BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, December 2016. Vol. **13**(4), 1945-1952

Diversity of Flora and Fauna in Halu Oleo University Botanical Garden

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http://dx.doi.org/10.13005/bbra/2348

(Received: 29 November 2016; accepted: 04 December 2016)

The study on the diversity of flora and fauna in Universitas Halu Oleo Botanical Garden had been carried out from August to October 2016. The method used was observation, survey and desk methods. The result of researh show that the flora and fauna in the Halu Oleo Botanical Garden found about 86 species of flora and 54 species of bird. In addition, it also found other fauna such as pigs, mice, wild chicken etc. There were some pressure influenced the existancy of flora and fauna in the garden, those are: illegal logging, hunting or trapped animals and forest fire. To anticipate impact of future pressure on flora and fauna, therefore, the prototyping to manage the garden had been developed as follows: (a) developing a public awareness activities or education to increase understanding of local community and students about function and existance of UHO botanical garden; (b) improving management system of botanical garden especially facilitation process on protection of the resources involving stakeholders (community, students, lecturers, etc) in proctection mangement; (c) to promote planting movement to enrich the Sulawesi endemic vegetation in the garden involving stakeholders; (d) to develop center of endemic vegetation of Sulawesi and (e) establishment of information and promotion center of UHO Botanical Garden to promote diversity of flora and fauna values as intangible value to support local economic development in the future.

Key words: Diversity of flora and fauna, Halu Oleo University, Botanical garden.

Botanical garden is one of the conservation concept which called ex situ conservation which success carry out an integrated conservation and economy (Anonym, 2016). Botanical garden had been developed in Indonesia, either in the national or regional level and there are 27 botanical garden (Ahmadi, 2015), however, these numbers are not relatively enough because ideally Indonesia should have 47 botanical garden as the number of ecoregions for the whole Indonesia of 47 point to achieve the function of botanical garden as stated in the President regulation No. 93/2011 namely conservation, research, education, tourism and environmental services (Witono *et al*, 2016).

To promote conservation implementation, the Halu Oleo University (UHO) had established botanical garden, and become the first botanical garden in Indonesia manage by university (Rianse in Anonym, 2015). The total size of Halu Oleo University botanical garden is ± 22,08 ha (Anonym, 2016). Therefore, Halu Oleo Unversity could prove it that its campus became the green campus.

The establishment of UHO botanical garden was as an expression of edu-eco-tourism rather than scientific and cultural arguments. The establishment of botanic garden in colonial empires

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is including Bogor and Purwodadi botanical gardens as well as all reflect colonial economic ambitions for the domestication of indigenous crops or the introduction of new other endemic vegetation from outside (Anonym, 1998).

Throughout history, many botanical gardens were found with plants based on utility, rather than aesthetic value, but in the past century, focus has shifted more to horticultural displays and conservation. Given that botanical gardens primary focus is plants, and that the majority of botanical gardens are in close proximity to highly populated urban centers, they are well positioned to serve as critical conduits for information about food plants and agriculture, adding this important element to their already well developed programs in conservation and horticulture (Brockway *et al*, 2002)

In addition, botanical gardens are uniquely placed to present and educate the public about all the plant sciences, not just diversity and conservation, but also all the many disparate kinds of research related to plant breeding and crop production (Danang *et al*, 2015; Rahayu, 2015). Therefore, development of UHO botanical garden will develop function of flora for education, conservation/environment and tourism based development (edu, eco, tourism).

Methodology

The Study Area

Location of study area of Halu Oleo Universty botanical garden is situated in the Halu Oleo University Campus Kambu District Kendari City Southeast Sulawesi Indonesia. The total area of UHO botanical garden is ± 22.8 ha, which consist of 3 block namely huge block of 18.46 ha, small block of 1 ha and swamp block of 3.42 ha. The orientation map and study location can be seen in Figure 1, as follows:

The topography of the study area have many variation with the slope level from flat areas (0-5%) to very slope areas (> 65%), where the highest point at 42 m above sea level and the owest at 8 m above sea level (Anonym, 2012). Based on the geology and soil analyses, that UHO botanical garden haave two geology formation, that is alangga and aluvial sediment. While the soil prroperties found were uttisol and entisols. The source of water in the study area is domiated by ground water sources. In addition, there si also river but have so poor water quality, the pH was 4 or acid condition (Anonym, 2016)**.** However, sadly that water source used by sorroundng community around UHO campus**.**

In addition, the data series of rain fall from 2005 to 2015, recorded that rain fall average yearly about 2.389 mm, the highest rain fall average on March and the lowest average was on September. The Schmidt-Ferguson climate classification system, classify that the study area include type B which indicate that wet month included in the tropical forest region. The average monthly temperature is 26.7^{o}C, where the highet temperature occured on April and the lowest occured on July. Whilst the highest humidity occur on June and the lowest one occur on October (BPS Kendari, 2015).

Economic condition of Kendari city tend to be an urban economic activities, where the expenses of community generally on tersier or services sectors rather then other sectors. There area several ethnics live around the study area, mostly ethnics which origin from Southeast Sulawesi such as Tolakinese, Butonese, Munanese and others. Halu Oleo University development generate impact on regional changes which indicate by a lot of land used changes for instance coversion of swamp and arable land into setlements, bussiness center, schools etc (BPS Kendari, 2015).

According to Statistic authority of Kendari city that population number of Kendari city in 2014 were 335,889 people, consist of men 169,371 people and women 166,318 people with the sex ratio 101.71 (BPS Kendari, 2015).

The location of UHO botanical garden consist of the land condition as follows: secondary forest with size 18,46 ha; swamp area with size of 3.42 ha and Arboretum area of 1.0 ha (Anonym, 2012) as shown in Figure 2.

Research Method

The research was conducted using the observation, interview, survey and desk methods. It was carried out from August to October 2016. Data used in this research derived from primary and secondary data sources, especially from previous studies and other related publications.

RESULTS AND DISCUSSION

Flora and Fauna in Halu Oleo University Botanical Garden

Vegetation analyses on diversity of flora and fauna have been conducted. It was found that there were 86 species of flora which included to 72 genus and 45 families as shown in Table 1. Myrtaceae was the dominant family found in the UHO botanical garden, followed by Apocynaceae and Phyllanthaceae. In addition, there are four endemic species discovered, those are soni or singi (*Dillenia serrata* Thunb.), tumbeuwa (*Kjellbergiodendron celebicum* (Koord.) Merr.), *Helicia kellbergii* Sleumer, and *Lasjia hildebrandii* Steenis which have a closed relative with Macadamia, the famous vegetation in Australia as reported by Indonesian Science Institute (LIPI) in Anonym, 2016.

Table 1. Diversity of Flora in UHO Botanical Garden

No	Species	Family Name	Local Name	Status Endanger
1	Acronychia trifolio Zoll. & Moritzi	Rutaceae	Sioh	x
2	Alangium sp	Alangiaceae		
3	Aistonia spectabilis R.Br	Apocynaceae		x
4	Alyxia sp	Apocynaceae		
5	Anamista cocculus (L.) Wight & arn.	Menispermaceae		x
6	Antidesma Montanum Blume	Phyllanthaceae		x
7	Antidesma sp.	Phyllanthaceae		
8	Antidesma ghaesembilla Gaertn.	Phyllanthaceae		x
9	Archhidendron pauciflorum (Benth.) I.C. Nielsen	Fabaceae	Benatan	x
10	Artocarpus altilis (parkinson ex F.A.Zom) Fosberg	Moraceae	Kulak	x
11	Baccaurea sp.	phyllanthaceae		
12	Bambusa sp.	Poaceae		
13	Barringtonia sp.	Lecythidaceae	Puta	
14	Calamus ornatus blume	Arecaceae	Rotan lambang	x
15	Canthium sp.	Rubiaceae		
16	Carallia brachiata (Lour.) Merr.	Rhizophoraceae		x
17	Caryota mitis lour	Arecaceae		x
18	Castanopsis buruana Miq.	Fagaceae	Eha	x
19	Cinnamomum sp.	Lauraceae		
20	Cleistanthus oblongifolius (Roxb.) Mull.Arg.	Phyllanthaceae		x
21	Cratoxylum formosum (Jacq.) Benth. & Hook.f. ex Dyer	Hypericaceae	Sisio	LR/LC ver 2.3
22	Cratoxylum sp.	Hypericaceae	Sisio	
23	Cycas circinalis L.	Cycadeceae	Pakis aji	En A2acd ver 3.1pop.Trend: decreasing
24	Dillenia serrata thunb.	Dilleniaceae	Soni (Muna); singi (tolaki)	x
25	Dioscorea hispida dennst.	Dioscoreaceae		x
26	Diospyros javanica bakh.	Ebenaceae		X
27	Dracaena angustifolia (medik.) Roxb.	Agavaceae	Kayu cina	x
28	Dracaena sp.	Agavaceae		
29	Elaeocarpus serratus L.	Elaeocarpaceae		x
30	Fagraea fragrans Roxb.	Gentianaceae	Kulahi	x
31	Fagraea racemosa Jack	Gentianaceae		x
32	Ficus crassiramea (Miq.) Miq.	Moraceae		x
33	Ficus drupaceae Thunb.	Moraceae	roramu	x
34	Ficus oleifolia king	Moraceae		x
35	Freycinetia sp.	Pandanaceae		
36	Garcinia celebica L.	Clusiaceae		x

37	Garcinia sp.	Clusiaceae		
38	Garcinia tetrandra pierre	Clusiaceae		x
39	Gardenia sp.	Rubiaceae		
40	Gnetum gnemon L.	Gnetaceae		LC ver 3.1 Pop. Trend: unknown
41	Grevillea elberti sleumer	Proteaceae		x
42	Grewia sp.	Malvaceae		
43	Guioa sp.	Sapindaceae		
44	Helicia kjellbergii sleumer	Proteaceae		x
45	Hoya sp.	Apocynnaceae		
46	Hydriastele sp.	Arecaceae		
47	Ixora lanceolata Lm.	Rubiaceae	Soka	x
49	Kibatalia sp.	Apocynnaceae		
49	Kjellbergiodendron celebicum (Koord.) Merr.	Myrtaceae	Tumbeuwa	x
50	Lepisanthes Amoena (Hassk.) Leenh.	Sapindaceae		x
51	Licuala rumphii Blume	Arecaceae		X
52	Lithocarpus sp.	Fagaceae	Rumbe	
53	Lygodium Circinatum (Burm.f.) Sw	Lygodiaceae	Paku ata	X
54	Lasjia hildebrandii (Steenis) P.H Weston & A. R.Mest	Proteaceae		X
55	Macrosolen sp.	Loranthaceae		
56	Mallotus philipensis (Lam.) Mull.Arg	Euphorbiaceae		x
57	Maranthes corymbosa Blume	Chysobalanaceae		LR/Lc ver 2.3
58	Metroxylon sagu Rottb	Arecaceae		x
59	Nauclea orientalis (L) L.	Rubiaceae		X
60	Nephrolepis sp	Nephrolepidaceae		
61	Nymphoides indica (L.) Kuntza	Menyanthaceae		Lc ver 3.1 Pop. trend : stable
62	Pandanus tectorius Parkinson ex Du Roi	Pandanaceae	Pandan hutan	x
63	Peltophorum pterocarpus (DC.) K.Heyne	Fabaceae		x
64	Piper Baccatum Blume	Piperaceae		x
65	Polyscias Kjellbergii (Phillipson) Lowry & G.M. plunkett	Araliaceae	Ghondolia	x
66	Rauvolfia sumatrana Jack	Apocynaceae	tolihe	x
67	Rhodamnia cinerea Jack	Myrtaceae		
68	Rhodamyrtus sp	Myrtaceae	Batu-batu	
69	Scheleichera oleosa (Lour.) Merr.	Sapindaceae		x
70	Stenochlaena palustris (Burm. f.) Bedd.	Blechnaceae		x
71	Strophanthus sp	Apocynaceae		
72	Syzygium acuminatissimum (Blume) DC	Myrtaceae		x
73	Syzygium sp.1	Myrtaceae	ruruhi	
74	Syzygium sp.2	Myrtaceae	see	
75	Syzygium sp.2	Myrtaceae	See kecil	
76	Tectaria sp.	Tectariaceae		
77	Tristaniopsis whiteana (Griff.) Peter G. Wilson & J.T. Waterh.	Myrtaceae		x
78	Vernonia arborea Buch.-Ham	Asteraceae		x
79	Vitex cofassus Reinw. Ex Blume	Lamiaceae	biti	x
80	Vitis sp.	Vitaceae		
81	Xanthophyllum sp.	Polygalaceae		
82	Xanthostemon petiolatus (Valeton) Peter G. Wilson	Myrtaceae	Kayu besi; Kayu nona	x
83	Xylopia sp.	Annonaceae		
84	Leersia hexandra Sw.	Poaceae	Rumput silet	x
85		Euphorbiaceae		
86		Icacinaceae		

Table 2. Bird Species in the UHO Botanical Garden

No	Species	Generic Name	Family Name
1	*Accipiter griseiceps*	Elang alap kepala kelabu	Accipitridae
2	*Aethopyga siparaja*	Burung madu sepah raja	Nectariniidae
3	*Anthreptes malacensis*	Burung madu kelapa	Nectariniidae
4	*Aplonis scrassa*	Perling tanibar	Sturnidae
5	*Aplonis minor*	Perling kecil	Sturnidae
6	*Apus affinis*	Kapinis rumah	Apodidae
7	*Centropus bengalensis*	Bubut alang-alang	Cuculidae
8	*Cisticola exilis*	Cici merah	Cisticolidae
9	*Collocalia infuscate*	Walet maluku	Apodidae
10	*Cypsiurus balasiensis*	Walet palem asia	Apodidae
11	*Dicaeum agile*	Cabai gesit	Dicaeidae
12	*Dicaeum aurelimbatun*	Cabai panggul kuning	Dicaeidae
13	*Dicaeum celebicum*	Cabai panggul kelabu	Dicaeidae
14	*Dicaeum monticolum*	Cabai panggul hitam	Dicaeidae
15	*Dicaeum sanguinolentum*	Cabai gunung	Dicaeidae
16	*Ducula aenea*	Pergam hijau	Columbidae
17	*Eudynamis orientalis*	Tuwur Sulawesi	Cuculidae
18	*Ficedula westermannii*	Sikatan belang	Muscicapidae
19	*Gallus gallus*	Ayam hitam merah	Phasianidae
20	*Halcyon chloris*	Cekakak sungai	Alcedinidae
21	*Halcyon coromanda*	Cekakak merah	Alcedinidae
22	*Heinrichia callygina*	Cingcoang sulawesi	Turdidae
23	*Hirundapus caudacutus*	Kapinis jarum asia	Apodidae
24	*Hirundo tahitica*	Layang-layang batu	Hirundinidae
25	*Lanius cristatus*	Bentet coklat	Laniidae
26	*Lichmera argentauris*	Isap madu topi sisik	Meliphagidae
27	*Lichmera indistinct*	Isap madu Australia	Meliphagidae
28	*Lonchura malacca*	Bondol rawa	Estrididae
29	*Lonchura pallid*	Bondol kepala pucat	Estrididae
30	*Lophozosterops squamiceps*	Opior sulawesi	Zosteropidae
31	*Monarcha pileatus*	Kehicap tengkuk putih	Monarchidae
32	*Muscicapa dauurica*	Sikatan bubik	Muscicapidae
33	*Myzomela erythrocephala*	Myzomela kepala merah	Meliphagidae
34	*Myzomela sanguinolenta*	Myzomela merah tua	Meliphagidae
35	*Nectarinia aspasia*	Burung madu hitam	Nectariniidae
36	*Nectarinia jugularis*	Burung madu sriganti	Nectariniidae
37	*Pachycephala pectoroalis*	Kancilan emas	
Pachycephalidae			
38	*Passer montanus*	Burung gereja erasia	Passeridae
39	*Philemon citregularis*	Cikukua kecil	Meliphagidae
40	*Phylloscopus borealis*	Cikrak kutub	Sylviidae
41	*Phylloscopus sarasinorum*	Cikrak sulawesi	Sylviidae
42	*Pyononotus aurigaster*	Cucak kutilang	Pycnonotidae
43	*Pyononotus goiavier*	Merbah cerukcuk	Pycnonotidae
44	*Rhamphococcyx calyorhynchus*	Kadalan sulawesi	Cuculidae
45	*Rhinomyias oscillans*	Sikatan rimba ayun	Muscicapidae
46	*Saxicola caprata*	Decu belang	Muscicapidae
47	*Surniculus lugubris*	Kedasi hitan	Cuculidae
48	*Trichastoma celebense*	Pelanduk sulawesi	Timaliidae
49	*Zosterops anomalus*	Kacamata makasar	Zesteropidae
50	*Zosterops atrifrons*	Kacamata dahi hitam	Zesteropidae
51	*Zosterops chloris*	Kacamata sulaewi	Zesteropidae
52	*Zosterops consobrinorum*	Kacamata laut	Zesteropidae
53	*Zosterops everetti*	Kacamata belukar	Zesteropidae
54	*Zosterops montanus*	Kacamata gunung	Zesteropidae

Source : Master Plan UHO Botanical Garden, 2016 Analysees)

Interestingly, that there were several species included in the IUCN redlist of Thretened Species, namely *Cycas circinalis* L., *Maranthes corymbosa* Blume, *Gnetum gnemon* L, *Cratoxylum formosum* (Jacq.) and *Nymphoides indica* (L.). Importantly, there some potential plants could be developed as ornamental plants, such as *Syzygium* sp. (Mhyrtaceae). pakis aji (*Cycas circinalis* L.), Soni (*Dillenia serrata* Thunb.), kayu cina (*Dracaena angustifolia* (Medik.) Roxb.), palem *Hydriastele* sp., and soka (*Ixora lanceolata* Lam.). Moreover, that several plants could be used for building materials and one of the dominant species is kayu nona (*Xanthostemon petiolatus* (Valeton) peter G. Wilson), benatan (*Archidendron pauciflorum* (Benth.) I.C.Nielsen), eha (*Castanopsis buruana* Miq.), tumbeuwa (*Kjellbergiodendron celebcum* (Koord.) Merr.), rumbe (*Lithocarpus* sp.), *Tristaniopsis whiteana* (Griff.) Peter G.Wilson & J.T.Waterh., and biti (*Vitex coassus reinw*. ex Blume).

Results of survey that trees in the secondary forest block were dominated by local species that already exist in the UHO forest. The structure of trees tend to be completed with local species such as ruruhi (*Syzigium*, sp), Songi (*Dillenia serrata* Thunb), eha (*Castanopsis*, sp), etc. This study is supported by previous survey reported by LIPI in Anonym, 2016 that forest in the Halu Oleo University Botanical Garden is characterized by secondary forest, where the structure of trees complete with local species domination (Anonym, 2016). In addition, the position of UHO secondary forest more important because situtaed in the middle of Kendari city. So UHO forest become good habitat for many fauna such as reptile, insects, mamals and birds.

According to Israh (2015), there were about 47 bird species found in the UHO forest and 7 species have been discovered and identified by LIPI (Anonym, 2016), therefore, the total number of bird species become are 54 species as shown in the Table 2.

As mention in the previous that UHO botanical garden had potential on flora and fauna especially birds. However, the existance of which are affected by some pressures or threats such as : illegal logging by the local, birds hunting and other animals trapping and forest fire. Hunting of wildlife especially birds, forest chichen and pigs are found in the UHO botanical garden forest. The traditional traps and gun were used to hunt fauna in the secondary forest block of UHO botanical garden. So, could be concluded that the pressure of flora and fauna in the UHO botanical garden are mostly influenced by human activities.

In accordance to above pressure, influence the recent status of flora and fauna in the UHO botanical garden. The result of observation that lots of cutted stems found in the forest floor of UHO. In addition, birds track and birds sound decreased when observation was done. Sadly, due to unresponsible visitor came to the UHO botanical garden, lots of plastics waste and other materials discharge in the forest, so

Fig. 1. Map of Study Area

Fig. 2. Map of Halu Oleo University Campus and Distribution of UHO Botanical Garden

those were also become threat and pressure of UHO forest. Therefore, based on the interviu with Head and secretary of UPT. Kebun Ilmu Hayati UHO, they said that illegal logging and hunting of birds in the garden still happen and therefore UHO botanical garden should be protected.

"One of the problem cause local community enter and cutting down trees and traped animals as well as hunting birds due to lack of awareness of the community on the existency of UHO botanical garden, therefore, UPT. Kebun Ilmu Hayati will conduct socialization works intensively" (Sadimantara, head of UPT. Kebun Ilmu Hayati, (2016)).

"I got information that local community live around UHO campus entered the UHO botanical garden and cutt down small trees usually they operate in early morning about at 4-5 o'clock. They sold the trees to support contructions material" (Annas Ma'ruf, 2016).

Responding to the pressures and the state of Halu Oleo University botanical garden, there are several prototypes have been developed through this research in order to achieve the best botanical garden in the future as stated in its vision " to be a world excellent university botanical garden on research, conservation and education of Endemic vegetation of Sulawesi". The prototyping of UHO botanical garden in order to protect and increase the diversity of flora and fauna are:

1. developing a public awareness activities or education to increase understanding of local community and students about function and existance of UHO botanical garden;
2. improving management system of botanical garden especially facilitation process on protection of the resources involving stakeholders (community, students, lecturers, etc) in proctection mangement;
3. to promote planting movement to enrich the Sulawesi endemic vegetation in garden involving stakeholders;
4. to develop center of endemic vegetation of Sulawesi, and
5. establishment of information and promotion center of UHO Botanical Garden to promote diversity of flora and fauna values as intangible value to support local economic development in the future.

CONCLUSION

In accordance with the result of this reseach, the following conclusion could be described, as follows:

1. The state of flora and fauna in the Halu Oleo University Botanical Garden dominated by indigenous species that already exist before and the diversity of flora found were 86 species and fauna (birds) were 54 species;
2. The existance of flora and fauna in the Halu Oleo University Botanical Garden faced several pressures and therefore, flora and fauna within the garden tend to be vurnerable to disturbance;
3. To develop the Halu Oleo University Botanical Garden in the future, the prototyping to manage the diversity of flora and fauna have been prepared, as follows: (a) developing a public awareness activities or education to increase understanding of local community and students about function and existance of UHO botanical garden; (b) improving management system of botanical garden especially facilitation process on protection of the resources involving stakeholders (community, students, lecturers, etc) in proctection mangement; (c) to promote planting movement to enrich the Sulawesi endemic vegetation in the garden involving stakeholders; (d) to develop center of endemic vegetation of Sulawesi and (e) establishment of information and promotion center of UHO Botanical Garden to promote diversity of flora and fauna values as intangible value to support local economic development in the future.

REFERENCES

1. Ahmadi, A. 2015. LIPI: Indonesia Kekurangan Kebun Raya, Desember 25, http;// www.VIVA.co.id.
2. Anonymous, 2016. Laporan Akhir Master Plan Kebun Raya Universitas Halu Oleo, Pusat Konservasi Tumbuhan Kebun Raya-LIPI, Universitas Halu Oleo.
3. SK Rektor UHO No.351a/UN29/KP/2015 tanggal 20 Maret 2015 tentang penunjukan hutan sekunder, lokasi tegakan kayu besi, dan rawa

menjadi Kebun Raya Halu Oleo, 2015.
4. Rencana Induk Pengembangan Universitas Halu Oleo 2012-2045, Peraturan Rektor No. 2610/ UN29/PR/2012, Universitas Halu Oleo, 2012.
5. Botanic Gardens Conservation International, an Instution Holding Collections of Documented and Living Plants for the Purposes of Scientific Research, Conservation, Display and Education, 1988.
6. BPS Kendari, Kota Kendari Dalam Angka. Badan Pusat Statistik Kendari, 2015.
7. Brockway and Lucile H., Science and Colonial Expansion: The Role of the British Royal Botanic Gardens (Studies in Social Discontinuity). Yale University Press, 2002.
8. Danang Wahyu Purnomo, Saniyatun Mar'atus Solihah dan Sumanto.**,** Nilai konservasi dan jasa lingkungan koleksi tumbuhan kebun raya pada kawasan perkotaan. Pusat Konservasi Tumbuhan Kebun Raya - Lembaga Ilmu Pengetahuan Indonesia, Bogor, 2015.
9. Israh, Keanekaragaman Jenis Burung Dalam Hutan Kampus Universitas Halu Oleo Kendari Provinsi Sulawesi Tenggara. Skripsi, Universitas Halu Oleo, Kendari, 2015.
10. Rahayu, S. Peran Kebun Raya Indonesia dalam Pelestarian Sumberdaya Genetik Tanaman Pusat Konservasi Tumbuhan Kebun Raya-LIPI. www.lipi.go.id, 2015.
11. Witono, J.R. Purnomo, D.W. Usmadi, D.O. Pribadi, D. Asikin, M. Maghandi, Sugiarti dan Yuzammi, Rencana Pengembangan Kebun Raya Indonesia, Pusat Konservasi Tumbuhan Kebun Raya Bogor-LIPI. Bogor, 2012.