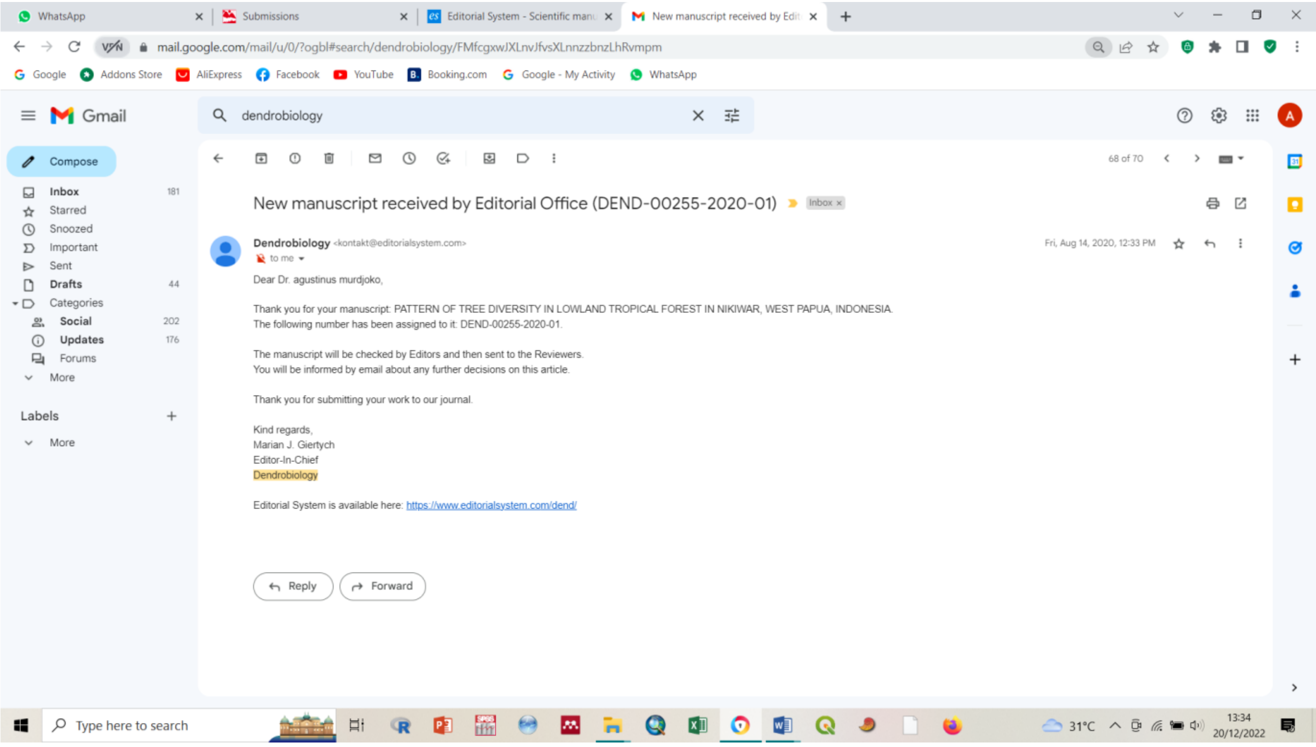
BUKTI KORESPONDENSI ARTIKEL

Murdjoko A, Djitmau DA, Ungirwalu A, Sinery AS, Herlina R, Siburian S, Mardiyadi Z, Wanma AO, Wanma JF, Rumatora A, Mofu WY, Worabai D, May NL, Jitmau MM, Alexander G, Mentansan F, Krey K, Musaad I, Manaf M, Abdullah Y, Mamboai H, Pamuji KE, Raharjo S, Kilmaskossu A, Bachri S, Mikael N, Benu H, Tambing J & Kuswandi R (2021) Pattern of tree diversity in lowland tropical forest in Nikiwar, West Papua, Indonesia. Dendrobiology 85:78–91.

Berikut adalah proses pengiriman artikel, proses, komentar reviewer, perbaikan dan korespondensi dengan pihak editor jurnal yang dilakukan oleh penulis korespondensi seperti di bawah ini:

Contents

Pengiriman pertama



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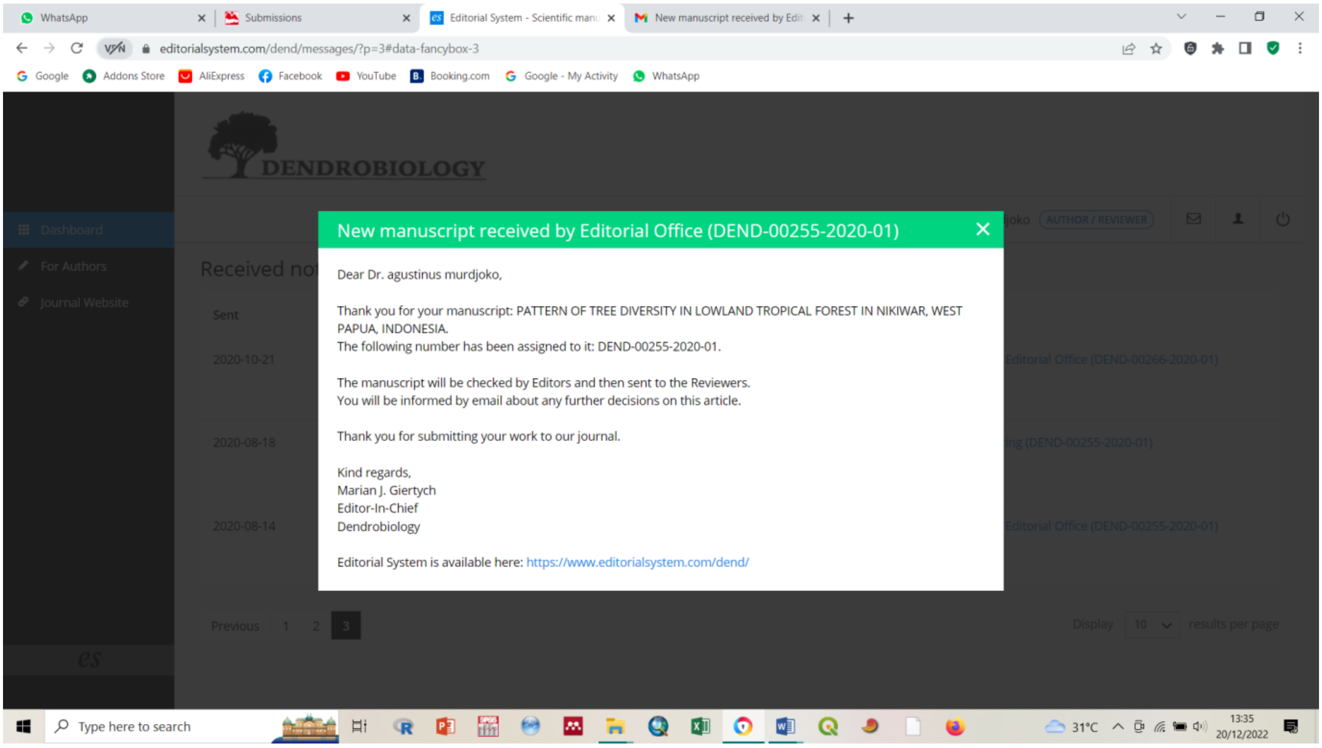

Perbaikan untuk Bahasa inggris dan setelah itu diproses untuk review

The manuscript requires editing (DEND-00255-2020-01)

Dear Dr. agustinus murdjoko,

Please edit your manuscript PATTERN OF TREE DIVERSITY IN LOWLAND TROPICAL FOREST IN NIKIWAR, WEST PAPUA, INDONESIA (DEND-00255-2020-01) according to the Editorial guidelines.

It is necessary to correct the English language of the manuscript.

It is necessary to correct formatting of the text in accordance with rules approved by the journal.

No clearly defined goal, methods described very poorly, results
along with the discussion (not in accordance with the guidelines for the authors) and presented in such a way that it is difficult to see what is going on.

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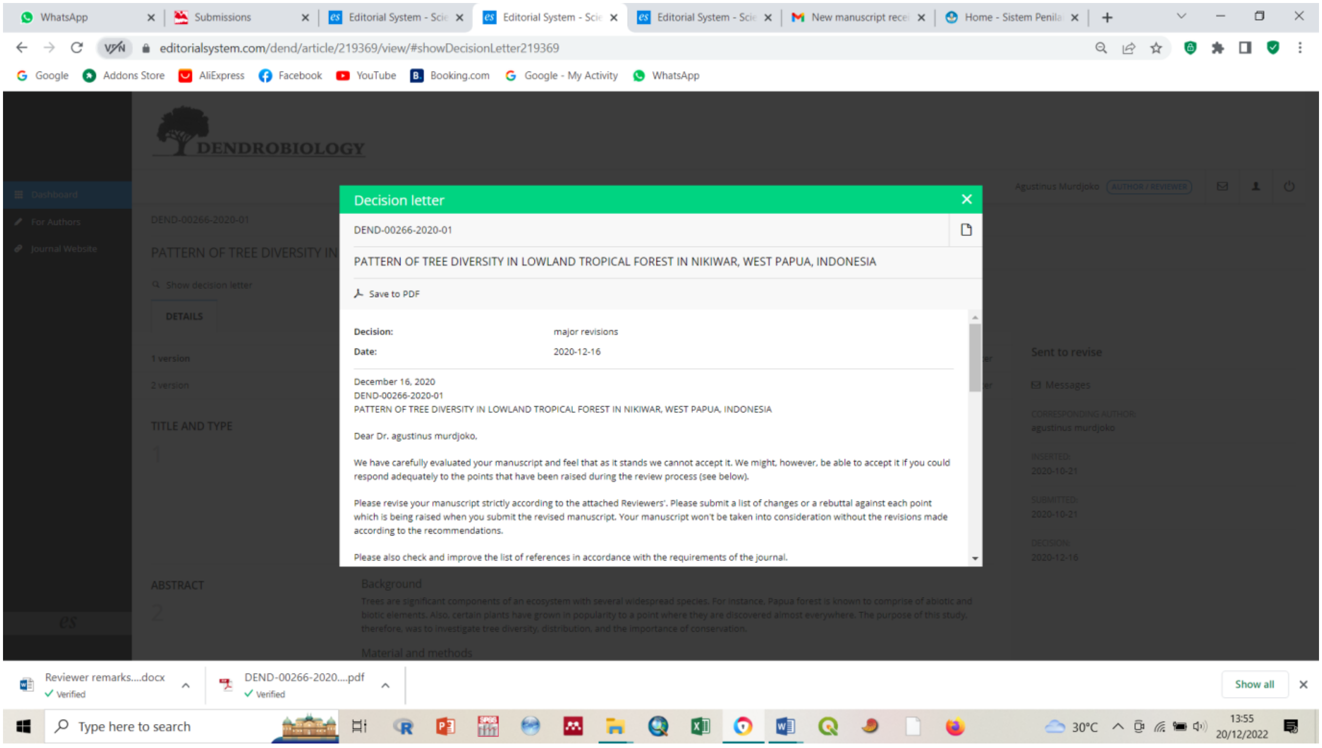
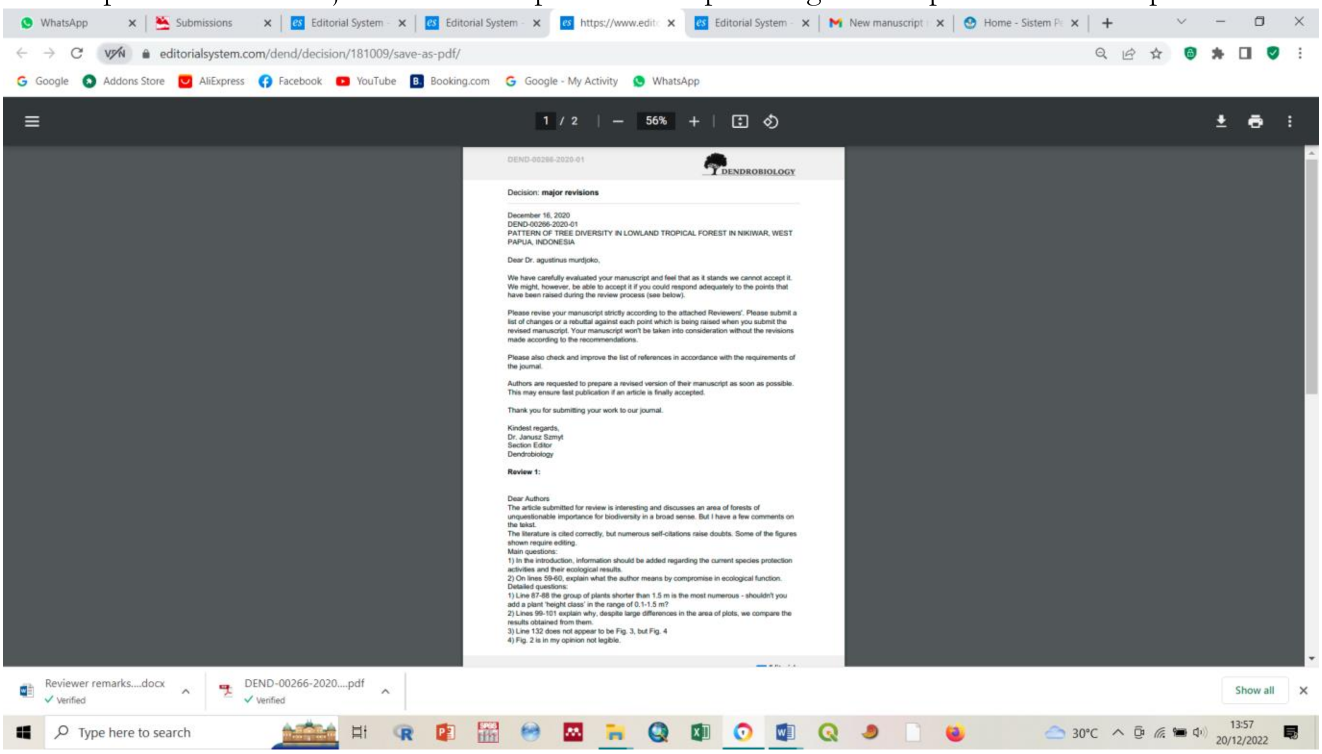
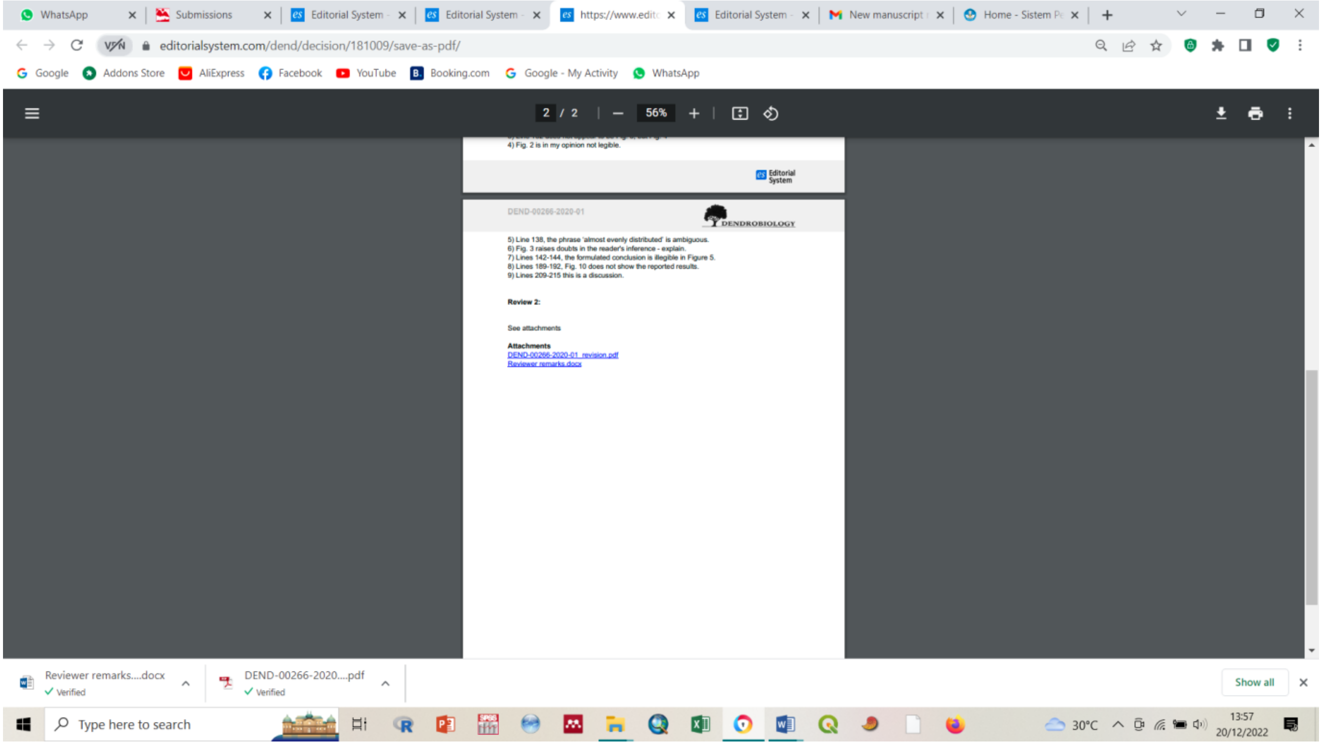
Editorial Office of Dendrobiology

Keputusan dan Perbaikan artikel



Hasil keputusan adalah major revision dan penulis merespon dengam memperbaiki manuscript tersebut.





Surat respon terhadap komentar reviewer dan revisi

Dear Editor of Dendrobiology,

Here we have improved the manuscript according to the recommendations and suggestions of the reviewers. We applied Track Changes in Word as shown in the file. We responded to the questions of the reviewers below:

Review 1

Main questions:

1) In the introduction, information should be added regarding the current species protection activities and their ecological results.

   Response

   We have added the sentence "The trees on tropical rain forest play an important role in ecological function…". We supported the information by adding the four references.

   Gaveau DLA, Kshatriya M, Sheil D, Sloan S, Molidena E, Wijaya A, Wich S, Ancrenaz M, Hansen M, Broich M, Guariguata MR, Pacheco P, Potapov P, Turubanova S & Meijaard E (2013) Reconciling Forest Conservation and Logging in Indonesian Borneo. PLoS ONE 8.

   Naniwadekar R, Shukla U, Isvaran K & Datta A (2015) Reduced hornbill abundance associated with low seed arrival and altered recruitment in a hunted and logged tropical forest. PLoS ONE 10:e0120062.

Riggs RA, Langston JD, Sayer J, Sloan S & Laurance WF (2020) Learning from Local Perceptions for Strategic Road Development in Cambodia's Protected Forests. Tropical Conservation Science 13.

Ueda MU, Kachina P, Marod D, Nakashizuka T & Kurokawa H (2017) Soil properties and gross nitrogen dynamics in old growth and secondary forest in four types of tropical forest in Thailand. Forest Ecology and Management 398:130–139.

2) On lines 59-60, explain what the author means by compromise in ecological function.
   Response
   We improved the sentence by replacing the word "compromise" with "change". So, we wanted to say that the parts of tropical rainforest has changed in ecological function.

Detailed questions:

1) Line 87-88 the group of plants shorter than 1.5 m is the most numerous - shouldn't you add a plant 'height class' in the range of 0.1-1.5 m?
   Response
   In the field, we only collected the trees as seedlings with height less than 1.5 m.
2) Lines 99-101 explain why, despite large differences in the area of plots, we compare the results obtained from them.
   Response
   We converted to ha from samplings. Thus, it would be logical to compare the four locations.
3) Line 132 does not appear to be Fig. 3, but Fig. 4
   Response
   We have improved as suggested.
4) Fig. 2 is in my opinion not legible.
   Response
   We have explained the family rank on the text in the "Diversity and Taxonomic Composition".
5) Line 138, the phrase 'almost evenly distributed' is ambiguous.
   Response
   We have improved
6) Fig. 3 raises doubts in the reader's inference - explain.
   Response
   We have added the explanation of the evenness index.
7) Lines 142-144, the formulated conclusion is illegible in Figure 5.
   Response

We have improved the correction.

8) Lines 189-192, Fig. 10 does not show the reported results.
Response
We have added the information related to the Fig. 10.
9) Lines 209-215 this is a discussion.
Response
We have improved this part.

Review 2

1) Line 52: “in”
Response
We have changed as suggested.

2) Line 81 – 83: I should use more useful format of geographical coordinates (e.g. Google Maps or others).
Response
We have changed as suggested.

3) Line 85: Italic
Response
We have changed as suggested.

4) Line 101: Italic
Response
We have changed as suggested.

5) Line 105: lowercase “l”
Response
We have changed as suggested.

6) Line 109: “-1” should be after word "tree"
Response
We have changed as suggested.

7) Line 116: without comma
Response
We have changed as suggested.

8) Line 118: lowercase “l”
Response
We have changed as suggested.

9) Line 132: Italic
Response
We have changed as suggested.

10) Line 134: It could be not clear for readers to distinct where is a plant family and where is location of plots. I think it should be clearly separate.
Response
We have changed as suggested.

11) Line 140: Replace with $\alpha<0.05$
Response
We have changed as suggested.

12) Line 141: as above
Response
We have changed as suggested.

13) Line 142: Italic
Response
We have changed as suggested.

14) Line 146: Italic
Response
We have changed as suggested.

15) Line 163: seedling?
Response
We have changed as suggested.

16) Line 165: Italic
Response
We have changed as suggested.

17) Line 174: Italic
Response
We have changed as suggested.

18) Line 176: Italic
Response
We have changed as suggested.

19) Line 180: Italic
Response
We have changed as suggested.

20) Line 200: missing letter „s"
Response
We have changed as suggested.

21) Line 204: Italic
Response
We have changed as suggested.

22) Line 209: Italic
Response
We have changed as suggested.

23) Line 210: missing letter „s"
Response
We have changed as suggested.

24) Line 223: Italic and capital letters
Response
We have changed as suggested.

25) Line 233: missing letter „s"
Response
We have changed as suggested.

26) Fig.1 This figure needs improvement. Unreadable in this form.
Response
We have changed as suggested.

27) Fig.3 Replace coma with full stop (e.g. 3,9) and α=5% to α=0.05. In the caption section: P>0.5 or rather P>0.05?
Response
We have changed as suggested.

28) Fig.4. I think description of X axis is inappropriate. What does the letters (A – D) mean (lack of description in caption of this figure

Response

We have changed as suggested.

29) Fig. 5 “and”

Response

We have changed as suggested.

Please the improvement of the manuscript in the word file.
Hopefully, this research could contribute to science by getting published in Dendrobiology Journal.
Thank you very much.

Kindest regards,
Agustinus Murdjoko

Bentuk revisi

Agustinus Murdjoko*, Dony Aristone Djitmau, Antoni Ungirwalu, Anton Silas Sineri, Rima Herlina Setiawati Siburian, Zulfikar Mardiyadi, Alfredo Ottow Wanma, Jimmy Frans Wanma, Alexander Rumatora, Wolfram Yahya Mofu, Descarlo Worabai, Nunang Lamaek May, Marthen Mathias Jitmau, George Alexander Frans Mentansan, Keliopas Krey, Ishak Musaad, Marhan Manaf, Yunus Abdullah, Hans Mamboai, Khristian Enggar Pamuji, Syafrudin Raharjo, Agustinus Kilmaskossu, Samsul Bachri, Nur-Alzair Nur-Alzair, Nithanel Mikael Hendrik Benu, Junus Tambing, Relawan Kuswandi, Lisna Khayati, Krisma Lekitoo

PATTERN OF TREE DIVERSITY IN LOWLAND TROPICAL FOREST IN NIKIWAR, WEST PAPUA, INDONESIA

Abstract. Trees are significant components of an ecosystem with several widespread species. For instance, Papua forest is known to comprise abiotic and biotic elements. Also, certain plants have grown in popularity to a point where they are discovered almost everywhere. The purpose of this study, therefore, was to investigate tree diversity, distribution, and the importance of conservation. Data were collected in four locations using a total of 24 sample plots spread across *Idoor*, *KarstKarst*, *Persemaian,* and *Torembi*, where 7, 4, 7, and 5 plots were allocated, respectively. These forests formed a mixed natural plantation comprising 76 species from 35 families. Furthermore, *Idoor* and *Karst* generated the highest species diversity and varied

significantly compared to *Persemaian*, while *Torembi* showed similarities with the other three locations. This condition formed three ecosystem communities across *Persemaian*, *Karst*, *Idoor*, and *Torembi*. In addition, the composition of the dominant species showed variations at the seedling and sapling levels believed to structure the understory, while the pole and tree levels characterized the upper story. The total species status was described as critically endangered (CR) of 2 species, vulnerable (VU) of 6 species, least concern (LC) of 28 species, and data deficient (DD) species. Therefore, location management is advised to not only pay significant attention in terms of economic benefits but also ecological, including the provisions for *ex-situ* and *in-situ* conservation in order to support sustainable forest management.
Keywords: dendrogram, conservation, Shannon-Weiner, understory, upperstory
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Introduction

Tropical rain forests harbor high biodiversity along with abiotic factors. The high variation in vegetation creates a place of wildlife habitation (Bonnell *et al.,* 2011; Rosin, 2014; Finnegan *et al.,* 2019). Also, forests provide ecosystem functions, including nutrient cycles (Vitoussek & Sanford, 1986; Gleason *et al.,* 2010; Johnson & Turner, 2019), hydrological function (Edwards *et al.,* 2014), and protection for soil and water. Consequently, the tropical forests are imperative sto preserve the integrity of naturally formed ecosystems (Lima *et al.,* 2018). Moreover, current research shows the role of tropical forests has a relationship with global warming (Taylor *et al.,* 2017). Degradation and deforestation are driving factors of climate change as atmospheric composition indicate an increase in the number of greenhouse gases (Aguilos *et al.,* 2018; Fleischer *et al.,* 2019). The trees on tropical rain forest play an important role in ecological function such as watershed regulation, support biodiversity of vegetation and wildlife (Gaveau et al., 2013; Naniwadekar et al., 2015; Ueda et al., 2017; Riggs et al., 2020). Therefore, the understanding of forest conditions is vital to manage sustainability with declining vegetation over time. This instigates a change in ecosystems previously stable or at equilibrium levels in the woods (Sist *et al.,* 2015; Levis *et al.,* 2017).

The forests of Papua presently contain natural tropical vegetation (Hughes *et al.,* 2015; Kuswandi *et al.,* 2015; Grussu *et al.,* 2016). Although, some places have experienced changes in in ecological function (Murdjoko, 2013; Kuswandi *et al.,* 2015; Laurance, 2015; Murdjoko *et al.,* 2017). Furthermore, the potential change in this region is possibly due to an impact from the pressure of development during regional expansion in Papua districts (Fatem *et al.,* 2018; Indrawan *et al.,* 2019). This condition is a dilemma in sustainable forest management, on one hand, there is the high economic demand for timber or non-timber forest products and more threatening is the policy pressure to convert forest areasfor other purposes. However, thewoods need to be properly controlled. Therefore, proper knowledge of sustainable management particularly development planning is essential for various parties. This includes policymakers, public or private sector, researchers, and others (Mansourian, 2017).

The benefit of these regions is understood from the view of forests as vegetation areas and also assessed in the comprehensive form with as much detail as possible. Moreover, among these tropical forests, habitats in the form of ecosystems, animals, social culture, and environmental services are potentially provided by existence of a stable condition within tropical forests (Liu & Slik, 2014). Therefore, it is imperative to study these regions particularly vegetation, including the distribution, population, species diversity, and others. This research was intended to study the diversity of trees and analyze individual distribution, and conservation status of Nikiwar Forests, Teluk Wondama District as a natural tropical forest.

Methods

Study Area

This research was conducted in Nikiwar District, Teluk Wondama Regency at four different locations, *Idoor*, *Karst*, *Persemaian,* and *Torembi*. The geographical position are as follows, *Idoor* at 2°27'54.32"S and 134° 6'21.02"E, *Karst* at 2°29'6.26"S and 134° 7'16.40"E, *Persemaian* in 2°25'49.28"S and 134° 7'54.48"E as well as *Torembi* at 2°23'27.09"S and 134° 7'47.27"E . Furthermore, the forest is a primary type divided into four groups characterized by ecological conditions especially edaphic and topographic factors. Furthermore, *Torembi* and *Persemaian* represent the eastern part while *Idoor* and *Karst* arefor the western region.

Data and Sampling

The species are divided into four parts, seedlings, saplings, poles, and trees. Subsequently, seedlings are marked to have a height of less than 1.5 m. Also, saplings are marked with a height of more than 1.5 m and a diameter of less than 10 cm. The pole has a diameter between 10 and 20 cm and the tree has a value greater than 20 cm.

Also, data collected from each plot are individual species and each one is identified according to the scientific name. Two vegetation experts from the herbarium technician identified tree species. The unidentified species were set as a voucher and sent to Herbarium *Papuense*, Balai Penelitian dan Pengembangan Lingkungan Hidup and Kehutanan (BP2LHK) Manokwari and Herbarium *Manokwariense* (MAN), Pusat Penelitian Keanekaragaman Hayati (PPKH), and Universitas Papua.– Subsequently, the number of each species in the plot was recorded. In addition, diameter at breast height (1.3 m) or 20 cm above the buttress are calculated for poles and trees, excluding seedling and sapling phases.

The plot used for this study consisted of four sizes, 2 m x 2 m for seedlings; 5 m x 5 m for saplings; 10 m x 10 m for the pole, and 20 m x 20 m for trees. A total of 23 plots were put in placewith 7 plots in *Idoor*, 4 plots in *Karst*, 7 plots in the *Persemaian,* and 5 plots in *Torembi*. In addition, plots at each location were randomly arranged on transects where distance between plots was at least 50 m.

Data Analysis

Dominance - The basal area (BA) is calculated by considering the diameter of the tree species as follows, $BA_i = \sum D_i{}^2\ x\ 0.7854$, where BA_i = basal area (m^2) of tree species *I*, D_i = diameter (m) of tree species i, and 0.7854 = π / 4. Then, to evaluate BA per hectare, the tree species are divided based on using the plot area (m2.ha^{-1}) as density. However, BA for each tree species describes the extent of dominance at the site. *Species Density* - Density is used to ascertain the number of tree species per hectare (tree.ha^{-1}). *Frequency* – This shows the distribution of each tree species. Next, the number of plots with the tree species i, is divided by the total number of sample plots. Therefore, frequency is calculated using the equation $Fr_i = \frac{n_i}{N}$ where Fr_i = Frequency of tree species i, n_i = number of plots where tree species i was located and n_i = total number of sample plots. *Importance Value Index (IVI)* - The importance value index determines the distribution of each tree species in terms of dominance (Curtis & McIntosh, 1950, Nirmal Kumar *et al.,* 2011). This index is calculated by adding the relatives of frequency, density, and dominance as $IVI_i =$

$RFr_i + RDe_i + RDo_i$ where IVI_i = importance value index of tree species *i*, RFr_i = relative frequency of tree species *i*, RDe_i = relative density of tree species *i*, and RDo_i = relative dominance of tree species *i*. *Diversity Index* - The diversity between locations was tested using a diversity index (Shannon, 1948; Spellerberg & Fedor, 2003). In addition, the Shannon-Weiner diversity index was chosen as a parameter to also describe the distribution of each species in terms of the number of individuals by calculating the evenness (E) (Pielou, 1966). A diversity index is calculated using the equation, $H' = -\sum p_i \ln\ (p_i)$ where H'= Shannon-Weiner diversity index and p_i = number of samples with tree species i. The evenness is measured by the equation $E = \frac{H'}{\ln(S)}$ where S is the number of species for each location. *Statistical Analysis* - Cluster dendrogram and the analysis of variance (ANOVA) were applied to investigate the statistical variation between the four locations. The computation was performed with R-3.6.3 for Windows (R Development Core Team 2014) and Vegan package (Oksanen *et al.*, 2019).

Results

Diversity and Taxonomic Composition

This research generated 76 tree species from 35 identified families. Subsequently, the dendrogram was grouped into three, including *Idoor* and *Torembi* (combined), *Persemaian,* and *Karst* (Fig. 4). Also, the dominant families varied among the four forests where *Sapindaceae*, *Myristicaceae*, *Meliaceae*, *Euphorbiaceae*, and *Ebenaceae* in *Indoor*; *Euphorbiaceae*, *Ebenaceae*, *Leguminosae*, *Sapindaceae*, and *Apocynaceae* in *Karst*; *Dipterocarpaceae*, *Phyllanthaceae*, *Leguminosae*, *Myristicaceae*, and *Myrtaceae* in *Persemaian; Myristicaceae*, *Sapindaceae*, *Lauraceae*, *Dipterocarpaceae,* and *Lamiaceae*in *Torembi* (Fig. 2). Under the species level of species within the four locations, the species distribution was uniformly distributed based on Evenness (E) (Fig. 3 B). However, the number of individuals showed more variation with *Torembi,* followed by *Persemaian*, *Idoor,* and *Karst*. Diversity Index (H') differed significantly in specie distribution (P = 0.002, α <0.05), while the evenness index did not show any significant difference (P = 0.302, α >0.05). *Persemaian* was observed with the lowest diversity compared to other three locations. Furthermore, *Idoor* and *Karst* indicated the highest species diversity, while *Torembi* maintained similar situation as all locations (Fig. 3 A and Fig. 5).

Species at the seedling level in *Idoor* were dominated by *Myristica* sp, *Pometia* sp, *Aglaia* sp, and *Diospyros* sp, while *Karst* was mainly presented by *Diospyros* sp, *Myristica* sp, *Palaquium amboinense* Burck, and *Spathiostemon* sp. Furthermore, *Vatica rassak* Blume, *Myristica* sp, *Baccaurea* sp, and *Neonauclea* sp, were present in *Persemaian*, followed by *Myristica* sp, *Palaquium amboinense* Burck, *Pometia* sp and *Canarium* sp in *Torembi*. At this seedling level, three species termed *Myristica* sp, *Pometia* sp, and *Palaquium amboinense* Burck existed in more than two places (Fig. 6). Specifically, *Myristica* sp showed dominance in these four locations with a high importance value index. This indicates the species with high capacity to regenerate, particularly during the fertilization and germination processes.

At the sapling level in *Idoor* region, *Myristica* sp, *Aglaia* cucullata (Roxb.) Pellegr., *Baccaurea* sp, and *Ganophyllum falcatum* Blume were observed, followed by *Chisocheton macrophyllus* King, *Diospyros* sp, *Spathiostemon javensis* Blume and *Buchanania* spume in *Karst*. Furthermore, several species of Baccaurea sp, *Vatica rassak* Blume, *Fagraea racemosa* Jack, and *Syzygium* sp were discovered in *Persemaian*, while in *Torembi*, the dominant species involved *Chisocheton macrophyllus* King, *Myristica* sp, *Syzygium* sp and *Alstonia scholaris* (L.) R. Br. (Fig. 7). Also, 2 species, termed *Myristica* sp and *Syzygium* sp, occurred in more than one location. These conditions indicate the ability to develop from seedling to sapling level as both varieties were more effective, particularly *Myristica* sp.

Various groups at the pole level differ from species dominance at seedling and sapling levels. This is clearly observed in *Idoor*, and is dominated by *Pimelodendron amboinicum* Hassk., *Pometia coriacea* Radlk., *Macaranga tanarius* (L.) Müll.Arg. and *Horsfieldia sylvestris* Warb. Also, in *Karst*, abundant species, including *Pimelodendron amboinicum* Hassk., *Intsia palembanica* Miq., *Pometia acuminata* Radlk. and *Ficus septica* Burm.f. were present. In *Persemaian*, the majority of individuals at the pole level were *Vatica rassak* Blume, *Pimelodendron amboinicum* Hassk., *Myristica fatua* Houtt. and *Syzygium* sp, while for *Torembi*, the number of groups of *Vatica rassak* Blume, *Pimelodendron amboinicum* Hassk., *Teijsmanniodendron* sp and *Myristica fatua* Houtt occurred in large quantity at the pole (Fig. 8). Of all the species present at the pole level, three varieties, termed *Pimelodendron amboinicum* Hassk., *Vatica rassak* Blume and *Myristica fatua* Houtt were extensive, especially *P. amboinicum*. At the tree level, *Tetrameles nudiflora* R. Br., *Campnosperma brevipetiolatum* Volkens, *Pometia coriacea* Radlk. and *Pometia acuminata* Radlk. developed in large numbers within the *Idoor* region, while *Pometia acuminata* Radlk., *Intsia palembanica* Miq., *Ficus pungens* Reinw. ex Blume and *Pimelodendron amboinicum* Hassk occurred in *Karst*, where more existed as dominant species. Furthermore, *Persemaian* was dominated by *Intsia palembanica* Miq., *Vatica rassak* Blume, *Myristica fatua* Houtt. and *Hopea papuana* Diels, while Vatica *rassak Blume*, *Teijsmanniodendron hollrungii* (Warb.) Kosterm., *Artocarpus altilis* (Parkinson ex F.A. Zorn) Fosberg and *Pometia coriacea* Radlk occurred abundantly in *Torembi* (Fig. 9). Among all species, *Pometia coriacea* Radlk., *Pometia acuminata* Radlk., *Intsia palembanica* Miq. and *Vatica rassak* Blume were individuals cultivated and controlled in more than one location, specifically *I. palembanica* known to dominate the tree level.

Distribution of Individual Tree Based on the Diameter

Wood forest products are described in the form of diameter distribution in each location, where greater diameter is known to increase the potentials for these products. At these locations, individual trees spread out at various diameters ranging from insignificant values to approximately 200 cm. This generates a distribution pattern in tropical forests where individuals with lesser diameter are more extensive compared to the number of individuals with larger diameter.

Based on the results of the non-linear regression analysis, the equation formed was specified as $y = 2.4422x^{-0.23}$ with the determination coefficient estimated at 27% (Fig. 10). This showed the larger diameter instigates lesser individuals in the forest area. Furthermore, the diameter size drastically decreases, commencing from 40 cm, while the number of individual diameters below 25 cm demonstrated higher values. Meanwhile, individuals with diameters above 100 cm existed in *Idoor* and *Persemaian*.

Conservation Status of Tree Species

In the four forest types, certain species develop from a variety. Table 1 shows the results of conservation status analysis based on the website www.iucnredlist.org, as 76 tree species (Table 1). Table 2 highlights four significant statuses, termed critically endangered (CR) of 2 species, vulnerable (VU) of 6 species, least concern (LC) of 28 species, and data deficient (DD) species. Of all these varieties, CR and VU specifically indicated a status population decline in forest areas caused by the conversion of the landscape to other purposes without any provision of ex-situ conservation programs. Therefore, 8 species, particularly the types with decreasing population status, including *Memecylon* sp and *Garcinia* sp, were assumed to demand more attention in the regeneration process, which is achieved by human intervention, e.g planting. Specifically, in Papua, the species *Intsia bijuga* (Colebr.) Kuntze with a commercial value and construction material input requires a program to support the regeneration process.

Based on total species distribution, the groups with CR status existed in all the locations, while VU occurred only in *Karst*. Also, LC species were scattered across the entire region. This situation showed critical interventions involving species regeneration, especially CR and VU are necessary. In addition, the research revealed the four locations are places or habitats of these species. Therefore, preserving natural areas from forests appears as a suitable initiative towards providing opportunities and growth for these species. Further studies on regeneration, spatial distribution, and the distinct characteristics of these species are paramount to support conservation programs, particularly species with critically endangered (CR) and vulnerable (VU) status.

Discussion

The species indigenous to each location constitute the communities. Based on the vegetation analyses of the four locations, a diverse natural forest with evenly distributed breeds was formed. This condition is typical of primary tropical forests in Papua. A wide variety of vegetation including lianas, rattan, herbs, forest floor coverings, epiphytes, and others are native to these zones (Murdjoko *et al.,* 2016a). However, this study is limited to the seedlings, saplings, poles, and trees located in *Idoor*, *Persemaian*, *Karst*, and *Torembi* regions.

Generally, vegetation in the under-story layer of dense forests is exposed to less sunlight, high humidity, and lower temperatures than other flora (Nopiansyah *et al.*, 2017; de Winter *et al.*, 2018). *Myristica* sp was discovered to dominate this stratum. Therefore, the species are speculated to be tolerant of these conditions, particularly shade. Meanwhile, poles and trees constitute the upper-story. At this level, *V. rassak* is prevalent because the plant grows well under exposure to direct sunlight, low humidity as well as high temperature (Corrià-Ainslie *et al.*, 2015).

This species is present at the highest stratum and also in the undergrowth. Meanwhile, some plants, including, *I. palembanica* do not have this ability. Therefore, such plants, especially those common to the upper canopy, bear flowers and fruit, but are unable to support regeneration in lower altitudes (Murdjoko *et al.*, 2016b). This may be a limiting factor with regard to species-specific predation. In addition, the probability of a seed to germinate at the forest floor influences individual initiation. Furthermore, seedlings capable of thriving in the presence of little or no sunlight have higher chances of survival (Gudiel *et al.*, 2016; Fatem *et al.*, 2020).

This increases the competition between plants at the understory as there are numerous shade-tolerant plants in a typical tropical woodland (Do *et al.*, 2019). In addition, some individuals of flora are allelopathic, and are capable of releasing biochemical agents to impede growth or even kill these contenders (Facelli & Pickett, 1991; Ladwig *et al.*, 2012). Also, the presence of species-specific herbivorous predators may influence continuity in a bio-diverse habitat (Balandier *et al.*, 2006).

Recommendations for Management Based on Sustainable Principles

Tree diversity and ecosystem formation are common characteristics of a mixed natural forest. Hence, there is a potential for bio-diversified vegetation. In addition, these flora possess economic benefits (Gaveau *et al.*, 2014; Pryde *et al.*, 2015; Colín-Urieta *et al.*, 2018). Furthermore, the ecological use of these locations ought to be considered. For instance, *Karst* is a highland zone and may serve as a rainwater catchment area when conserved. Meanwhile, *Idoor*, *Persemaian*, and *Torembi* constitute the lowlands and are readily accessible sources of timber as well as other forest products.

However, Critically Endangered (CR) and Vulnerable (VU) species must be properly managed to avoid a population decline. Therefore, inventory is necessary to ascertain the degree of diversity. In addition, in-situ and ex-situ programs may be integrated to increase effectiveness (Todou *et al.*, 2014; Ren *et al.*, 2019). For instance, in the *Persemaian* region, this may be achieved by the creation of a buffer location where fauna of economic and ecological importance are made available and those of CR and VU status remain preserved. Subsequently, the success of this technique is evaluated through continual research. Furthermore, the germination and growth supporting capacity of habitats are studied in an effort to provide practical solutions for nursery development and acceleration of regrowth in slowly regenerating plants, including *I. palembanica*.

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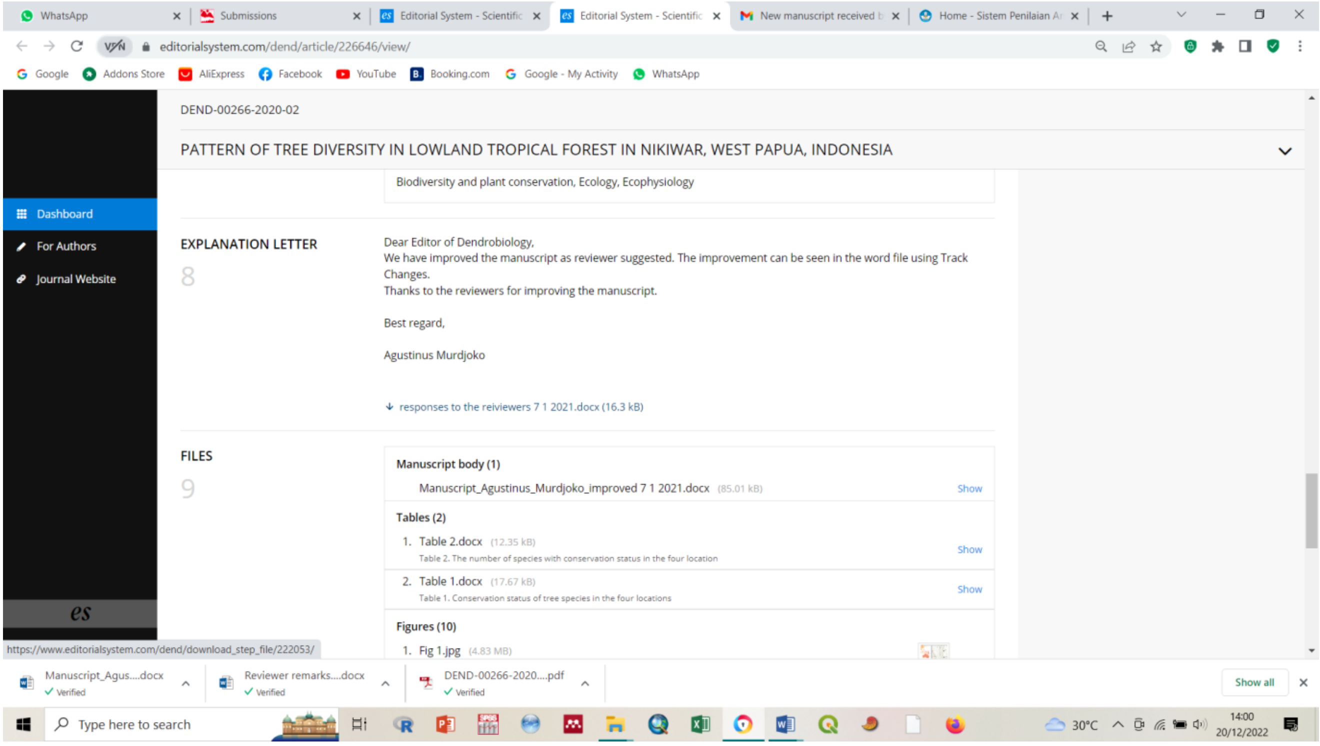

DEND-00266-2020-02

PATTERN OF TREE DIVERSITY IN LOWLAND TROPICAL FOREST IN NIKIWAR, WEST PAPUA, INDONESIA

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8

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We have improved the manuscript as reviewer suggested. The improvement can be seen in the word file using Track Changes.
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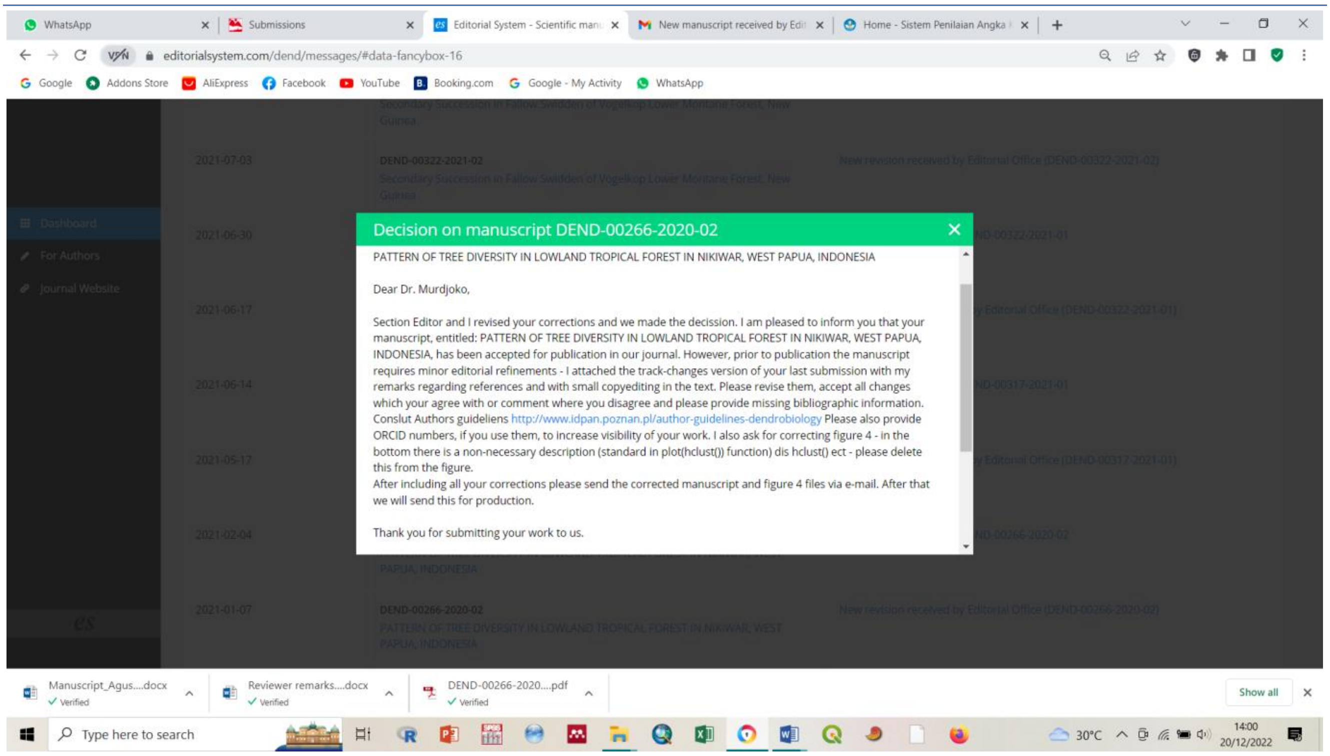

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PATTERN OF TREE DIVERSITY IN LOWLAND TROPICAL FOREST IN NIKIWAR, WEST PAPUA, INDONESIA

Dear Dr. Murdjoko,

Section Editor and I revised your corrections and we made the decission. I am pleased to inform you that your manuscript, entitled: PATTERN OF TREE DIVERSITY IN LOWLAND TROPICAL FOREST IN NIKIWAR, WEST PAPUA, INDONESIA, has been accepted for publication in our journal. However, prior to publication the manuscript requires minor editorial refinements - I attached the track-changes version of your last submission with my remarks regarding references and with small copyediting in the text. Please revise them, accept all changes which your agree with or comment where you disagree and please provide missing bibliographic information. Consult Authors guideliens http://www.idpan.poznan.pl/author-guidelines-dendrobiology Please also provide ORCID numbers, if you use them, to increase visibility of your work. I also ask for correcting figure 4 - in the bottom there is a non-necessary description (standard in plot(hclust()) function) dis hclust() ect - please delete this from the figure.
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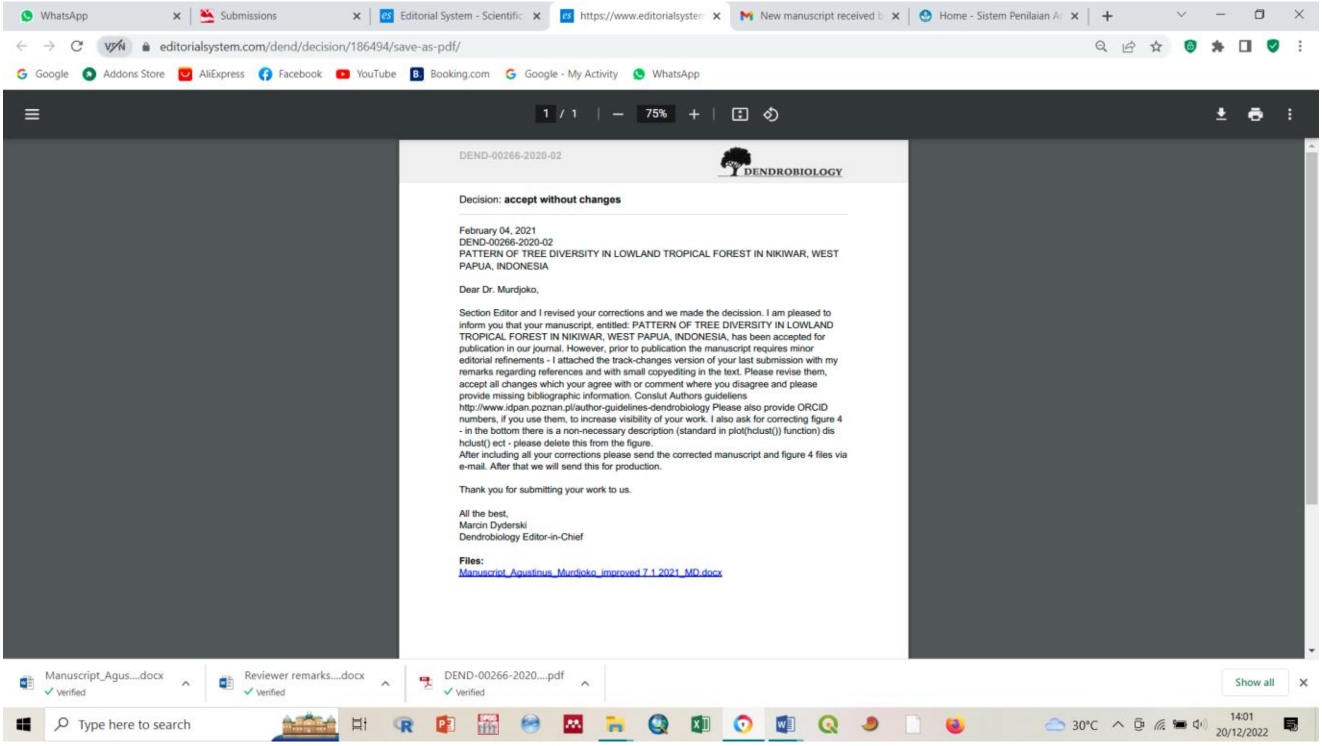

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Decision: **accept without changes**

February 04, 2021
DEND-00266-2020-02
PATTERN OF TREE DIVERSITY IN LOWLAND TROPICAL FOREST IN NIKIWAR, WEST PAPUA, INDONESIA

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Thank you for submitting your work to us.

All the best,
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