REINWARDTIA

A JOURNAL ON TAXONOMIC BOTANY, PLANT SOCIOLOGY AND ECOLOGY

ISSN 0034 – 365 X | E-ISSN 2337 – 8824 | Accredited 792/AU3/P2MI-LIPI/04/2016

2016 15 (1)

REINWARDTIA

A JOURNAL ON TAXONOMIC BOTANY, PLANT SOCIOLOGY AND ECOLOGY

Vol. 15 (1): 1 – 65, June 27, 2016

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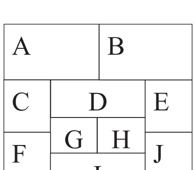

Cover images: *Begonia manuselaensis* Ardaka & Ardi. A. Plant habit in situ; B. Plant habit ex situ; C. Lamina abaxial surface with the small red scales on the veins; D. Stipules. E. Male inflorescence; F. Solitary female inflorescence; G. Male flower; H. Female flowers; I. Ovary cross section; J. Fruit. Source of materials: Wisnu Ardi, WI 104 (BO, KRB, SING). Photo credits: (B-J) by Wisnu Ardi; A: I.G. Tirta

The Editors would like to thank all reviewers of volume 15(1):

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REINWARDTIA
Vol 15, No 1, pp: 1 − 9

A STUDY OF THE UNDERGROWTH VEGETATION OF SEMPU ISLAND, EAST JAVA, INDONESIA

Received 03 September 2015; accepted 26 May 2016

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ABSTRACT
SADILI, A. & KARTAWINATA, K. 2016. A study of the undergrowth vegetation of Sempu Island, East Java, Indonesia. *Reinwardtia* 15(1): 1 − 9. — A study of forest floor vegetation in coastal forest (site 1) and inland lowland forest (site 2) was carried out at the Sempu Island Nature Reserve, Malang Regency, East Java. The objective of the study is to obtain data on plant species diversity, species composition and structure of the forest floor vegetation. In each site the vegetation was sampled with a plot of 1 m × 50 m, which was divided into 50 subplots of 1 m × 1 m each. Overall from the two plots we recorded 59 species, 57 genera and 39 families. Shannon-Wienner diversity indices (H') were relatively high. *i.e.,* 4.47 in Plot 1 and 3.2 in Plot 2, with a mean of 3.84. The number of the seedlings of shrubs and trees was greater than that of the herbaceous species. The families having the highest number of species were Euphorbiaceae (6 species) and Fabaceae (5 species). Based on dominant species the vegetation in Plot 1 was designated as *Scleria lithosperma-Asystasia nemorum* community type, while in Plot 2 *Pterospermum javanicum-Knema* sp. community type. The similarity index between these community types was only 18%. Only *P. javanicum* showed a good regeneration and the regeneration of other species in the two community types was poor, indicating unclear floristic changes in the forest of the Sempu Island.

Key words: Seedling and herbaceous composition, Sempu Island Nature Reserve, species diversity.

ABSTRAK
SADILI, A. & KARTAWINATA, K. 2016. Kajian vegetasi lantai hutan di Pulau Sempu, Jawa Timur, Indonesia. *Reinwardtia* 15(1): 1 − 9. — Penelitian vegetasi lantai di hutan pantai (lokasi 1) dan hutan pamah (lokasi 2) dilakukan di Cagar Alam Pulau Sempu, Kabupaten Malang, Jawa Timur. Tujuan penelitian untuk memperoleh data keanekaragaman dan komposisi jenis serta struktur vegetasi lantai hutan. Di setiap lokasi vegetasi dicuplik dengan menggunakan petak memanjang berukuran 1 m × 50 m yang dibagi menjadi 50 subpetak masing-masing berukuran 1 m × 1 m. Dua petak pencuplikan tersebut merekam 59 jenis 57 marga dari 39 suku. Indeks keanekaragaman jenis Shannon-Wienner (H'). relatif tinggi, yaitu 4,47 di Petak 1 dan 3,2 di Petak 2, dengan rerata 3,84. Jenis-jenis semai pohon dan perdu lebih banyak dibandingkan dengan jenis-jenis terna. Suku yang memiliki jumlah jenis terbanyak adalah Euphorbiaceae (6 jenis) dan Fabaceae (5 jenis). Berdasarkan jenis dominan vegetasi di Petak 1 dinamakan tipe komunitas *Scleria lithosperma-Asystasia nemorum* sedangkan di Petak 2 disebut tipe komunitas *Pterospermum javanicum-Knema* sp. Indek kesamaan antara dua tipe komunitas tersebut hanya 18%. Hanya *P. javanicum* yang menunjukkann regenerasi yang baik sedangkan regenerasi pohon jenis lainnya sebagian besar di kedua tipe komunitas tersebut tidak baik, sehingga arah perubahan komposisi komunitas hutan di Pulau Sempu tidak cukup jelas.

Kata kunci: Cagar Alam Pulau Sempu, keanekaragaman jenis, komposisi jenis terna dan semai.

INTRODUCTION

Indonesia has a high number of vegetation types representing natural ecosystems with a high degree of plant species diversity, comprising the littoral vegetation at the sea level up to the nival vegetation type on permanent snow at the highest mountain top of Mt. Jaya in Papua (Kartawinata, 2005). Much of the lowland forests have suffered destruction by timber logging, coal and mineral mining, conversion into timber, rubber and oil palm plantations, human settlements and other uses. The remaining undisturbed primary lowland forests today can be found mainly in various protected areas, such as national parks and nature reserves. The Sempu Island Nature Reserve (Cagar Alam Pulau Sempu), or Sempu Island NR for short, in East Java represents one of such areas.

To date the vegetation studies in Indonesia have been concerned mainly with the lowland forests, focusing primarily on tree life form (Kartawinata, 2005) and very few investigations have devoted to undergrowth communities (*e.g.* Ismail, 1975; Sumardja & Kartawinata, 1977; Sadili *et al.*, 2009; Sadili, 2010). In rain forests, trees are the dominant life form and the undergrowth consists of tree seedlings, shrubs and herbs, while the so called "herb layer" is a synusia of tree seedlings (Whitmore, 1986). Studies in tropical forest elsewhere revealed that herb diversity contributes a great deal to the total species diversity (Cicuzza *et al.,* 2013; Gentry & Dodson, 1987; Kiew, 1978;

Meijer, 1959; Nath *et al.,* 2005; Poulsen, 1996; Ting & Poulsen, 2009; Tran *et al.,* 2005). The understory vegetation in South American tropical forests is said to be rich in species, with herbaceous plants amounting to 21 to 47% of the total plant species (Croat, 1978; Gentry & Dodson, 1987). It has been reported that herbaceous plants represent 8 to 29% of the total plant species richness in moist to wet forests, 53% in dry forests and 6% in forests on white sandy soils (Hall & Swaine, 1976; Gentry & Dodson, 1987; Gentry & Emmons, 1987). Herbs and seedlings constitute an integral part of and have important functions in a forest ecosystem, hence their conservation is necessary (Irwanto, 2006). In lowland forests, dense herbs often form patches of closed vegetation in natural and man-made gaps and along foot paths and rivers that are well illuminated, but in the interior of mature rain forest, herbs occur mainly as scattered individuals and are even absent (Richards, 1996).

In view of these phenomena we undertook a study on the undergrowth communities in the coastal and lowland forests on the Sempu Island NR. Previous studies on the island have been concerned with the structure and composition of the tree layers in the mangrove forest (Prawiroatmodjo, 2013) and the dryland forests (Polosakan 2011, 2014) as well as with the conservation status of species, such as *Myristica teysmannii* (Risna, 2009). To date no studies on undergrowth communities have been previously undertaken on this island. In this study we took into a consideration the observation of Richards (1996) that the synusia of ground herbs is not synonymous with the "ground flora" of lowest (E) stratum because the majority of the plants in third layer are young trees, shrubs and woody climbers.

In our study the undergrowth community covered the E layer comprising herbs, seedlings of trees and shrubs but excluded epiphytes. We expect that the study will be useful to complement existing forest tree data needed for the management of the Sempu Island NR. Research is necessary to understand the relationship between various components of the ecosystem preserved, to facilitate and support the management. The objective of the present study is to obtain basic ecological data in the form of the structure and composition of the undergrowth communities in the coastal and the inland lowland forests that will be of use in the management of the reserve.

MATERIALS AND METHODS

The Sempu Island NR covers the entire island with the total area of ± 877 ha and is managed by the Sub-Seksi Konservasi Sumber Daya Alam Malang (Malang Natural Resources Conservation Subsection) of the Balai Besar Konservasi Sumber Daya Alam Jawa Timur (East Java Office of Natural Resource Conservation) (Kehutanan, 2009; MOF, 2009). Administratively it belongs to the Sendang Biru Subdistrict, Sumbermanjing Wetan District, Malang Regency and East Java Province. Geographically it is located at 112°40'45" – 112° 42'45" East and 8°27'24"– 8°24'54" South. On the north side it borders with the Sempu Bay while on the east, south and north sides it is surrounded by the Indian Ocean (Fig. 1).

In the rainfall scheme of Schmidt & Ferguson (1951) the Sempu Island falls under the rainfall type C, indicating the slightly wet climate, where the prevalent natural vegetation is evergreen forest with an indication of slight seasonality by the presence of few deciduous tree species (Kartawinata, 2013). Fig. 2 is the climate diagram for Sumbermanjing weather station, about 60 km north of Sempu Island, based on Walter's (1973) method, using the 30-year rainfall data of LMG (1967) and Climate-Data.Org (2015) for temperature. It shows the drought period during the lowest rainfall in August (29 mm) and September (23 mm) and the wet period between October (115 mm) and July (119 mm), with the highest rainfall (322 mm) in December. In the climate diagram the drought period is indicated by the chart area enclosed by the rainfall curve and the temperature curve during the months of August and September, where during this period the evapotranspiration is assumed to exceed the precipitation (Walter, 1973). This period is critical for the life of plants, especially herbaceous plants that may be wilting and even dead. The soils on the island is rocky covered with thin layer of litter and having low moisture, low fertility, pH of 6-7 and temperature of 30-32°C (Kramadibrata *et al*., 2010).

Mangrove forest, coastal forest, lowland forest and lake-side forest can be found on the Sempu Island. Some ecosystems have been disturbed by touristic activities and other human uses by people living in the surrounding areas. The field study was conducted from 29 September to 10 October 2010 within the research plots of Polosakan (2011 & 2014) located in a coastal forest (Site 1) at Waruwaru and a lowland forest (Site 2) at Telonpring (Fig. 1). Site 1 was located at 08º25'50.76" S and 112º41'40.76" E'. The forest at Site 1 was slightly disturbed by touristic activities. The soil was calcareous with a thin litter layer. The study by Polosakan (2011) revealed that the coastal forest was structurally dominated by small trees (diameter < 20 cm) with a density of 705 trees/ha. The prevalent species, with the importance value > 10, were *Mallotus floribundus, Ficus* sp., *Drypetes ovalis*, *Artocarpus elasticus*, *Vitex pinnata*, *Aglaia odoratissima*, *Pterospermum diversifolium* and *Terminalia* sp. The families with the highest number of species

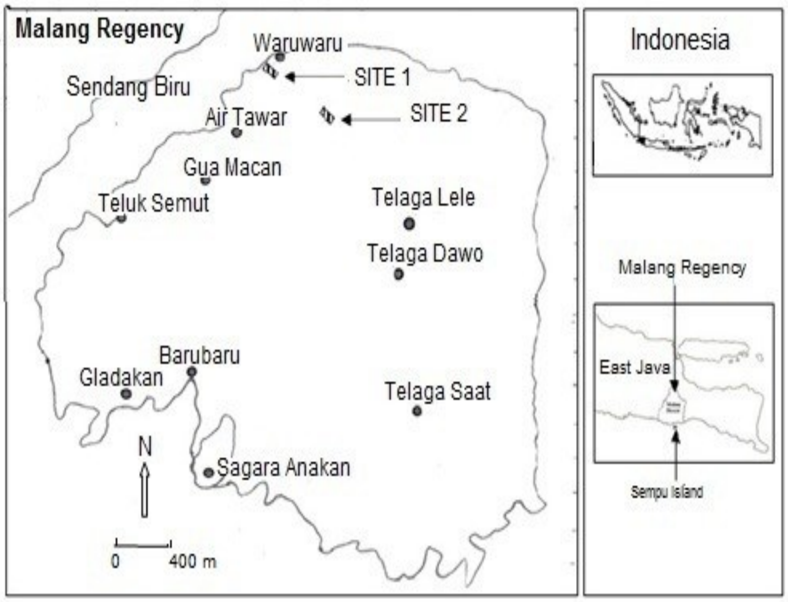

Fig. 1. The geographic position of the Sempu Island showing the study sites on the northern side of the island near Waruwaru.

were Euphorbiaceae, Sterculiaceae and Anacardiaceae. Site 2 at 08º26'13.13" S and 112º41'56.56" E was selected in the lowland forest located further inland which was denser than forest in Site 1 and was still in very good condition with no human disturbance. The soil was moister and thicker and physiography was more undulating than that in Site 1. Polosakan (2014) recorded that the tree density was 1005 trees/ha dominated by trees with diameters < 20 cm and canopy height of 15-20 m. The prevalent tree species were *Streblus asper, Aglaia argentea, Drypetes longifolia* and *Pseuduvaria reticulata.* The emergent trees with height > 25 m were *Pterospermum javanicum*, *Terminalia subspathulata*, *Bischofia javanica* and *Cratoxylum sumatranum*. The families with the highest number of species were Euphorbiaceae, Annonaceae, Clusiaceae and Sterculiaceae.

The undergrowth communities in each site was sampled with a plot of 1 m × 50 m, which was further divided into 50 subplots of 1 m × 1 m each. Within each subplot all species of herbs and seedlings (woody plants with height of < 50 cm) were identified; the number of individuals and the percentage of cover of each species were measured. Voucher specimens of each species were collected and identified at the Herbarium Bogoriense, Research Center of Biology–LIPI, Cibinong. The nomenclature of plant names follows Backer & Bakhuizen van den Brink, Jr. (1963, 1965, 1968). Validation name for the new version was obtained through the Plant List. In each subplot the following habitat factors were measured: slope, soil properties (pH, moisture and fertility) with a portable direct soil meter and the light reaching ground was estimated by the percentage of canopy opening. Data analysis follows the method of Mueller-Dombois & Ellenberg (1974) covering Relative Density (RD), Relative Dominance (RDo), Relative Frequency (RF) and Importance Value (IV = RD + RDo + RF). Sorensen's similarity index based on density between the two sites was calculated using the Biodiversity Pro version 2 and diversity index (H') was calculated using the formula of Shannon-Wienner (Barbour *et al*., 1987).

RESULTS AND DISCUSSION

Floristic composition

In the two plots studied we recorded 59 species, 57 genera and 39 families, with density of 315,000 individuals/ha, comprising 13 (22.03%) species of herbs and 46 (77.97%), species of woody seedlings (Table 1). It agrees with Whitmore (1986), who mentioned that in tropical forests the ground herb synusia is not so rich in species as the woody part. The low occurrence of herbs in our study was likely due to the fact that the study was carried out during the drought period in September-October (Fig. 2), where most herbs must have wilted and died away, leaving only the hardy species that could withstand drought, which in the present study were represented by *Apostasia* sp*., Asystasia nemorum, Cayratia japonica, Hedychium* sp*., Panicum* sp. *Pleomele* sp. and *Scleria lithosperma.*

Of the total 59 species, 53 species occurred in Plot 1 and 32 species in Plot 2, respectively. The two plots differed greatly with the index of similarity of only 18%. Similarity between the two

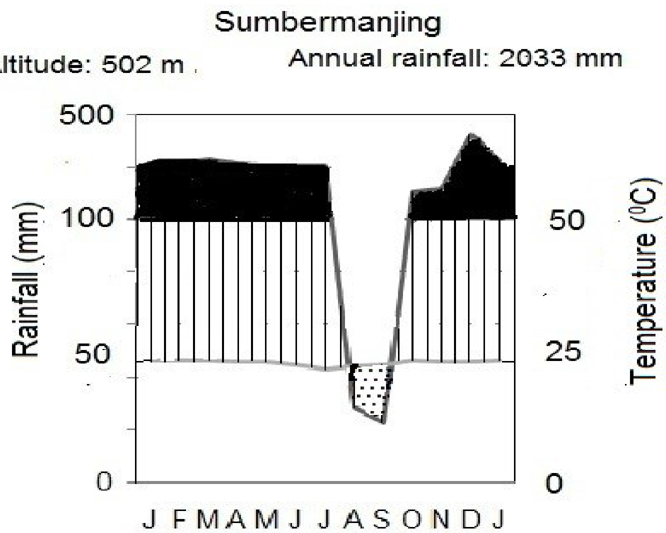

Fig. 2. Climate diagram for Sumbermanjing weather station, about 60 km north of Sempu Island, based on Walter's (1973) method, using data from LMG (1967) for rainfall and Climate-Data.Org (2015) for temperature. It shows a drought period in August and September and wet period between October and July.

plots were attributed to 26 species in Group 1 (Table 1), which were present in both plots at different values of density, dominance and frequency thus importance values. *Pterospermum javanicum, Knema* sp. *Microcos argentata, Ficus* sp., *Antidesma bunius, Ilex cymosa, Terminalia catappa* and *Aglaia argentea* were dominating (IV = 8.69 0-76.73%). The other species in Group 1 (Table 1) shared together by Plot 1 and Plot 2 were less significant compared to the above dominant species as they had much lower density, cover, frequency and importance values. The habitats vary from one place to another within an island, resulting in the variation in species diversity. Such a phenomenon occurred in the forest of the Sempu Island, as shown by the Shannon-Wienner Diversity Index of 4.47 for Plot 1 and 3.2 for Plot 2, with the mean of 3.84. Applying the criteria of Barbour *et al*. (1987) the plant species diversity in the forests of the Sempu Island was considered high (H'=3–4) to very high (H'>4).

Plot 1 was dominated by a sedge species, *Scleria lithosperma* (IV = 56.56), which was absent in Plot 2, indicating the community was a secondary growth, as it commonly grows in communities that developed abundantly following the clearance of primary forests as well as on open rocks and sandy habitats (Kern, 1974). The species was fairly well distributed throughout the subplots as indicated by its high frequency (RF= 5.63%). The second dominant species was *Asystasia nemorum* (IV = 31.24). The two species had the widest distribution in the subplots as indicated by highest RF (5.63% and 7.81%, respectively). Based on these vegetation parameters the two species can be used to name the undergrowth community in Plot 1 as the "*Scleria lithosperma-Asystasia nemorum* community type". The community was further complemented by Species Group 2 (Table 1), consisting of 28 species, having much lower RF and IV and occurring only in Plot 1, hence characterizing the undergrowth vegetation in the coastal forest of the Sempu Island. It is interesting to note that there were only *Guettarda speciosa, Hibiscus tiliaceus* and *Terminalia catappa* representing the typical coastal forest species, especially those characteristics of the "*Barringtonia* formation". Similar situation was also observed in the composition of the tree layer reported by Polosakan (2011).

Plot 2 was jointly dominated by *Pterospermum javanicum, Knema* sp. and *Microcos argentata,* which were the most prevalent in having high values of dominance, density and frequency (Table 1). Other prevalent species with lower IV were *Ficus* sp., *Antidesma bunius, Ilex cymosa, Terminalia catappa* and *Aglaia argentea.* It should be noted that *Pterospermum javanicum* is a typical species found in forests on small islands and inland lowland forests in West Java (Ismail, 1975; Kartawinata, 1977; Kartawinata *et al.,* 1985; Sumardja & Kartawinata, 1977). Of interest was *Terminalia catappa*, which is generally the main component of any coastal forest (Kartawinata, 2013; Steenis & Schippers-Lammerstse, 1965), was more prevalent in Plot 2 representing the inland lowland forest, indicating the sign of invasion. Species in Group 3 characterized the undergrowth community in the lowland inland primary forest, as the occurrence of these species was restricted to Plot 2. Except for *Garcinia* sp. and *Myristica teysmannii,* they are secondary growth species as they are commonly growing in the open forests and dry scrubs on open places especially in teak forest and seasonal forests (Backer & Bakhuizen van den Brink, Jr., 1963, 1965).

The microclimatic condition under the shade of tall trees and short trees in a forest with closed canopy is different from that under a forest with canopy gaps. In a closed-canopy forest, the light reaching the ground is low, humidity is high, temperature is low and evapotranspiration is low (Richard, 1996). Under such conditions the herbaceous species and seedlings do not always grow well and normal, as have been observed in Plot 1. The floristic differences between Plot 1 and Plot 2 were apparently attributed to the differences in the habitat conditions in the two plots, in particular the canopy gaps and slope (Table 1). The percentage of canopy gaps in Plot 1 was higher than in Plot 2, which was related to the higher density of trees and the more closed canopy in Plot 2. In a lowland forest, dense herbaceous vegetation frequently occur in natural and man-made openings, along paths and rivers, where the solar radiation is good, but in the interior of mature rain forest, herbs are found chiefly as scattered individuals and are sometimes absent (Richards, 1996). Herbs are common along streams, other wet places and canopy gaps, allowing greater penetration of light (Richards, 1996; Whitmore, 1986). Our field observations elsewhere show that undergrowth species may form patches of closed vegetation and are found mainly beneath canopy gaps.

The species-area curves (Fig. 3) initially showed the increase of the number of species with the increase in areas in the two plots, but beginning to level off at the areas of 4000 m^2 – 4900 m^2 (40^{th} – 49^{th} subplots), indicating that the area of 50 m^2 may be considered a mínimum area to sufficiently register the representative number of species within the community. It was further confirmed also by the regression index (R^2) of ± 0.927 for Plot I and ± 0.970 for Plot II, which were approaching 1, implying that further increase of the number of species was stable or constant, *i.e.* one or two species only.

The species composition of the undergrowth communities in the Sempu Island NR was considered high compared to those in other communities along the south coast of Java *e.g.* Ismail (1975) at Sukawayana, Sumardja & Kartawinata (1977) at Pangandaran and Sadili (2010) at Cikepuh. The differences could be attributed to different natural habitat conditions as well as to human disturbance factors.

Distribution and regeneration

The distributional patterns of herbs and seedlings in the Sempu Island NR, as expressed by the frequency values, were the product of interactions among ecological processes that have been progressing thus far, combined with the reproductive capacity and adaptability of the species to the environment (Barbour *et al*., 1987; Sadili, 2010). Table 1 shows that *Asystasia nemorum*, *Syzygium* sp*., Scleria lithosperma* and *Ficus* sp. in Plot 1 had a relatively better distribution compared to the others (RF > 5%), but in Plot 2 the RF values for *Asystasia nemorum* and *Syzygium* sp. were lower, except for *Ficus* sp. which was higher (FR=8. 46%), while *Scleria lithosperma* was not present at all. Species with high frequency (FR > 5%) were *Knema* sp., *Microcos argentata*, *Pterospermum javanicum*, *Ficus* sp., *Ilex cymosa*, *Antidesma bunius* and *Terminalia catappa*. They were recorded in Plot 2

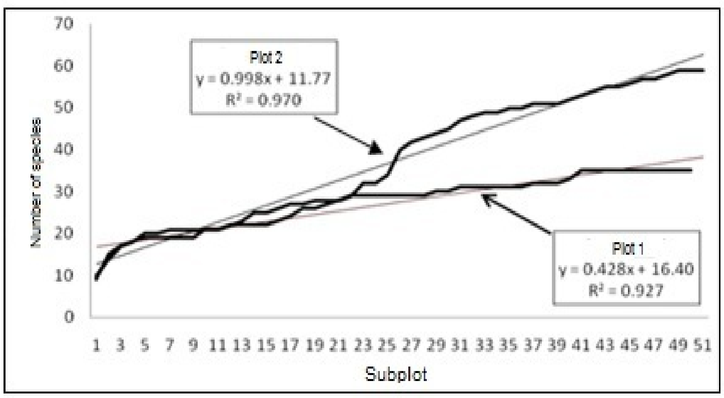

Fig. 3. Species-area curve for undergrowth communities in a coastal forest (Plot 1) and a lowland forest (Plot 2) at the Sempu Island NR, Malang, East Java.

Table 1. Species of tree (T), shrub (S), herb (H), and liana (L) in Plot 1 and Plot 2 expressed in terms of Relative Density (RD), Relative Dominance (RDo), Relative Frequency (RF) and Importance Value (IV= RD+RDo+RF), vegetation characteristics and hábitat of the undergrowth communities in the coastal and inland lowland forests of the Sempu Island Nature Reserve, Malang, East Java

No			Site							
			Plot 1				Plot 2			
	Habitat									
	Soil pH		6.78 ± 0.27				6.65 ± 0.41			
	Humidity (%)		30.71 ± 0.68				30.73 ± 1.08			
	Soil fertility scale		1.16 ± 0.41				1.48 ± 0.50			
	Canopy gap (%)		29.53 ± 11.91				9.68 ± 11.73			
	Slope (%)		5.00 ± 9.92				12.10 ± 13.52			
	Vegetation characteristics									
	Density (Individuals/1 ha)		317.600				312.400			
	Number of species		53				32			
	Number of genus		47				30			
	Number of family		35				22			
	Shannon Diversity Index (H')		4.47				3.2			
	Species	**Life-form**	**RDo**	**RD**	**RF**	**IV**	**RDo**	**RD**	**RF**	**IV**
	Species Group 1									
1	*Pterospermum javanicum* Jungh.	T	1.00	1.25	3.13	5.38	33.81	30.54	12.39	76.73
2	*Knema* sp.	T	0.88	0.13	0.63	1.64	13.93	17.67	15.71	47.31
3	*Microcos argentata* Burret	T	1.04	0.66	1.88	3.58	15.09	16.84	13.90	45.82
4	*Ficus* sp.	T	2.49	6.27	5.00	13.76	10.24	8.19	8.46	26.89
5	*Antidesma bunius* (L.) Spreng.	T	1.24	1.32	1.88	4.43	7.02	6.02	6.65	19.69
6	*Ilex cymosa* Blume	T	0.92	0.26	0.94	2.13	3.61	4.55	7.55	15.71
7	*Terminalia catappa* L.	T	1.28	1.45	3.44	6.17	2.38	2.88	6.34	11.61
8	*Aglaia argentea* Blume	T	1.02	0.59	1.25	2.87	2.11	2.05	4.53	8.69
9	*Lithocarpus sundaicus* (Blume) Rehder	T	1.04	0.66	1.25	2.95	0.78	0.90	1.21	2.88
10	*Desmodium* sp.	S	1.35	1.72	2.50	5.57	0.62	0.58	1.51	2.70
11	*Ardisia* sp.	T	1.06	0.73	0.63	2.41	0.64	0.64	1.21	2.49
12	*Mitrephora polypyrena* Miq.	T	0.92	0.26	0.31	1.50	0.25	0.38	1.81	2.45
13	*Crotalaria* sp.	S	0.88	0.13	0.31	1.33	0.30	0.32	1.21	1.83
14	*Polyalthia* sp.	T	1.10	0.86	1.88	3.83	0.56	0.38	0.60	1.55
15	*Dalbergia latifolia* Roxb.	T	0.87	0.07	0.31	1.24	0.34	0.38	0.60	1.32
16	*Lasianthus* sp.	T	1.24	1.32	2.19	4.74	0.12	0.19	0.91	1.22
17	*Streblus asper* Lour.	T	1.14	0.99	1.25	3.38	0.21	0.32	0.60	1.13
18	*Diospyros cauliflora* Blume	T	1.55	2.37	3.13	7.05	0.24	0.19	0.60	1.03
19	*Psychotria sarmentosa* Blume	T	1.65	2.70	3.75	8.10	0.19	0.13	0.60	0.93
20	*Pterospermum diversifolium* Blume	T	1.06	1.25	3.75	6.06	0.12	0.13	0.60	0.85

Table 1. Species of tree (T), shrub (S), herb (H), and liana (L) in Plot 1 and Plot 2 expressed in terms of Relative Density (RD), Relative Dominance (RDo), Relative Frequency (RF) and Importance Value (IV= RD+RDo+RF), vegetation characteristics and hábitat of the undergrowth communities in the coastal and inland lowland forests of the Sempu Island Nature Reserve, Malang, East Java (continued)

21	*Barringtonia racemosa* (L.) Spreng.	T	1.35	1.72	1.88	4.94	0.08	0.06	0.30	0.44
22	*Engelhardia* sp.	T	1.08	0.79	2.50	4.37	0.18	0.13	0.60	0.92
23	*Apostasia* sp.	H	0.96	0.40	0.31	1.67	0.09	0.13	0.30	0.52
24	*Garcinia celebica* L.	T	0.88	0.13	0.31	1.33	0.06	0.06	0.30	0.43
25	*Syzygium* sp.	T	1.61	3.30	5.63	10.54	0.40	0.26	0.60	1.26
26	*Asystasia nemorum* Nees	H	5.56	17.88	7.81	31.24	3.73	3.07	3.63	10.43
	Species Group 2									
27	*Scleria lithosperma* (L.) Sw.	H	34.18	16.75	5.63	56.56				
28	*Cleistanthus glaber* Airy Shaw	T	3.29	10.36	4.38	18.02				
29	*Knema laurina* Warb.	T	2.23	6.79	4.69	13.71				
30	*Cayratia japonica* (Thunb.) Gagnep.	L	1.35	1.72	4.06	7.13				
31	*Bambusa* sp.	S	1.55	3.10	2.19	6.84				
32	*Guettarda speciosa* L.	T	1.10	0.86	2.19	4.15				
33	*Lophopetalum javanum* Turcz.	T	1.37	1.78	2.19	5.34				
34	*Panicum* sp.	H	1.34	1.65	1.56	4.55				
35	*Syzygium claviflorum* (Roxb.) Wall. ex A.M.Cowan & Cowan	T	1.14	0.99	1.88	4.00				
36	*Hibiscus tiliaceus* L.	T	1.20	1.19	1.56	3.95				
37	*Beilschmiedia madang* Blume	T	1.08	0.79	1.56	3.43				
38	*Peltophorum inerme* (Roxb.) Naves	T	1.06	0.73	1.56	3.35				
39	*Ficus punctata* Thunb.	T	1.02	0.59	1.25	2.87				
40	*Glochidion* sp.	T	1.02	0.59	0.94	2.55				
41	*Santiria* sp.	T	1.02	0.59	0.94	2.55				
42	*Dioscorea* sp.	L	0.94	0.33	1.25	2.52				
43	*Diospyros sumatrana* Miq.	T	1.02	0.59	0.63	2.24				
44	*Diospyros* sp.	T	0.98	0.46	0.63	2.07				
45	*Hedychium* sp.	H	0.88	0.13	0.63	1.64				
46	*Clematis nepalensis* Royle	L	0.90	0.20	0.31	1.41				
47	*Pleomele* sp.	S	0.90	0.20	0.31	1.41				
48	*Allophylus cobbe* (L.) Raeusch.	T	0.87	0.07	0.31	1.24				
49	*Artocarpus elasticus* Reinw. ex Blume	T	0.87	0.07	0.31	1.24				
50	*Diospyros javanica* Bakh.	T	0.87	0.07	0.31	1.24				
51	*Mallotus floribundus* (Blume) Müll.Arg.	T	0.87	0.07	0.31	1.24				
52	*Memecylon* sp.	T	0.87	0.07	0.31	1.24				
53	*Polyscias fruticosa* (L.) Harms	T	0.87	0.07	0.31	1.24				
	Species Group 3									
54	*Croton argyratus* Blume	T					1.49	1.28	2.11	4.89
55	*Garcinia* sp.	T					0.45	0.58	1.51	2.54
56	*Myristica teysmannii* Miq.	T					0.28	0.26	1.21	1.75
57	*Dillenia* sp.	T					0.15	0.19	0.6	0.95
58	*Aporosa aurita* (Tul.) Miq.	T					0.09	0.13	0.3	0.52
59	*Leea aequata* L.	S					0.06	0.06	0.3	0.43

and also in Plot 1 but with lower values (Table 1). Species which were present with relatively high frequencies in Plot 1 and Plot 2 signified that they had better distribution and regeneration than the other species, implying that the habitat conditions at the Sempu Island NR were favorable for their survival and good growth. Polosakan (2011, 2014) recorded 49 species of trees in the coastal forest in the Sempu Island, of which, in the present study, only 9 species (18.37%) occurred in the seedling stage and of 63 species of trees in the lowland forest only 14 species (22.22%) were seedlings. It indicated that the regeneration in these forests were poor. The standing trees in the plots of Polosakan (2011, 2014) were represented only by *Aglaia argentea, Artocarpus elasticus, Diospyros cauliflora, Garcinia celebica, Guettarda speciosa, Mallotus floribundus, Mytrephora polyneura, Peltophorum inerme, Pterospermum diversifolium.* and *P. javanicum*. Among these species only *P. javanicum* had the highest IV = 76.73 and RF = 30.54% in Plot 2 and IV = 5.38 and RD = 1.25% in Plot 1. It implies that only *P. javanicum* will maintain itself and perhaps become more dominant in the inland forest in the future. This is, however, only weak indication and the situation will be different if the study is further enlarged by establishing more samples of tree and undergrowth layers over larger areas. *Myristica teysmannii* which was classified as endangered species (Risna, 2009) was present only in Plot 1 with relatively high density (RD = 17.67%) and frequency (RF = 15.71 hence it had a good chance to survive in the area.

CONCLUSIONS

The undergrowth flora in the coastal forest formed the *Scleria lithosperma—Asystasia nemorum* community type and in the inland lowland forest the *Pterospermum javanicum-Knema* sp. community type and each community type had a high species diversity. The floristic similarity between the two communities was very low. The floristic composition in the two communities did not reflect a good regeneration of the forests and the direction of floristic change and the future tree composition of the forest was not clear. Only *Pterospermum javanicum* will maintain itself and perhaps become more dominant in the inland forest in the future. This is, however, only an indication and the situation will be more affirmative if the study is further enlarged to cover larger areas. Further investigation of undergrowth and tree layers in the coastal and inland forest over a wider area with higher sampling intensity is needed to provide good data for better management of the Sempu Island NR. The pressure of human activities including economic development upon the reserve is greatly increasing which should be checked to ensure the future existence and viability of the reserve. More studies on floristic composition and structure of various plant communities in protected and non-protected areas should be carried out to clarify scientific explanation concerning the cause of patterns of species richness and also to provide data for utilization, management and conservation of biodiversity (Kartawinata, 2005).

ACKNOWLEDGEMENTS

We are grateful to the Head of Herbarium Bogoriense the Botany Division, the Head of the Biology Research Center-LIPI and the Directorate of Higher Education of the Ministry of National Education (through the Ministry of Research and Technology) for providing financial support. We also thank the Head of the East Jawa Office of Natural Resource Conservation (Balai Besar Konservasi Sumber Daya Alam Jawa Timur), for providing a research permit and to Pak Ipin, the Head of the Sempu Island NR and Pak Saihu for providing field facilities and assistance. We should acknowledge also the members of the research team (*i.e.* Kartini Kramadibrata, Suhardjono, Ruddy Polosakan, Florentina I. Windadri, Agus Sujadi, Idang Sumanta and Dewi Rosalina) for their cooperation during the field work.

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