPAN, Ecology and Systematics. Cornell University. Ithaca New York.

Harkink A. 1987. Vegetation study on Eastern Higland Provinces in Goroka Province, Papua New Guinea. Wageningen Agriculture University.

Jhons RJ. 1997. Common Trees of Irian jaya Papua Indonesia. Royal Botanic Gardens, Kew Richmond. England.

Kartikasari SN, Marshal AJ, Behleer B. 2012. Ekologi Papua. Yayasan Obor Indonesia dan Conservation International.

Lekitoo K, Matani PM, Remetwa H, Heatubun CD. 2007. Keanekaragaman Flora Taman Wisata Alam Gunung Meja-Papua Barat. Jenis-jenis Pohon Bagian Pertama. Balai Penelitian Kehutanan Manokwari.

Lulus AP. 2005. Analisis Vegetasi di Areal Hutan Sekunder Kampung Susweni. Distrik Manokwari Barat. [Skripsi]. Papua, Indonesia: Universitas Papua

Muller K. 2005. Keanekeragaman Hayati Tanah Papua. Universitas Negeri Papua dan Dinas Pendidikan dan Pengajaran Provinsi Papua.

Maturbongs RA. 2001. Vegetation analysis on Wadapi lowland forest, Yapen Waropen District. Beccariana J 3(2): 38-44.

Meijerd E, Sheil D, Nasi R, David A, Rosenbaum B, Djoko I, Titiek S, Rachmatika I, Anna W, Soehartono, Stanley S, Timothy B. 2005. Life after Logging. Reconcialing wildlife conservation and production forestry in Indonesia Borneo. Centre for International Forestry in Indonesia.

Menzies JI. 1991. A Hand Book of New Guinea Marsupials & Monotremes. Madang Papua New Guinea. Christen Press Inc.

Petocz RG. 1994. Mamalia Darat Irian Jaya. Jakarta. Gramedia.

Petocz RG. 1989. Konservasi Alam dan Pembangunan di Irian Jaya. Jakarta: Grafiti Press.

Paijmans K., *et al* .,1976 New Guinea Vegetation, CSIRO, Canberra (harus dilengkapi dl)

Sykora K. 2009. Vegetation science, multivariate analysis and plant community of Terscheling; manual on field course vegetation science and system ecology. Nature Conservation and Plant Ecology Group, Wageningen University and Research Centre.

van Steenis CGG. 1989.Flora of Melanesiana. Leiden Herbarium Published.

van Steenis CGGJ, Hoed DG, Blomeberge S, Eyma PJ. 2005. Flora untuk Sekolah di Indonesia.

Westerman MS, Springer, Krajewski C. 2001. Molecular relationships of the New Guinean Bandicoot Genera *Microperoryctes* and *Echymipera* (Marsupialia: Peramelidae). J Mamm Evol 8(2).

Whitmore TC, Tantra IGM, Sutisna U. 1997. Tree flora of Indonesia. Checklists for Irian Jaya. Ministry of Forestry. Forestry Research and Development Agency. Bogor.

Appendix 2. Differential vegetation table with both separate relevés and synoptic information. For the separate relevés the cover-abundance is represented by the ordinal 9-scale, synoptic information consists of % presence and characteristic cover (mean cover of the number of occurrences of a species in a certain cluster).

COMMUNITY	Imperata cylindrica-Ipomoea aquatica grassland		Ficus robusta -Dendrocnide sp, grassland-Forest transition								Someria leuchophilla-Paratropis glabra										Musa paradisiaca -Callamus longipina, logged forest					Diospyros hebecarpa-Lepinopsis ternatensis, logged forest on sites with large cover of rocks.							Smilax malacensis-Pandanus tectorius, Logged forest with rocks						
RELEVE CODE	PF-a1		SF-b13	PF-a2	SF-a9	SF-a10	HF-14	SF-a11	SF-a12		PF-b7	PF-b6	HF-15	HF-16	HF-17	PF-b8	PF-a4	PF-b5	PF-a3		LA-28	LA-29	LA-26	LA-27		WF-22	WF-23	BF-18	BF-19	BF-20	BF-21		WF-24	WF-25	SF-33	SF-30	SF-31	SF-32	
	A1		A2	A2	A2	A2	A2	A2	A2		A3	A3	A3	A3	A3	A3	A3	A3	A3		A4	A4	A4	A4		A5	A5	A5	A5	A5	A5		A6	A6	A6	A6	A6	A6	
Moss layer (cm)	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0		0	0	0	0		1	1	0	1	1	1		1	0	1	0	0	1	
Herb layer (cm)	90		50	60	40	40	90	30	50		50	40	50	50	30	50	10	40	20		90	90	90	90		10	20	20	10	20	20		15	20	50	50	50	50	
Litter layer (cm)	1		2	2	2	2	1	2	2		4	4	4	2	4	4	4	2	2		2	2	2	2		1	1	1	1	1	1		1	1	1	1	1	1	
Canopy (%)	10		50	40	50	50	40	50	50		90	90	70	80	90	90	90	60	70		50	50	40	50		50	50	40	40	50	50		50	50	50	60	60	60	
Altitude (m.a.s.l.)	29		47	38	42	30	50	39	46		51	49	71	54	71	57	102	44	82		45	45	38	43		109	138	62	98	155	178		155	178	179	130	169	194	
Slope (°)	3.43		5.71	9.09	5.71	5.71	12.41	5.71	14.57		13.50	1.15	32.62	13.50	16.70	11.31	7.97	6.84	23.75		5.71	7.97	4.57	10.20		12.41	22.78	19.80	5.71	32.62	16.70		10.20	16.70	16.70	14.57	19.80	5.71	
Distance (m)	5143		7264	5120	6723	6734	6002	6746	6751		8084	8056	6015	6042	6067	8093	5120	8035	5120		4326	4349	4230	4265		499	617	482	608	737	890		755	891	876	418	508	678	
Amount stump (ind/cutting times)	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0		1	1	1	1		5	5	6	5	5	5		5	5	5	5	5	5	
Hunting intensity (times/week)	0		2	1	1	1	2	1	1		1	1	2	1	2	1	0	1	1		0	0	1	0		3	3	1	1	1	1		3	3	3	3	3	3	
Cutting intensity (times/week)	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0		1	1	1	1		5	5	5	5	5	5		5	5	5	5	5	5	
Logging period (year)	0		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0		1	1	1	1		3	3	3	3	3	3		3	3	3	3	3	3	
Macropodidae encounter (ind)	0		0	0	0	0	0	0	0		0	0	0	0	1	1	0	0	0		0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0	
Feeding remnant (gr)	3		0	0	0	3	0	3	0		0	2	0	0	0	0	0	0	0		0	0	1	0		0	0	0	0	0	0		0	0	0	0	0	0	
Trail (ind)	1		1	0	0	1	1	1	1		1	1	1	1	1	1	1	0	0		1	1	1	1		0	0	0	0	0	0		0	0	0	0	0	0	
Dung (gr)	0		0	0	0	1	0	1	0		0	0	1	0	0	0	0	1	0		1	2	0	0		0	0	0	0	0	0		0	0	0	0	0	0	
Macropodidae present (ind)	1		1	0	0	1	1	1	1		1	1	1	1	1	1	1	1	0		1	1	1	1		0	0	0	0	0	0		0	0	0	0	0	0	
Food plant (ind)	17		21	8	10	7	15	9	13		7	6	16	11	13	9	14	8	8		11	12	17	16		13	9	19	11	5	10		15	13	12	12	11	10	
Food plant cover (%)	2120		2959	1939	2615	2107	2287	2685	2558		2569	2397	2550	2603	2426	2356	2378	2491	2103		2579	2733	2532	2760		2437	2155	2509	2406	2017	2315		2506	2401	2884	2542	2617	2220	
Community division after Twinspan	1					2									3							4						5								6			
Releve number after Twinspan	1		2	3	4	5	6	7	8		13	14	15	16	17	18	19	20	21		9	10	11	12		22	23	24	25	26	27		28	29	30	31	32	33	
RELEVE CODE	PF-a1		SF-b13	PF-a2	SF-a9	SF-a10	HF-14	SF-a11	SF-a12		PF-b7	PF-b6	HF-15	HF-16	HF-17	PF-b8	PF-a4	PF-b5	PF-a3		LA-28	LA-29	LA-26	LA-27		WF-22	WF-23	BF-18	BF-19	BF-20	BF-21		WF-24	WF-25	SF-33	SF-30	SF-31	SF-32	
Differential spec group 1. Imperata cylindrica- Ipomoea aquatica grassland																																							
Imperata sp	9	100 9																																					
Nephrolepsis biserata	9	100 9	9			1			1	43 4					1					11 1			3		25 3									8					17 8
Imperata cylindrica	9	100 9					9			14 9																													
Ipomea aquatica	8	100 8																																					
Saccharum spontaneum	8	100 8					8			14 8								9		11 9																			
Malotus philipinensis	6	100 6																								1	1	3			3	67 2	3			1		2	50 2
Ipomea batatas	5	100 5																																					
Jussiaee octavalifis	4	100 4	5		3	2	4			57 4	3				5			4		33 4																			
Piper aduncum	1	100 1	5		5		3	3	4	71 4								4		11 4			2	2	50 2	4		1				33 3		6					17 6
Macaranga mappa	1	100 1	9		8		2			43 6													1		25 1	1		1				33 1	3	7					33 5
Mimosa pudica	1	100 1																																					
Muntigia callabura	1	100 1																																					
Mucuna novaeguinesis	1	100 1		1		4	3		8	57 4											2				25 2														
Pueraria javanica	1	100 1			1					14 1								1		11 1																			
Spondias cytherea	1	100 1																				1			25 1			3	6		3	50 4	7						17 7
Micania sp	1	100 1			3		3		3	43 3													7	8	50 8									1					17 1
Zingiber sp 2	1	100 1									2	2				2	2		1	56 2																	3		17 3
Differential spec. group 2: Ficus robusta -Dendrocnide sp, grassland-Forest transition																																							
Ficus robusta			8	2	9	3	2	7	3	100 5	1				1		1			33 1		1		1	50 1	2						17 2	1	1		3		4	67 2
Donax caniformis			5	2	9	8	8	9	9	100 7	3		3	4	2	3				56 3	2			5	50 4	2		1				33 2	1			1	7		50 3
Dendrochide sp					9	1	7	3	5	71 5						1				11 1			2		25 2														
Ficus tracipison			5	1	5			2	3	71 3													3		25 3			1				17 1							
Hornstendia scottiana			7		4		1	9	4	71 5	2			3	3					33 3				7	25 7								1	1					33 1
Pandanus dubius			4				2	2	1	57 2																													
Derris alba				5	5		7	1		57 5																											1		17 1
Sterculia shillinglawi						1		2	2	43 2							1			11 1											1	17 1						1	17 1
Ficus japonica			5			1			4	43 3													1		25 1									1			1		33 1
Cariya papaya			1				1		1	43 1																		1		1		33 1							
Oriocnide nitida							1		1	29 1																							1						17 1
Endospernum moluccanum							1	2		29 2													1		25 1			1			1	33 1				1			17 1
Rhapidophora sp				1					3	29 2																													
Spathodea campanulata			7	1						29 4																													
Neolaleba atra			1	2						29 2																										3			17 3
Ficus sp 1			9							14 9																													
Vittex pinnata			8							14 8			1	1			1			33 1								1				17 1	1			2			33 2
Durio zibethinus			7							14 7																													
Lancium domesticum			7							14 7																													
Cyatea molucanna									6	14 6							1			11 1																			
Ficus variegata							3			14 3													1		25 1														
Cleytances sp									3	14 3		1								11 1																			
Pandanus conoideus			2							14 2																													
Drymopholeus litigiosus							2			14 2			7							11 7																			
Theobroma cacao			2							14 2																													
Macaranga gigantea			1							14 1																													
Mangifera indica			1							14 1																													
Ananas comosus			1							14 1																													
Callamus warbugii				1						14 1																													
Cocos nucifera			1							14 1																													
Prinium sp				1						14 1																													
Sallaca edulis			1							14 1																													
Kokoona ochracea								1		14 1							1			11 1																			
Dendrobium sp									1	14 1																													

Differential species group 3: Someria leuchophilla-Paratropis glabra																																										
Sommieria leucophylla										7	7	9		8	9		1		67	7																						
Alpinia sp										2	4				3	1		3	56	3										1	1		33	1								
Paraltropis glabra											4		1	3		1		1	56	2				8	25	8																
Buchanania arborescens										4	4				2				33	3																						
Adina sp										2		1			1				33	1																						
Garcinia latisima														1	1			1	33	1		1			25	1																
Garcinia sp										1							1	1	33	1																						
Orania palindan															**5**	**1**	**6**		33	4																						
Pterocarpus indicus		1						14	1	3		1	1						33	2																						
Ficus benyamina										3		1			1				33	2																						
Intsia bijuga															5	1			22	3																						
Anthocepalus chinensis							3	14	3				1		3				22	2																						
Paracroton pendulous												2	2						22	2																						
Licuala sp				5				14	5							5		1	22	3																						
Parasarianthes falcataria		1						14	1			2			1				22	2																2					17	2
Baringtonia sp																9			11	9																						
Eudia sp																4			11	4																						
Hernandia ovigera										2									11	2																						
Popowia sp																1			11	1																						
Ficus picrorrhiza																1			11	1																						
Aleuritis molucanna											1								11	1																						
Gymnacantera farcuhariana																		1	11	1																						
DIFFERENTIAL SPECIES. D1																																										
Selaginella martensi	9	3	9	7	9	9	9	100	8	8	9	9	5	7	8	7	7	9	100	8			9	9	50	9																
Scindapsus pietus	4	4		2		3	3	71	3	2	3	2	3	4	2	4	4	3	100	3																						
Tabernaemontana sp		1	4	6	1	4	7	86	4	2	3			4			6	7	56	4																						
Scindapus euscuarius	1	4				4	3	57	3	2		4	1	3	4	4		3	78	3																						
Homalium foetidium	6		8	4	2			57	5			3	1	2	4	2		8	67	3	4	2		5	75	4			1				17	1					2	1	33	2
Flageria indica	1		3		5	2		57	3			1	1					1	33	1		2		2	50	2																
Pleomele angustifolia	3			1				29	2	4					3				22	4		3			25	3																
Balbitis rhyzophylla	4	2					4	43	3	4		7	5	4	6	5		4	78	5																						
Piper interruptum	1					2	1	43	1				2	1	2	2		1	56	2									1	2	2	3	67	2								
Clomarippsidacae sp	2	4				2	3	57	3	4			2	6	1	3		6	67	4																	1				17	1
Differential spec. group 4: Musa paradisiaca -Callamus longipina, logged forest																																										
Musa paradisiaca	5	1	1					43	2			1							11	1	5	2	3	8	100	5	1		1	3			50	2	1						17	1
Callamus longipina				1	5			29	3			2		7	4				33	4	4	2	3	3	100	3																
Palaquium lobbianum						3		14	3		6	9		2			4	1	56	4	9	8	4	7	100	7			7			5	33	6	1			2			33	2
Planconella obofata					1			14	1			8							11	8	7	3	4	6	100	5			2	2	7	3	67	4					2		17	2
Archidendron bogoriensis																			0		3	4			50	4	2		1				33	2								
Machinlaya celebia																			0			1		1	50	1			1				17	1								
Toona sp																1			11	1	7				25	7																
Coleyne asperata																			0			1			25	1																
Fagraia rasemosa																			0			1			25	1																
Macaranga tesylata																			0			1			25	1																
Pigafetta filaris																			0				1		25	1																
Ficus tingtoria																			0				1		25	1																
Haplolobus selebica																			0			1			25	1													6		17	6
Podocarpus blumei													1		2				22	2	1				25	1									1						17	1
Canarium indicum										1									11	1		1			25	1																
DIFFERENTIAL SPECIES. D2																																										
Semecarpus papuana												8	1	1					33	3	6	3		1	75	3	1		1				33	1				1			17	1
Drymophloues olivormis				2				14	2		4		3	7					33	5	2	6		3	75	4		1					17	1								
Freynetia sp						3		14	3	5		7		1		1	1	1	67	3		4	7		50	6												2			17	2
Bubia sp												1	2	2		4		1	56	2	3				25	3																
Laportea candensis	1	1						29	1	3	8		4		2		1		56	4			6		25	6																
Gonocarium litoralle										3	1			3		1			44	2		6		6	50	6									1		1		1		50	1
Cynometra sp															2	1		1	33	1	5			1	50	3	1						17	1								
Pinanga rumphiana											1	7		4	1				44	3		2		5	50	4																
Canarium hirsutum												1	6			7			33	5	2				25	2											1				17	1
Campnosperma brevipetiolata												4	1		4				33	3				1	25	1																
Girinops sp																7			11	7			8		25	8																
Differential spec. group 5: Diospyros hebecarpa-Lepinopsis ternatensis, logged forest on sites with large cover of rocks.																																										
Diospyros hebecarpa																											3	8	1		7	2	83	4								
Lepinopsis ternatensis																	1		11	1		3			25	3			1	1	2	2	67	2								
Spatiostemon javensis																												2		6	8	9	67	6			4				17	4
Clerodendron sp																												1			1	3	50	2								
Gluta sp																													2	8	6		50	5								
Premna corymbosa																											7		1		1		50	3								
Tetrameles nudiflora																												1	1			1	50	1								
Prunus arborea																															1	2	33	2								
Amorphopalus sp																											3				1		33	2								
Corimborchis sp																	1	1	22	1								1	1				33	1								
Aglaia spectabilis																															1	1	33	1								
Bambusa sp	1							14	1																				9				17	9								
Alectrion sp																																3	17	3								
Davallia solida																																3	17	3								
Harpulia sp																																2	17	2				1			17	1
Branchin redgea																		1	11	1												2	17	2								
Lindsea repens																																2	17	2								
Streblus elongata																														1			17	1								
Rhapidophora sp																															1		17	1								
Duabanga molucanna																											1						17	1								
Giowa sp																													1				17	1								
Horsfieldia laevigata																													1				17	1								
Apostasia odorata																															1		17	1								
Ficus nodosa					2			14	2					1					11	1										1			17	1								
Callamus sp	1							14	1																				1				17	1								
Ficus anulata												1							11	1									1				17	1								
Ochrosia barbonica																														1			17	1								
Pangium edula																															1		17	1								

Appendix 2. Continued

Differential spec. group 6: Smilax malacensis-Pandanus tectorius, Logged forest with rocks																																										
Smilax malacensis					1	2		29	2							1			11	1									1		5		33	3	2	6	1	3	7	9	100	5
Pandanus tectorius																												1					17	1	2			1	1	4	67	2
Garcinia picrorrhiza					1			14	1			1							11	1										1		1	33	1	1	1		1	1		67	1
Cayratia trifoliata																																					2	6		5	50	4
Mangivera minor		1						14	1																										2	1			6		50	3
Endiandra sp																													2				17	2	1		3	2			50	2
Ficus septica	4				1			29	3																										1		1			4	50	2
Litsea ladremanii																5			11	5											1		17	1	1	2	2				50	2
Sterculia parkinsonii																													1				17				2	1		4	50	2
Arenga microcarpa						2		14	2									1	11	1																1		3	1		50	2
Policyas nodosa																																				1	1			3	50	2
Cananga odorata					1	1		29	1														1		25	1		1					17	1	4	7					33	6
Adina nerifolius																											1				1		33	1			2			9	33	6
Teysmaniodendron bogoriensis												2							11	2		9			25	9										2		7			33	5
Rhus taitensis																													1	1			33	1		3	5				33	4
Dianella ensifolia	1							14	1																														1	6	33	4
Elaeocarpus angustifolius											1								11	1																		1		6	33	4
Syzigium versteegi																													1	1		1	50	1			2			3	33	3
Horsfeldia sylvestris														1					11	1												2	17	2		1	3				33	2
Ficus semisefera																																					1			4	33	3
Cerbera floribunda																6			11	6									1				17	1	1			2			33	2
Myristica gigantea																														1			17	1	1					1	33	1
Actinodaphne nitida																												1					17	1				1	1		33	1
Pterocimbium becari											2					1			22	2											1		17	1	1				1		33	1
Syzigium sp											5							1	22	3																		1	1		33	1
Archidendron parviflorum																												1					17	1			1	1			33	1
Ficus pubescens																																						9			17	9
Ligodium circinatum																																						7			17	7
Davallia hymenophy							1	14	1																													6			17	6
Disoxylum sp																													2				17	2					5		17	5
Cyclopeltis crenata																1			11	1																		4			17	4
Smilax malabatricum																																						4			17	4
Phacomeria speciosa																																						4			17	4
Alocasia zebrina																																						3			17	3
Aglaia simisifera																																						3			17	3
Sononia krasipen																																			2						17	2
Ficus aurantiaceae																																						2			17	2
Micania micantha																																						2			17	2
Nastus holtumianus																																						2			17	2
Gramatophylum papuana																																							1		17	1
Aserantium opositifolium																																				1					17	1
Terminalia complanata												1							11	1																			1		17	1
Calocasia sp																																						1			17	1
Mastixiodendron pachyclados	4							14	4	2									11	2																1					17	1
Lea acualeata															5				11	5							1						17	1			1				17	1
Pandanus polycarpa																7			11	7																1					17	1
DIFFERENTIAL SPECIES .D3																																										
Koordersiodendron pinnatum																											2	2	4	2	7	3	100	3	8	3	9		5		67	6
Sterculia macrophylla																1			11	1							4	1	2	4	7	6	100	4	8	1		7	6		67	6
Pometia corriacea												1			2				22	2							8	3	3	8	9		83	6	8	8	9	9	9	8	100	9
Pterigota horsfeldia						1	1	29	1		1								11	1							7	4	3	2	1		83	3	7	3	4	7			67	5
Cryptocarya sp							6	14	6							1			11	1									1	7	1		50	3		1	5	7	7	2	83	4
Lunasia amara																											7	9	2	8		9	83	7	3		1			9	50	4
Sisipus jujuba															4				11	4				1	25	1		3	1	1			50	2	2	3	6	2	7		83	4
Palaquium amboinensis												1							11	1								1	8	9	9	9	83	7	7		4		3	6	67	5
Dracontumelum dao		1		1		1		43	1			2							11	2				2	25	2		2	2	4		1	67	2		2	7	2			50	4
Areangilisa flava												2					1		22	2							3	3	2			7	67	4	6	2					33	4
Disoxylum mollisimus																												2			1	3	50	2	1			1	3	9	67	4
Freynetia scandens																											3			1			33	2	1			1	2	1	67	1

Myristica fatua							1			14	1																				1		5		33	3	1			1	2	3	67	2
Callamus aruensis																													1		2	1			50	1		1	1	3	5		67	3
Glosidion sp																															1		1	1	50	1			2			2	33	2
Poliyalthia sp															1				1		22	1									3	3	4		50	3		2	7				33	5
Nuclea orientalis																													4	1					33	3	2	7		3			50	4
Poliyalthia sumatrana																								5			25	5				4		3	33	4	2		3				33	3
Inocarpus fagiverus																		1			11	1							1						17	1	2	1					33	2
Diospyros papuana																																	1		17	1			1				17	1
Platicerium biffurcatum									1	14	1																							1	17	1			1				17	1
Pysonia umbelifera																																		1	17	1						1	17	1
Rapanea sp																				1	11	1											1		17	1	2						17	2
Terminala caniculata																																		1	17	1						1	17	1
Morinda citrifollia			1							14	1																				1				17	1						1	17	1
Polyalthia glauca																														4					17	4					4		17	4
Arthocarpus vresianus																													1						17	1						1	17	1
DIFFERENTIAL SPECIES.D4																																												
Alstonia scholaris														3				1	1	1	44	2	1	2		2	75	2	1	1	1	3		1	83	1		4					17	4
Gnetum gnemodeis												7	3					1	1	2	56	3	2	2			50	2					1	2	33	2	1	1	5		1	1	83	2
Canarium dekamanum													2	1				8	7		44	5	7	7	1		75	5	4	2					33	3		4	3				33	4
Licuala telivera												7		6	2	1	7		1		67	4	1	7		8	75	5	2	3					33	3	4			1	2		50	2
Callamus cayensis																1			1	1	33	1		2		1	50	2	1	1	7				50	3	9						17	9
Pometia acuminata																	1				11	1		1			25	1		1				1	33	1		3					17	3
Syzigium malacensis														1	4			1			33	2		1			25	1			1				17	1					3		17	3
Prainea limpato								2		14	2										0				2		25	2				1			17	1								
COMMUNITY C- REMAINING SPECIES																																												
Meremia peltata	2	100 2	7	5	9	4	3	8		86	6	4	5	5	6	2				3	67	4		8	9	7	75	8	6	3	8	4	7	8	100	6		2		2	7	2	67	3
Gnetum gnemo			4			1	1		1	57	2		3	3	2	1	3	6	1	1	89	3	2	5	1	2	100	3			1			1	33	1	1	2	4	4	3	3	100	3
Celtis Latifolia				1					1	29	1	9		1			1	6	1		56	4	8	3	2	5	100	5			7	8	5		50	7	9	9	9	8	8	3	100	8
Amomum aculeatum			8	1	3	4	7	9	1	100	5	1		4	3	4					44	3	3		5	4	75	4		2	4				33	3	1	1			1		50	1
Korthalzia zippelii			1	1		9	8	9	7	86	6	7		7	9		7	3	1	1	78	5	5	4	3	7	100	5		1					17	1								
Horsfeldia parviflora			5				2	9	8	57	6	5	6	7	7	2	2	1	7		89	5	8	6	3	5	100	6	8		3	2			50	4		3	2		3		50	3
Medusanthera laxiflora				1			1	1		43	1	1	7		5	3				1	56	3	4	1	6	8	100	5	5			7		7	50	6	2						17	2
Pimeleodendrom amboinicum				1			1			29	1	5	2	1		1	2	1			67	2	4	6	3	7	100	5	8	4	8	8	8		83	7	1	3	7		3	7	83	4
Phylodendron sp			1				1		2	43	1	6	2	5	8	2		1	1	1	89	3	4	6	5	8	100	6		2	5			1	50	3			2	7	7		50	5
Horsfeldia irya									1	14	1	2					2	1			33	2	3	1	3	6	100	3			2	8		3	50	4	1			1			33	1
Piper gibbilimbum			2	1			3	7	4	71	3		4	3	4	5		6	9		67	5		5		8	50	7	3		3	6	4		67	4	6	5	3	8	8	1	100	5
Bauhinia tomentosa			3	1			1	1	6	71	2				5	5	7	1	8		56	5		7		3	50	5	3	3			2	7	67	4	6	1	7	6	7	2	100	5
Pometia pinnata			6			4	2	8		57	5	8	9	7	9	9	6	5	9	9	100	8		9	5	8	75	7	1		3				33	2	1	1		2			50	1
Maniltoa brownoides							1			14	1	5		2		5		1			44	3	6	7		7	75	7	4	5	3	2	1	2	100	3	7			7	7		50	7
Arthocarpus altilis			4	1	5				9	57	5	4		7	1	1	1	1	1	1	89	2	6	5	3		75	5	1	1	2				50	1	6	1	2			2	67	3
Aglaia odorata						1	1	1		43	1	3	5	5		1		7	6	1	78	4		4	4		50	4	5	1	8	7			67	5	2	1	2		4		67	2
Litsea timoriana								3	7	29	5	2	1	4					1		44	2	5		1	2	75	3	3		7				33	5	1						17	1
Hydriastele rhopalocarpa							1	7	5	43	4							6		6	22	6	2	2	6		75	3	1				4		33	3								
Haplolobus lanceotus				1						14	1						2	7	6		33	5	4	7	2		75	4		1		1		2	50	1	1			3			33	2
Asplenium nidus									1	14	1			2							11	2		3	2	2	75	2		1			1	1	50	1								
Areca macrocalyx			1					2		29	2	3		3		5			1	1	56	3		3	2	8	75	4			1				17	1				1			17	1
Zingiber sp1			4	1	2	2		1		71	2								1	2	22	2	2		2	1	75	2			5	2			33	4			2	1		1	50	1
Pandanus sp			5	6	9	6			2	71	6				1	1	5		4		44	3				3	25	3			7		1	2	50	3								
Goniotalamus sp							1			14	1	5	1	2		2			3	1	67	2	7	2			50	5			2		3		33	3		2					17	2
Caryotha rumphiana					1		1	1	1	57	1							1			11	1	1				25	1		1	2		1		50	1	1	1		1	2	1	83	1
Chisocheton seramicus					1	4	3	9		57	4				9	9	6		8	7	56	8		8	6		50	7				2			17	2								
Rhopalobaste ladermanii						4		3		29	4			9	1				5		33	5		3	1		50	2	1		1	1			50	1	1		2	1			50	1
Euodia eleryana					1			2		29	2							1			11	1	5			3	50	4									2	2					33	2
Palmeria scandens								2		14	2	3	3	5							33	4		3		2	50	3													7		17	7
Osmoxylun globulare				1			1			29	1			1							11	1		1		2	50	2			1				17	1		1					17	1
Licuala lauterbachii							3	1		29	2			6	7	8					33	7		1		7	50	4		1					17	1	3	7					33	5
Drypetes sp								1		14	1							6	2		22	4									3	1	1		50	2	3						17	3
Octomeles sumatrana				5	1				1	43	2				1						11	1			1		25	1	2						17	2	2				1		33	2
Gompandra glabosa				1						14	1		5					6	7		33	6									2				17	2	2	2					33	2
Antiaris toxicaria							1			14	1		1	1						1	33	1									3				17	3				2	1		33	2
Chisocheton ceramicus									9	14	9	7	9	6							33	7		8			25	8	1		1				33	1								
Aglaia sp					1	4				29	3		1						9		22	5							1						17	1	1		1				33	1
Myristica psedoargentea								7	8	29	8					1				1	22	1				7	25	7		1					17	1	2						17	2