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# Ranggawulung's Urban Forest, Subang District, Indonesia: Landuse Change and Values in Relation to Plant Community Structure

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## ABSTRACT

Ranggawulung's Urban Forest (RUF) is one of urban forest in Subang District under management of PT Pertamina EP field Subang giving good ecosystem services for people living surrounding the forest. Along with increasing population growth, the degradation of urban forest also increases and it is resulted in decreased biodiversity. This study was conducted to analyze plant community structure of RUF which was related to the land use change from 2012-2015 and also the values provided from its. The sampling sites were done in 42 large and small plots for tree (size: 40x40 cm) and shrub (size: 5x5 cm) in the area of 82 Ha. Data were collected from October-November 2015 including tree and shrub which were classified in family then were compared to data collected in 2012. Diversity index of Shannon-Wiener was analyzed to vegetation which was also associated with the consideration of land use change. Ranggawulung's urban forest had high diversity index (H'= 3.64 for tree, H'=3.07 for shrub) with the total number of individual were 1655 individuals belonging to 179 species from 101 families. Comparing to 2012, there was a decline of 153% total individual, although number of species and family increased in 2015. The land use change increased up to 65% in 2015 whereas 47% in 2012 of RUF including recreational activities, rice field, residential area and crop plantation. Thus, there is a serious problem faced by

the existence of RUF which is needed high attention to conserve biodiversity sustainably by all stakeholders, not only regional government but also all communities living surrounding this area. Socialization and education are the most important as initial steps for conservation acts besides replanting program which could be conducted by PT. Pertamina EP field Subang as a stakeholder of RUF.

**Keywords**: Landuse change, Plant community structure, Ranggawulung's urban forest, Subang District

## INTRODUCTION

Ranggawulung's urban forest (RUF) is one of the protected areas in Subang district, West Java, Indonesia. The management of this urban forest is under the management of PT. Pertamina EP field Subang together with responsibility of Department of Forestry and Plantation, Subang representatives. Starting at 2012, biodiversity study in RUF had already conducted by Centre for Environmental Studies UIN Syarif Hidayatullah Jakarta which was found that the diversity index of vegetation in RUF was categorized in moderate to high level (Centre for Environmental Studies UIN Jakarta 2012).

The community structure of plant is differed between in urban landscape and rural landscape. The urban landscape is more isolated than rural landscape which has varied characteristics in their size, shape, and internal dynamic. Landscape changes are the main cause of degradation in plant diversity at RUF which was reported by others including encroachment and agricultural expansion (Gebrehiwot and Hundera 2014), fodder, fire-wood and timber value (Hussain et al. 2008).

With the increasing population density of 128,096 person/km$^2$ in Subang district (Anonymous 2014), it has been particularly impressed on vegetation abundance. Similar to other studies, we found that the growth of urban population in Subang was resulted in disturbance in RUF which was showed by the increased recreational pressures (Maharjan et al. 2006, Balvanera et al. 2005, Dolan et al. 2015).

Indonesian oil and gas's company, PT. Pertamina EP field Subang is a company engaged in the exploration on natural resources which certainly will have an impact to the quality of surrounding environment. The company is very aware of its responsibility for protecting environment through conservation program in the region of Subang as the implementation of sustainable development policies stated in the Indonesian Constitution No. 32 of 2009 about the Protection and Management of the Environment. Conservation effort had been conducted in the area of RUF since 2012 by PT. Pertamina EP field Subang through planting program of fruit, woody plants and medicinal plants.

We had 2 objectives in this study. The first objective was to identity diversity of plants in RUF and to analyze the change of community structure of plants. Our second objective was to investigate landuse change as anthropogenic aspect. This study compared the condition of RUF at 2012 and 2015 on plant diversity associated with landuse change and evaluated planting program conducted by PT. Pertamina EP

field Subang at 2012. Database of plant diversity in RUF is an important tool in monitoring the changes occur in community structure of plants caused by anthropogenic activities and need to be updated continously.

## MATERIALS AND METHODHS

Ranggawulung's urban forest is located in the district of Subang, West Java with an area of 84 hectares at an altitude of 700 asl. This is administratively included in Subang district, which has a strategic potential conservative area providing ecosystem services for communities in Subang area. Level of rainfall in Subang is high reached 1600-3000 mm/year which is catched into 3 watersheds (Ciasem, Cipunagara, and Cilamaya). Subang district has unique topography divided into 3 zones which are mountain (in southern), hilly and plains (centre), and lowland (Northern) (Anonymous 2014).

This research had been carried out in the urban forest of Ranggawulung from October-November 2015 using survey method. There were 42 plots provided to observe 4 strata which were shrub (understorey species), sapling (< 10 cm dbh), pole (10-20 cm dbh) and tree (> 20 cm dbh). At each sampling plots, It was established a 10 m radius circular plot (Dombois and Ellenberg 1974). Shrub strata was quantified in 1 x 1 m quadrats whereas sapling, pole and tree were estimated each 5 x 5 m, 10 x 10 m and 20 x 20 m quadrats. All species and their individual number were collected and identified directly in the field but for all plants that were not known were taken a picture and brought to laboratory to identify by Identification book (Sabara 2011, Djawarningsih 2011, Soerjani et al. 1987, Priyadi et al. 2010). Estimation of density, species diversity, species dominance and species evenness were measured using Shannon Wiener's diversity index (Shannon-Wiener, 1949). Important valuable index (IVI) was also calculated to assess general situation of community structure in forest following Maharjan et al. (2006). Differences in density, diversity and evenness for the vegetation strata were analyzed by One way ANOVA using SPPS version 20.

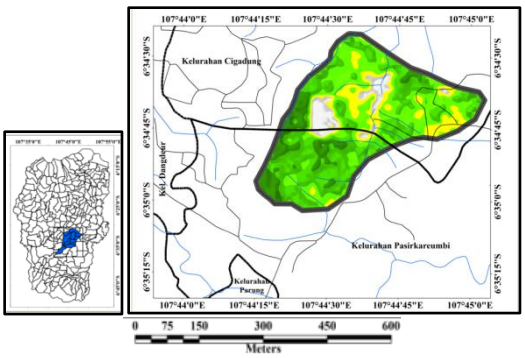


**Figure 1**.Map of Subang District showing RUF and Site of Study

## RESULTS AND DISCUSSION

A total of 1655 individuals belonging to 179 species from 101 families of shrubs and

tree species were identified in Ranggawulung's urban forest in 2015 (Table 1). Comparing to 2012, there was a decline of 153% total individual, although number of species and family increased in 2015. The landuse change was the main cause the disturbances occurred in RUF which increased up to 65% in 2015 whereas 47% in 2012 of RUF. The activities were identified as recreational activities, rock mining, rice field, plantation (crop and vegetables) and residential area. Tree logging had also been occurred in RUF during 2012 until 2015 which some species vanished and there were not found in 2015 including *Pinus merkusii, Artocarpus chempeden, Parajubae sunkha, Bambusa multiplex, Homalanthus populneus, Hibiscus tiliaceus, Melaleuca cajupati, Cocos nucifera, Delonix regia,* and *Leucaena leucocephala* (Table 2). Most of them were exploited by local people for their wood as the prices were high. While *Swietenia macrophyla, Lagerstroemia speciosa, Tectona grandis* were the most plants taken for wood but in 2015 they were replanted for economic purposes by local people although few number of sapling and pole were found (Table 2). The low income was the main reason of illegal logging in RUF. It can be understood that agriculture (27%) and mining (14%) are the major area conducted by most of the people in Subang (Anonymous 2014) which have higher potency in diversity disturbances for economic needs. This was also reported in agro-forestry, Jambi (Ningsih 2009), Soerjo Cangar's forest park, Malang (Maisyaroh 2010).

**Tabel 1**: Community Structure of Plants at RUF in 2012 & 2015

| **Parameter** | **2012** | | **2015** | |
|---|---|---|---|---|
| | **Shrub** | **Tree** | **Shrub** | **Tree** |
| Density (D) | 0.103 | 72.22 | 18 | 0.186 |
| Frequency (F) | 0.182 | 0.231 | 4.024 | 2.714 |
| Evenness Index (E) | 0.87 | 0.84 | 0.73 | 0.95 |
| Diversity Index (H') | 3.26 | 2.43 | 3.07 | 3.64 |
| Total Individual | 3829 | 363 | 756 | 899 |
| Total Family | 53 | 29 | 42 | 59 |
| Total Species | 96 | 42 | 67 | 112 |

**Table 2**. Total Species in Different Form of Canopy Layer in 2015 & 2012

| **local name** | **scientific name** | | **2015** | | | **2012** | | |
|---|---|---|---|---|---|---|---|---|
| | | **family** | **sapling** | **pole** | **tree** | **sapling** | **pole** | **tree** |
| Harendong | *Melastoma affine* | Melastomataceae | + | - | - | - | - | - |
| Pongporang | *Oroxylum Indicum* | Bignoniaceae | + | - | - | - | - | - |
| Laban | *Vitex pubescens* | Verbenaceae | + | + | + | - | - | - |
| Mahoni Uganda | *Swietenia macrophyla* | Meliaceae | + | - | - | - | - | + |
| Tisuk | *Hibiscus macrophyllus* | Malvaceae | + | + | + | - | - | - |
| Srikaya | *Annona squamosa* | Annonaceae | + | - | - | - | - | - |
| Jambu | *Psidium sp.* | Anacardiaceae | + | - | - | - | - | - |
| Jalitri | *Elaeocarpus sphaericus* | Elaeocarpaceae | + | - | - | - | - | - |
| Jeungjing | *Paraserianthes falcataria* | Fabaceae | + | + | + | - | - | + |
| Rengas Manuk | *Gluta wallichii* | Anacardiaceae | + | + | + | - | - | - |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Drowak | *Grewia acuminata* | Malvaceae | + | + | + | - | - | + |
| Sobsi | *Maesopsis eminii* | Rhamnaceae | + | + | + | - | - | - |
| Jengkol | *Archidendron pauciflorum* | Fabaceae | + | + | + | - | - | + |
| Rambutan | *Nephelium lappaceum* | Sapindaceae | + | + | + | - | - | + |
| Angsana | *Pterocarpus indicus* | Fabaceae | + | - | + | - | - | + |
| Tanjung | *Mimusops elengi* | Sapotaceae | + | + | + | - | - | - |
| Lampeni | *Ardisia humilis* | Myrsinaceae | + | - | - | - | - | - |
| Pete | *Parkia speciosa* | Fabaceae | + | - | + | - | - | + |
| Jabon | *Gmelina arborea* | Lamiaceae | + | + | + | - | - | - |
| Jalatra | *Gliricidia maculata* | Fabaceae | + | - | + | - | - | - |
| Teureup | *Artocarpus elasticus* | Moraceae | + | - | + | - | - | - |
| Mangga | *Mangifera indica* | Anacardiaceae | + | + | + | - | - | + |
| Jambu Mawar | *Syzygium jambos* | Myrtaceae | + | - | - | - | - | - |
| Nangka | *Arthrocarpus integra* | Moraceae | + | + | + | - | - | + |
| Kecapi | *Sandoricum koetjape* | Meliaceae | + | + | + | - | - | - |
| Karet | *Havea brasiliensis* | Euphorbiaceae | + | + | + | - | - | + |
| Bungur | *Lagerstroemia speciosa* | Lythraceae | + | + | + | - | - | + |
| Mahoni | *Swietenia mahagoni* | Meliaceae | + | + | + | - | - | - |
| Peutag | *Syzigium densiflorum* | Myrtaceae | + | + | - | - | - | - |
| Jambu Kopo | *Syzygium littorale* | Myrtaceae | + | + | + | - | - | + |
| Kanyere | *Bridelia glauca* | Phyllanthaceae | + | + | - | - | - | - |
| Lame | *Alstonia scholaris* | Apocynaceae | + | + | + | - | - | + |
| Hanjuang Hijau | *Cordyline dracaena* | Laxmanniaceae | + | - | - | - | - | - |
| Acret | *Spathodea campanulata* | Bignoniaceae | + | - | - | - | - | - |
| Salam | *Syzygium polyanthum* | Myrtaceae | + | - | - | - | - | - |
| Akasia | *Acacia mangium* | Fabaceae | + | - | + | - | - | + |
| Jamblang | *Syzygium cuminii* | Myrtaceae | + | - | - | - | - | - |
| Daun Kari | *Murraya koenigii* | Rutaceae | + | - | - | - | - | - |
| Mindi | *Melia azedarach* | Meliaceae | + | + | - | - | - | - |
| Jati Belanda | *Guazuma ulmifolia* | Sterculiaceae | + | | - | - | - | - |
| Bintinu | *Melochia umbellata* | Sterculiaceae | + | + | - | - | - | - |
| Singkong | *Manihot esculenta* | Euphorbiaceae | + | - | - | - | - | - |
| Waru | *Hibiscus tiliaceus* | Malvaceae | + | - | - | - | - | + |
| Kaliandra | *Calliandra calothyrsus* | Leguminosae | + | - | - | - | - | + |
| sp. 2 | | | + | + | - | - | - | + |
| Bambu Tali | *Gigantochloa apus* | Poaceae | + | - | - | - | - | - |
| Bambu Talang | *Schizostachyum brachycladum* | Poaceae | + | - | - | - | - | - |
| Jati | *Tectona grandis* | Lamiaceae | - | + | + | - | - | + |
| Bacang | *Mangifera foetida* | Anacardiaceae | - | + | - | - | - | - |
| Mahoni Uganda | *Swietenia mahagoni* | Meliaceae | - | - | + | - | - | - |
| Randu Kapuk | *Ceiba pentandra* | Malvaceae | - | - | + | - | - | - |
| Foris | *Acacia auriculiformis* | Fabaceae | - | - | + | - | - | - |
| Jambu Biji | *Psidium guajava* | Myrtaceae | - | - | + | - | - | + |
| Duren | *Durio zibethinus* | Malvaceae | - | - | + | - | - | |
| Jambu Mede | *Anacardium occidentale* | Anacardiaceae | - | - | + | - | - | + |
| Ki Bonteng | *Platea latifolia* | Stemonuraceae | - | - | + | - | - | - |
| Kluwih | *Artocarpus camansi* | Moraceae | - | - | + | - | - | - |
| Alpukat | *Persea americana* | Lauraceae | - | - | + | - | - | + |
| Asam | *Tamarindus indica* | Fabaceae | - | - | + | - | - | - |
| Kawung | *Arenga pinnata* | Arecaceae | - | - | + | - | - | - |
| Kondang | *Ficus variegata* | Moraceae | - | - | + | - | - | - |
| Melinjo | *Gnetum gnemon* | Gnetaceae | - | - | + | - | - | - |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Peundeuy | *Parkia javanica* | Fabaceae | - | - | + | - | - | - |
| Sawit | *Elaeis oleifera* | Arecaceae | - | - | + | - | - | - |
| Tin | *Ficus carica* | Moraceae | - | - | + | - | - | - |
| Trembesi | *Albizia saman* | Fabaceae | - | - | + | - | - | - |
| Pinus | *Pinus merkusii* | Pinaceae | - | - | + | - | - | + |
| Nangka beurik | *Artocarpus chempeden* | Moraceae | - | - | - | - | - | + |
| Palem | *Parajubae sunkha* | *Arecaceae* | - | - | - | - | - | + |
| Bambu | *Bambusa multiplex* | *poaceae* | - | - | - | - | - | + |
| Kareumbi | *Homalanthus populneus* | Euphorbiaceae | - | - | - | - | - | + |
| Waru | *Hibiscus tiliaceus* | Malvaceae | - | - | - | - | - | + |
| Kayu putih | *Melaleuca cajupati* | Myrtaceae | - | - | - | - | - | + |
| Kelapa | *Cocos nucifera* | Arecaceae | - | - | - | - | - | + |
| Flamboyan | *Delonix regia* | Caesalpiniaceae | - | - | - | - | - | + |
| Lamtoro | *Leucaena leucocephala* | Fabaceae | - | - | - | - | - | + |

*+: exist, -: no*

The disturbances in RUF were also showed by the declined density in 2015 while shrub was found more (Table 1). Land clearing for agriculture is one of assumption. Poaceae is a family of shrub dominantly grows in the cleared land which in this study *Cynodon dactylon* was found dominantly with highest IVI of 31.86 (Table 3).

Although disturbances in RUF resulted in loss of some species of trees, diversity index of tree increased in 2015 and was categorized in high density (H'= 3.64). It means that conservation conducted by PT. Pertamina EP field Subang was successful which was started from 2012. In 2015, the conservation program including tree planting has been giving good result in rehabilitation of diversity destruction in RUF. Moreover, the efforts could also be reported with many saplings were planted reached 62% and 33% of the pole (Table 2). Meanwhile, the lower density of tree in 2015 the higher attention was needed through restoration program in all open area which were mostly used for agricultural area.

The most species of shrub rich families were presented by Asteraceae, Melostomataceae, Poaceae and Fabaceae in 2012 while only Poaceae was a dominated family in 2015 (Figure 2). *Cynodon dactylon* and *Eupatorium odoratum* were showed the highest IVI up to 10% (Table 3) belonging to family of Poaceae and Asteracea. High tolerant is the main character of both families which are usually known as a pioneer plant. Both species can survive and easily grow in very low rainfall or high temperatures.

The most tree species dominated was belonging to Pinaceae and Fabacea in 2012 and also in 2015. *Pinus merkusii, Maesopsis eminii, Gmelina arborea, Mangifera indica, Swietenia mahagoni, Arthrocarpus integra, Paraserianthes falcataria,* and *Lagerstroemia speciosa* were indicated the highest IVI more than 10% (Table 4). Neverthelles, number of some fruit trees found in 2012 declined which were *Lagerstroemia speciosa, Artocarpus chempeden, Nephelium lanacum, and Mangifera indica.* as climate change factor. Illegal logging was other cause of declined woody trees such as *Swietenia macrophylla, Tectona grandis and Bambusa multiplex*. Lack of seed preparation and planting knowledge also occurred in planting of *Pinus merkusii.* These trees were planted by PT. Pertamina EP field Subang in 2012 through the wrong way which were already 1.5-2 m tall and in dry season, then they all were

died. Getting good result in planting *Pinus merkusii* depends on seed condition (age 3-4 months in plot weaning, 25-30 cm tall) and the season's planting which is good in rainy season providing enough water for plants growth (Cooling, 1968). The water will be evaporated up to 64.5% of total rainfall (Pudjiharta 1995), so *Pinus merkusii* needs more water to grow well and could prevent landslide as they strengthen root system through evapotranspiration system (Indrajaya and Handayani 2008).

The restoration program conducted by PT. Pertamina EP field Subang gave good impact to enhancement of diversity in RUF. The awareness of people to existence of RUF as source of germplasm in Subang district increased which some fruit, woody and medicinal plants were still preserved, such as *Mangifera indica, Artocarpus chempeden, Nephelium lanacum, Paraserianthes falcataria,* and *Gmelina arborea.*

In terms of RUF management in the future, sustainable conservation can only be reached if all stakeholders, not only regional government but also all communities living surrounding this area, give high contribution consistently. Socialization and education are the most important as initial steps for conservation acts besides replanting program which could be conducted by PT. Pertamina EP field Subang as a stakeholder of RUF together with all communities in Subang district.

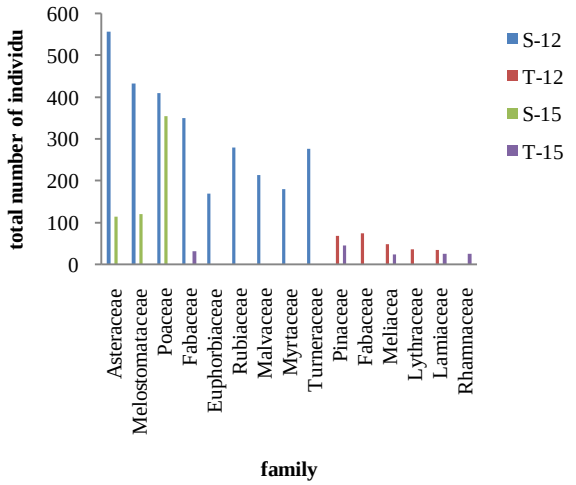


**Figure 2.** The most dominant Families in RUF 2012 and 2015

**Table 3.** Community Structure of Shrubs in RUF in 2015

| Local Name | Scientific Name | Σ Individual | D | RD | INP | C | H' | E |
|---|---|---|---|---|---|---|---|---|
| Rumput Kakawatan | *Cynodon dactylon* | 214 | 5.09524 | 28.31 | 31.86 | 0.025371989 | 3.072 | 0.73 |
| Kirinyuh | *Eupatorium odoratum* | 72 | 1.71429 | 9.52 | 17.81 | 0.007927973 | | |
| Jukut Pahit | *Paspalum conjugatum* | 52 | 1.2381 | 6.88 | 9.84 | 0.002419109 | | |
| Kakacangan | *Mucuna bracteata* | 21 | 0.5 | 2.78 | 8.69 | 0.001890048 | | |
| Harendong | *Melastoma malabathricum* | 14 | 0.33333 | 1.85 | 7.18 | 0.001287839 | | |
| Capi Tuheur | *Mikania cordata* | 17 | 0.40476 | 2.25 | 6.98 | 0.00121885 | | |
| Rumput Bebontengan | *Leptochloa chinensis* | 40 | 0.95238 | 5.29 | 6.47 | 0.001047958 | | |
| Bunga Pukul 8 | *Turnera ulmifolia* | 16 | 0.38095 | 2.12 | 6.26 | 0.000979194 | | |
| ilalang | *Imperata cylindrica* | 23 | 0.54762 | 3.04 | 6.00 | 0.000900272 | | |
| Babadotan | *Ageratum conyzoides* | 28 | 0.66667 | 3.70 | 5.48 | 0.000750445 | | |
| Mahoni | *Swietenia mahagoni* | 14 | 0.33333 | 1.85 | 5.40 | 0.00072958 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nanangkaan | *Euphorbia hirta* | 36 | 0.85714 | 4.76 | 5.35 | 0.000716531 | | |
| Jengkol | *Archidendron pauciflorum* | 13 | 0.30952 | 1.72 | 4.68 | 0.000547129 | | |
| Putri Malu | *Mimosa pudica* | 12 | 0.28571 | 1.59 | 3.95 | 0.000390886 | | |
| Pung Pulutan | *Urena lobata* | 11 | 0.2619 | 1.46 | 3.82 | 0.000365171 | | |
| Rumput Jajagon Leutik | *Echinochloa crus-galli* | 15 | 0.35714 | 1.98 | 3.17 | 0.000250836 | | |
| Jukut Bulu Mata Kibo | *Cyperus polystachyos* | 13 | 0.30952 | 1.72 | 2.90 | 0.000210686 | | |
| Jeungjing | *Paraserianthes falcataria* | 6 | 0.14286 | 0.79 | 2.57 | 0.000164968 | | |
| Karet | *Havea brasiliensis* | 10 | 0.2381 | 1.32 | 2.51 | 0.000157024 | | |
| Sawit | *Elaeis oleifera* | 5 | 0.11905 | 0.66 | 2.44 | 0.000148416 | | |
| Singkong | *Manihot esculenta* | 4 | 0.09524 | 0.53 | 2.30 | 0.000132739 | | |
| Nanas | *Ananas cuamosa* | 4 | 0.09524 | 0.53 | 2.30 | 0.000132739 | | |
| Kawung | *Arenga pinnata* | 4 | 0.09524 | 0.53 | 2.30 | 0.000132739 | | |
| Rumput Gajah | *Pennisctum purpureum* | 7 | 0.16667 | 0.93 | 2.11 | 0.000111235 | | |
| Areuy ki koneng | *Arcangelisia flava* | 7 | 0.16667 | 0.93 | 2.11 | 0.000111235 | | |
| Kiasahan | *Tetracera scandens* | 5 | 0.11905 | 0.66 | 1.84 | 8.50829E-05 | | |
| Ki Huut | *Tetenna laxiflora* | 5 | 0.11905 | 0.66 | 1.84 | 8.50829E-05 | | |
| sp. 1 | | 4 | 0.09524 | 0.53 | 1.71 | 7.33192E-05 | | |
| Nangka | *Artocarpus heterophyllus* | 4 | 0.09524 | 0.53 | 1.71 | 7.33192E-05 | | |
| Ludwigia | *Ludwigia perennis* | 4 | 0.09524 | 0.53 | 1.71 | 7.33192E-05 | | |
| Gadung | *Dioscorea hispida Dennst.* | 4 | 0.09524 | 0.53 | 1.71 | 7.33192E-05 | | |
| Ludwigia | *Ludwigia longifolia* | 8 | 0.19048 | 1.06 | 1.65 | 6.80557E-05 | | |
| Ki Peuret / Sambiloto | *Andrographis paniculata* | 3 | 0.07143 | 0.40 | 1.58 | 6.24303E-05 | | |
| Hampelas | *Ficus ampelas* | 3 | 0.07143 | 0.40 | 1.58 | 6.24303E-05 | | |
| Sereh Wangi | *Cymbopogon nardus* | 2 | 0.04762 | 0.26 | 1.45 | 5.24163E-05 | | |
| Rambutan | *Nephelium lappaceum* | 2 | 0.04762 | 0.26 | 1.45 | 5.24163E-05 | | |
| Pisang | *Musa paradisiaca* | 2 | 0.04762 | 0.26 | 1.45 | 5.24163E-05 | | |
| Buset | *Mimosa pigra* | 2 | 0.04762 | 0.26 | 1.45 | 5.24163E-05 | | |
| Bunga Jarong | *Stachytarpheta jamaicensis* | 2 | 0.04762 | 0.26 | 1.45 | 5.24163E-05 | | |
| Soka | *Ixora grandifolia* | 6 | 0.14286 | 0.79 | 1.39 | 4.7981E-05 | | |
| Temu Kunci | *Boesenbergia pandurata* | 1 | 0.02381 | 0.13 | 1.32 | 4.32771E-05 | | |
| Rumput Cyperus | *Cyperus iria* | 4 | 0.09524 | 0.53 | 1.12 | 3.14057E-05 | | |
| Pacing | *Costus speciosus* | 4 | 0.09524 | 0.53 | 1.12 | 3.14057E-05 | | |
| Pandan | *Pandanus furcatus* | 3 | 0.07143 | 0.40 | 0.99 | 2.44304E-05 | | |
| Laban | *Vitex pubescens* | 3 | 0.07143 | 0.40 | 0.99 | 2.44304E-05 | | |
| Urang-Aring | *Eclipta prostrata* | 2 | 0.04762 | 0.26 | 0.86 | 1.83298E-05 | | |
| Suji | *Dracaena angustifolia* | 2 | 0.04762 | 0.26 | 0.86 | 1.83298E-05 | | |
| Sobsi | *Maesopsis eminii* | 2 | 0.04762 | 0.26 | 0.86 | 1.83298E-05 | | |
| Jabon | *Gmelina arborea* | 2 | 0.04762 | 0.26 | 0.86 | 1.83298E-05 | | |
| Drowak | *Grewia acuminata* | 2 | 0.04762 | 0.26 | 0.86 | 1.83298E-05 | | |
| Alang-alang | *Imperata brevifolia* | 2 | 0.04762 | 0.26 | 0.86 | 1.83298E-05 | | |
| Tanjung | *Mimusops elengi* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Rumput Mutiara | Hedyotis corymbosa | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Paku Ata | *Lygodium microphyllum* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Paku | *Lygodium flexuosum* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Melastoma | *Melastoma* sp. | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Ki Bonteng | *Canarium hirsutum* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Kecapi | *Sandoricum koetjape* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Katuk | *Sauropus androgynus* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Kanyere | *Bridelia glauca Blume* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Jambu Mede | *Anacardium occidentale* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Jalitri | *Elaeocarpus sphaericus* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Daun Kari | *Murraya koenigii* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Cabai | *Capsicum annum* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Bungur | *Lagerstroemia speciosa* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |
| Alpukat | *Parsea americana* | 1 | 0.02381 | 0.13 | 0.72 | 1.31041E-05 | | |

*D: density, RD: relative density, IVI: important value index, C: dominancy index, H': Shannon Wiener Diversity Index, E: evenness index*

**Table 4.** Community Structure of Major Tree Species in RUF 2015

| **Lokal** | **Ilmiah** | **Σ Individual** | **D** | **RD** | **INP** | **C** | **H'** | **E** |
|---|---|---|---|---|---|---|---|---|
| Pinus | *Pinus merkusii* | 45 | 0.00268 | 19.74 | 28.60 | 0.00909 | 3.03 | 0.81 |
| Sobsi | *Maesopsis eminii* | 24 | 0.00143 | 10.53 | 19.92 | 0.00441 | | |
| Jabon | *Gmelina arborea* | 19 | 0.00113 | 8.33 | 18.11 | 0.00365 | | |
| Mangga | *Mangifera indica* | 13 | 0.00077 | 5.70 | 14.61 | 0.00237 | | |
| Mahoni | *Swietenia mahagoni* | 16 | 0.00095 | 7.02 | 14.59 | 0.00237 | | |
| Nangka | *Arthrocarpus integra* | 14 | 0.00083 | 6.14 | 14.19 | 0.00224 | | |
| Jeungjing | *Paraserianthes falcataria* | 11 | 0.00065 | 4.83 | 13.98 | 0.00217 | | |
| Bungur | *Lagerstroemia speciosa* | 13 | 0.00077 | 5.70 | 12.00 | 0.0016 | | |
| Jengkol | *Archidendron pauciflorum* | 6 | 0.00036 | 2.63 | 9.32 | 0.00096 | | |
| Jati | *Tectona grandis* | 5 | 0.0003 | 2.19 | 8.62 | 0.00082 | | |
| Randu Kapuk | *Ceiba pentandra* | 6 | 0.00036 | 2.63 | 7.67 | 0.00065 | | |
| Peundeuy | *Parkia javanica* | 1 | 6E-05 | 0.44 | 7.38 | 0.00061 | | |
| Karet | *Havea brasiliensis* | 3 | 0.00018 | 1.32 | 7.00 | 0.00054 | | |
| Sawit | *Elaeis oleifera* | 1 | 6E-05 | 0.44 | 6.87 | 0.00052 | | |
| Foris | *Acacia auriculiformis* | 3 | 0.00018 | 1.32 | 6.51 | 0.00047 | | |
| Lame | *Alstonia scholaris* | 3 | 0.00018 | 1.32 | 6.08 | 0.00041 | | |
| Drowak | *Grewia acuminata* | 3 | 0.00018 | 1.32 | 5.67 | 0.00036 | | |
| Asam | *Tamarindus indica* | 1 | 6E-05 | 0.44 | 5.59 | 0.00035 | | |
| Kecapi | *Sandoricum koetjape* | 4 | 0.00024 | 1.75 | 5.34 | 0.00032 | | |
| Angsana | *Pterocarpus indicus* | 3 | 0.00018 | 1.32 | 5.24 | 0.00031 | | |
| Kawung | *Arenga pinnata* | 1 | 6E-05 | 0.44 | 5.13 | 0.00029 | | |
| Akasia | *Acacia mangium* | 1 | 6E-05 | 0.44 | 5.13 | 0.00029 | | |
| Kluwih | *Artocarpus camansi* | 2 | 0.00012 | 0.88 | 4.95 | 0.00027 | | |
| Mahoni Uganda | *Swietenia macrophyla* | 3 | 0.00018 | 1.32 | 4.93 | 0.00027 | | |
| Duren | *Durio zibethinus* | 2 | 0.00012 | 0.88 | 4.45 | 0.00022 | | |
| Rengas Manuk | *Gluta wallichii* | 2 | 0.00012 | 0.88 | 4.44 | 0.00022 | | |
| Pete | *Parkia speciosa* | 2 | 0.00012 | 0.88 | 4.29 | 0.0002 | | |
| Jambu Mede | *Anacardium occidentale* | 2 | 0.00012 | 0.88 | 4.23 | 0.0002 | | |
| Tanjung | *Mimusops elengi* | 2 | 0.00012 | 0.88 | 3.73 | 0.00015 | | |
| Alpukat | *Persea americana* | 1 | 6E-05 | 0.44 | 3.70 | 0.00015 | | |
| Melinjo | *Gnetum gnemon* | 1 | 6E-05 | 0.44 | 3.52 | 0.00014 | | |
| Jambu Biji | *Psidium guajava* | 2 | 0.00012 | 0.88 | 3.52 | 0.00014 | | |
| Jambu Kopo | *Syzygium littorale* | 2 | 0.00012 | 0.88 | 3.48 | 0.00013 | | |
| Jalatra | *Gliricidia maculata* | 2 | 0.00012 | 0.88 | 3.46 | 0.00013 | | |
| Laban | *Vitex pubescens* | 1 | 6E-05 | 0.44 | 3.41 | 0.00013 | | |
| Rambutan | *Nephelium lappaceum* | 1 | 6E-05 | 0.44 | 3.39 | 0.00013 | | |
| Tisuk | *Hibiscus macrophyllus* | 1 | 6E-05 | 0.44 | 3.11 | 0.00011 | | |
| Tin | *Ficus carica* | 1 | 6E-05 | 0.44 | 2.86 | 9.1E-05 | | |
| Teureup | *Artocarpus elasticus* | 1 | 6E-05 | 0.44 | 2.77 | 8.5E-05 | | |
| Ki Bonteng | *Platea latifolia* | 2 | 0.00012 | 0.88 | 2.77 | 8.5E-05 | | |
| Kondang | *Ficus variegata* | 1 | 6E-05 | 0.44 | 2.75 | 8.4E-05 | | |
| Trembesi | *Albizia saman* | 1 | 6E-05 | 0.44 | 2.71 | 8.1E-05 | | |

*D: density, RD: relative density, IVI: important value index, C: dominancy index, H': Shannon Wiener Diversity Index, E: evenness index*

For conservation acts, vegetation index can be used to monitor the vegetation cover condition in one area of conservation. Using the vegetation index described below (Figure 3), it was confirmed that there was declined pattern since 2012 to 2015 in

RUF. This index was covers the measurements of greenness of vegetation canopy, the composite of chlorophyll, leaves area, structure and canopy cover (Huete 2011). The color of the vegetation index shows the level of vegetation covering the land. The area had a value of vegetation greenness below 0.2 was not counted as it could be water basin, shrub, rice field or stony area. For the area had a value above 0.4 counted as it was covered by vegetation in different level of dense.

In 2015, the land area with high vegetation declined to 15.54 Ha whereas in 2012 reached 26.64 Ha (Figure 4). The open areas which were not found any vegetation increased in 2015 reached 19.8 Ha while in 2012 only 16.56 Ha. The landuse for agriculture, residential and recreational purposes was the causes of increased uncover basal area by vegetation in RUF. Other cause was could be died for old trees or used for economic needs. The reduction of vegetation cover at RUF in 2015 was also supported by lower individual number of shrub and tree, despite diversity index showed higher value than in 2012 (Tabel 1).

Important steps that need to be conducted in order to conserve biodiversity are: (a) at the policy level, it needs to be developed for mainstreaming strategy document in the form of the Regional Conservation Strategy as part of the mandate IBSAP (Indonesian Biodiversity Strategic and Action Plan) 2015 to 2020, (b) consistent execution of local government regulation in raising awareness of the public and monitoring the status of biodiversity, (c) providing database of biodiversity, both spatial and temporal data, (d) commitment to law enforcement, and (e) the involvement of all stakeholders in biodiversity conservation program.

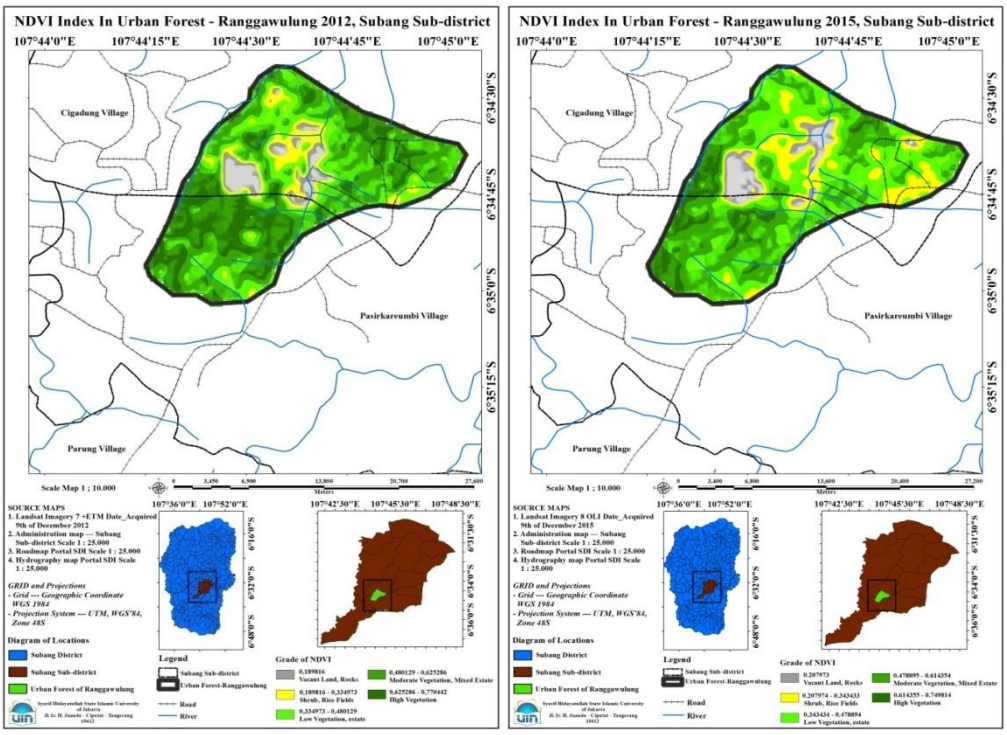


**Figure 3.** Vegetation Cover at RUF in 2012 and 2015

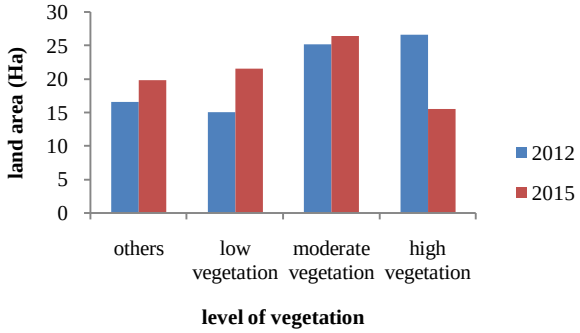


**Figure 4.** Land area of Vegetation in RUF

## CONCLUSION

The benefits of Ranggawulung's urban forest (RUF) existence in terms of ecological, economic, social and aesthetic were provided for surrounding's people. Management of RUF by local government in collaboration with PT. Petamina EP Field Subang was successful through planting of crops with high economic value such as *Paraserianthes falcataria, Gmelina arborea, Swietenia mahagoni, Gmelina arborea, Lagerstroemia speciosa, and Tectona grandis.* This was proved by enhancement of diversity index of Shannon-Wiener in 2015 compared to in 2012. The higher diversity in 2015 (H'=3.64 for tree and H'=3.07 for shrub) was not followed by increasing number of individual which the number of plants lost as much as 153% since 2012. The landuse change was the main cause increased up to 65% in 2015 whereas 47% in 2012 including recreational activities, rice field, residential area and crop plantation.

As one of stakeholders, PT. Pertamina showed clear evidence of the seriousness to do conservation program that have positive impacts on the quality of the environment. However, this conservation program faced a lot of obstacles and interference from outside parties or persons who damage the vegetation of RUF. In addition, land conversion looks increasingly rampant beside natural factor such as El-nino phenomenon which interfered with the growth of vegetation. Thus, there is a serious problem faced by the existence of RUF needs high attention to conserve biodiversity sustainably by all stakeholders. It was not borne solely by regional government but also all the communities nearby. For recommendation, Socialization and education are the most important as initial steps for conservation acts besides replanting program which had been conducted by PT. Pertamina EP field Subang and should be seriously supported.

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