Comparison of species diversity of butterflies between burnt and unburnt land at various levels of post-burnt land age in Mount Ciremai National Park

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Abstract. Forest fires occur almost every year in some locations in Indonesia, including in Mount Ciremai National Park (TNCG). Different age of land due to fire is believed to affect its biodiversity including the losses and gains of butterfly species. The study aims to estimate the diversity and composition of butterfly species and estimate the loss and gain of butterflies due to fire at different levels of post-burnt land age. The study was conducted on April 1st to May 21st, 2019 at three locations of burnt land with different ages (1, 2, and 4 years post-burnt). The Pollard Transect Method was used to estimate and analyze the species number of butterflies, the Margalef richness index, species diversity index, and species evenness index. The referential habitat as the basic approach was used to determine the losses and gains of butterfly species in each land. The results showed that there were 76 species of butterflies in all land, the highest index of Margalef was found on 2-year-old of burnt land, the highest index of diversity on 1-year-old of burnt land, and index of Evenness close to 1. The highest gains of diversity due to fire was found on 4-year-old of burnt land at 84.21% while the highest losses of diversity due to fire on 2-year-old of burnt land at 45.71%. In conclusion, there are differences in species diversity, losses, and gains of butterflies at various levels of post-burnt land age in Mount Ciremai National Park.

1. Introduction

In Indonesia, forest fires occur almost every year in various locations, especially in the dry season, both in production forest areas, protected forests, and even in forest areas with the status of conservation areas such as national parks. The Mount Ciremai National Park (TNCG) area in West Java is one of the conservation areas that experience fires almost every year. During the period 2012-2018, there was a fire with the greatest intensity occurring in 2018 with an area of burning land reaching 1,123.55 hectares [1]. Many factors are suspected as the cause of fire, both human and natural factors, one of which is the availability of fuel in the form of reeds and bushes that dry out during the dry season [2].

Fires have a broad impact on the destruction of forest ecosystems and the potential loss of biodiversity. Biodiversity loss due to fire has a higher value in national parks and protected areas [3]. One of the biodiversity that is allegedly severely affected by forest fires is the butterfly. Considering the existence of butterflies in an ecosystem as one type of insect that has important value as a pollinator and part of the food chain as prey for insectivores [4], ecologically its presence contributes to maintaining ecosystem balance and the continuity of plant regeneration [5, 6]. Thus, changes in diversity and
population density can be used as an indicator of environmental quality [7]. Butterflies are also known as organisms that have sensitivity and specificity to certain environmental conditions so that their presence can characterize the environmental conditions of their habitat [8, 9].

On the other hand, butterflies as wildlife, in general, are also known to have the ability to adapt to the dynamics of change, including the dynamics of forest change as their habitat during fires and post-fires. After a fire, insects such as butterflies can adapt in response to environmental changes [10] and have strong flying abilities with large wings to respond quickly to changes in vegetation after fire [10]. Butterflies are insects that have strong flying abilities with large wings, so they can respond quickly to changes in vegetation after fires [11].

Field facts show that there are differences in the years of forest fires in the TNGC area so that in general there is also a difference in the age of post-fire land with characteristics of their habitat conditions both in terms of physical and biotic components. Regarding good adaptability [10] and rapid response to habitat changes after the fire [11], it is strongly suspected that there is a potential for the acquisition of butterfly species at the locations of fires in the TNGC as well as a potential loss. The data in TNGC shows that there are at least three age categories of post-fire areas in TNGC, namely 1 year, 2 years and 4 years. Considering the existence of TNGC area as a conservation area with the main function, among others, for protection and preservation of biodiversity including biodiversity of butterflies, it is deemed important to conduct this research with the aim to (1) predict diversity and species composition of butterflies at various levels of burnt land age, and (2) predict losses and gains of butterfly species diversity as a result of fires at various levels of burnt land age.

2. Research Method

The study was conducted in the Mount Ciremai National Park (Figure 1) from April 1 to May 21, 2019. Data collection was carried out at three locations of post-fire areas that illustrate the different post-fire land ages, namely: (1) Lambosir Block, aged 1 year after burning (fire in 2018), (2) Pajaten Block, aged 2 years after burning (fire in 2017), and (3) Karangsari Block, aged 4 years after burning (fire in 2015). The three study sites are included in the Kuningan I Region National Park Management Section.

Figure 1. Research location map.
To assess the loss and gain of butterfly species at each post-fire land age, the adjacent unburnt habitat was used as the reference habitat or control habitat. Unburnt land at each location is assumed to be the initial condition of the post-burnt land before the fire. Therefore, this research used two lanes in each observation block, which is burnt and unburnt land. The distance between the two lanes at each location ranges from 420-570 m with the height of each different location spreading from 250 masl to 1175 masl (Table 1). Data on diversity and species of butterfly were collected including the species loss and gain in each burnt land age, and environmental factors that affect butterfly presence.

Data on habitat characteristics for vegetation components were collected through vegetation analysis using the track plot method [12], especially to identify the plant species as food for larva and butterfly, breeding and cover, and to identify the water sources and to the measurement of temperature and air humidity. The measurement of temperature and humidity was carried out three times (in the morning at 08.30-09.00 WIB; afternoon at 12.30-13.00 WIB, and in the afternoon at 15.30-16.00 WIB), with an interval of 10 minutes. The measurement of temperature and humidity data was carried out simultaneously with the time of butterfly data retrieval using a wet-dry ball thermometer placed 120 cm from the ground surface.

The collection of diversity and composition of butterfly species was carried out by butterfly inventory using the Pollard Transect method [13], with a total length of 1 km transect line divided into 20 plots in the form of imaginary boxes with 5 m wide left and right and the path length of each plot is 50 m, and the interval between plots is 10 m. The transect lane was made at each location based on the age of the burnt land, which was divided into two lanes (burnt and non-burnt land), repeated 3 times observation in each lane. For species recognition, a butterfly was caught using a net in each observation lane. The time of butterfly catching was at 09.00-15.00 in sunny, calm and warm conditions adjusted to the active time of the butterfly as a diurnal animal [14].

For the inventory and identification of butterfly species, the butterfly catching was also carried out using the trap method installed in the observation lanes. Each lane was installed as many as 4 traps that were placed by hanging in a location that was considered difficult to reach by butterfly nets, namely in the area of high ravines and trees. The bait used to trap butterflies was orange and honey. To identify the species of butterflies in the field, a reference to the Butterfly Practical Guide in the Bogor Botanical Gardens [14] and the Identification Guide for Butterflies of West Java[15] were used.

| No. | Block  | Year of fire | Post-fire land age (year) | Altitude (mdpl) | Lane       | Distance between lanes (m) |
|-----|--------|--------------|---------------------------|-----------------|------------|---------------------------|
| 1   | Lambosir| 2018         | 1                         | 737 – 825       | Burnt Unburnt | 440                       |
| 2   | Pejaten | 2017         | 2                         | 250 – 300       | Burnt Unburnt | 570                       |
| 3   | Karangsari| 2015       | 4                         | 1,100 – 1,175   | Burnt Unburnt | 420                       |

The obtained data from the vegetation analysis, temperature and humidity, and water sources were used to determine a general description of butterfly habitat conditions at each research location [12]. The diversity data and composition of butterfly species were analyzed quantitatively using the number of species parameters, Shannon-Wiener Diversity Index (H'), Margalef Wealth Index (Dmg), and Evenness Index (E) [16], and determine the community similarity of butterfly in the three age locations of the burnt area using the Jaccard Community Similarity Index (ISJ) [17]. The loss and gain of species diversity of butterflies in each age level of burnt land were obtained by calculating and comparing the
number of species that survived, obtained (gain), and lost (loss) and using the unburnt land as the reference, then determined the percentage of loss and gain in each age level of burnt land.

3. Result and Discussion

3.1. General Conditions of Burnt Area as Butterfly Habitat

Result of field observation showed that the land cover of Lambosir Block (1-year-old burnt land) was bushes dominated by Imperata (Imperata cylindrica) and overgrown by kaliandra (Calliandra sp.), the Pejaten Block (2-year-old burnt land) with land cover was dominated by weeds and grasses, interspersed with several sonokeling trees whereas Karangsari Block (4-year-old burnt land) was located adjacent to a plantation area or community fields, and the land cover was a mixed forest dominated by pine (Pinus merkusii) and coffee plants (Coffea robusta).

Generally, the number of vegetation types in the unburnt land was greater than in burnt land, and the highest number of vegetation types was found in burnt land aged 4 years whereas the lowest was in burnt land aged 2 years (Table 2). The largest value of vegetation Similarity Index (SI) was found in the 4-year-old burnt land (0.3) and the lowest was in burnt land aged 1 year (0.21). The Community Similarity Index at various age levels of burnt land indicated that the highest value was found in burnt land aged 1 year and 2 years whereas the lowest value was found in burnt land aged 2 years and 4 years (Table 3).

Table 1. Species and individual number and Similarity Index (SI) of vegetation in burnt land and unburnt (control) land in Mount Ciremai National Park.

| No. | Land age | Number of species | Number of individuals | SI per lane |
|-----|----------|-------------------|-----------------------|-------------|
| 1.  | 1 year old | 29                | 1,010                 | 0.21        |
|     | Control   | 34                | 976                   |             |
| 2.  | 2 years old | 24                | 917                   | 0.28        |
|     | Control   | 39                | 511                   |             |
| 3.  | 4 years old | 31                | 1,018                 | 0.30        |
|     | Control   | 21                | 533                   |             |

Table 2. Plant Community Similarity Index in burnt land in Mount Ciremai National Park.

| No. | Index of Similarity | 1 year old | 2 years old | 4 years old |
|-----|---------------------|------------|-------------|-------------|
| 1.  | 1 year              | 0.11       | 0.07        |             |
| 2.  | 2 years             | -          | 0.03        |             |
| 3.  | 4 years             | -          | -           |             |

The result of plant species identification especially as larval and butterfly food plants showed that there were 50 species of plants. Generally, the number of plant species as larval food and butterfly food in all three burnt land ages was different in which the highest number was discovered in the 4-year-old burnt land. The number of plant species identified as larval food was about 7-19 species, and the ones identified as butterfly food was about 6-15 species.

Temperature and humidity at the three levels of burnt land age showed different fluctuations at different hours. The average daily temperature and air humidity in burnt and unburnt land were different, with an interval of daily temperature were 23-32.5°C, and air humidity was 46-88%. Data on temperature and humidity in this location were considered within the tolerance range of the butterfly as butterflies can survive on the temperature around 18-38°C [18], while the humidity so as not to become dehydrated.
or lack of water is around 60% [19]. The humidity needed by butterflies to breed is around 84%-92% [6]. Referring to the temperature and humidity limits of the air, data showed that the temperature and humidity in the post-burnt land aged 1 year and 4 years are considered suitable to meet the needs of butterflies to live, while the 2-year-old burnt land is relatively dry with temperature relatively high and low humidity. Low air humidity in a location can affect the life of a butterfly because a butterfly can lose a lot of fluid in its body [20]. The high temperature and low humidity of the air in the 2-year-old burnt land (Pejaten Block) are also related to its low altitude, around 250-300 meters above sea level. Field observations also showed that there were water sources in burnt land aged 1 year, but water sources were found in burnt land aged 2 years and 4 years. The source of water in a 2-year old burnt land was an artificial water source in the form of a water reservoir and installed water sprinkles that are operated every day during the dry season. The water source in the 4-year-old burnt land was a natural water source which is the Ci Noman river that flows water throughout the year. The existence of water sources in each burnt land age is expected to affect the diversity of butterfly species. Prior research found that riparian habitat has a higher species richness, diversity, and evenness compared to terrestrial habitats, and one of the physical environment predictors is a source of water [21].

3.2. Diversity and Composition of Butterfly Species

3.2.1. Butterfly Species Diversity

The number of butterfly species found in burnt land aged 1 year, 2 years, and 4 years was 76 species with a total of 542 individuals, were included in five families, namely Hesperiidae (14 species), Lycaenidae (15 species), Nymphalidae (34 species), Papilionidae (6 species) and Pieridae (7 species) (Table 4). According to the protection status of butterfly species, the 76 species of butterflies are not protected according to the Indonesian government through the Regulation of Environmental and Forestry Minister No. 106 of 2018, and not registered in the CITES Appendix, but there are 4 species of butterflies were protected according to the IUCN Red List with the category of Least Concern (low risk), namely Junonia almana, Mycalesis janardana, Cyrestis themire, and Eurema brigitta.

| Families       | Land age |   |   |   |   |
|----------------|----------|---|---|---|---|
|                | 1 year old | Control | 2 years old | Control | 4 years old | Control |
| Hesperiidae    | 4         | 5           | 2          | 6          | 6          | 2       |
| Lycaenidae     | 2         | 3           | 6          | 6          | 4          | 3       |
| Nymphalidae    | 11        | 11          | 11         | 16         | 12         | 10      |
| Papilionidae   | 5         | 6           | 3          | 3          | 1          | 2       |
| Pieridae       | 3         | 5           | 6          | 4          | 3          | 2       |
| Number of species | 25        | 30          | 28         | 35         | 26         | 19      |
| Number of individuals | 80       | 73          | 67         | 75         | 102        | 145     |

Table 4 shows that the number of butterfly species raised in unburnt land is greater than in burnt land, except in 4-year burnt land, the number of species found is more (26 species) compared with control land (19 species). As for the three age categories of burnt land, the number of butterflies was found most in 2-year-old burnt land (28 species) compared to 2-year-old burnt land (25 species) and in 4-year-old burnt land (26 species). This fact also shows that forest fires have a significant impact on the reduction in the number of butterfly species in their habitat, because butterflies are animals whose lives are highly dependent on plants and are very vulnerable to environmental changes [22]. The highest species richness of butterflies is in forested areas [11], followed by unburnt land and the lowest in burnt land. On the contrary, another findings show that the average number of butterfly species in covert-type burnt land

Table 3. Number of species and individuals of butterflies from each family in burnt land and unburnt (control) land in Mount Ciremai National Park.
is more than that of covert-type unburnt land, due to the large amount of feed that is spread along the observation path, and presumably due to differences the number of vegetation types in the study location [23].

Table 4 also shows that the Nymphalidae family is the butterfly family that is most commonly found by species members in all burnt land and unburnt land. It is suspected that this is due to the Nymphalidae family is known to have the largest members and is widely distributed compared to other butterflies [24], besides ecologically the availability of feed sources from the Nymphalidae family in their habitat is also known to be very large [25]. Field observations showed that in almost all three age levels of burnt land as well as of unburnt land (control) there were many species of adult butterfly feed plants of the Nymphalidae family such as Melastoma malabathricum (INP = 49%) and Lantana camara (INP = 13%) that are used by butterflies either as food, breeding grounds or shelter (cover). It is an indication that the three age levels of burnt land have functioned optimally as a butterfly habitat [26].

The research also showed that there were different species of butterflies which were commonly found in each age of burnt land, that is in the 1-year-old burnt land is Eurema laeta, in the 2-year-old burnt land is Jamides celeno, and in the 4-year-old burnt land is Ypthima pandocus. This phenomenon can be interpreted as an indication of the preference of a butterfly species to the specific condition of its habitat, especially related to the peculiarities of its plant species which are found in each age category after burning. For example, Eurema laeta butterflies have a specific type of feed plant that is found in 1-year-old burnt land, namely Impatiens sp., Commelina diffusa, Calliandra sp., Minosa sp., and Turnera ulmifolia, while the Ypthima pandocus butterfly species have specific feed plants that are commonly found in 2-year-old burnt land namely Chromolaena odorata and Eleusine indica. The Jamides celeno butterfly species were mostly found in the 4-year-old land because there were many specific food plants, namely Arachis sp. One important note from the findings of these four species of butterflies is the discovery of Eurema laeta butterflies known so far not recorded in the statistic as a type of butterfly in TNGC [27], although prior research in TNGC has also reported this species as one of the butterfly species in TNGC which can be found in the hills and open fields, usually flying low near the ground and grasses or undergrowth, and rarely seen flying high above trees [21]. This phenomenon of different species of butterfly found in the burnt and unburnt lands is allegedly related to the category of butterflies in terms of the use of resources to fulfill their lives, which are specialist or generalist based [28].

Specialist butterflies in this study were divided into two categories: closed-habitat specialist butterfly and open-habitat specialist butterfly. The results showed that closed-habitat specialist butterflies were found only in 4-year-old unburnt land (Karangsari Block) as many as 4 species whereas other pathways had a more open land cover so that the number of butterfly species found was the highest, and thus classified as an open-habitat specialist butterfly. The butterflies found in both land cover are called generalist butterflies. The types of specialist and generalist butterflies per study pathway are shown in Table 5.

| Categories           | Land age                  | 1 year old | Control | 2 years old | Control | 4 years old | Control |
|----------------------|---------------------------|------------|---------|-------------|---------|-------------|---------|
| Closed-habitat specialist | -                        | -          | -       | -           | -       | -           | 4       |
| Open-habitat specialist | 17                       | 23         | 23      | 29          | 16      | -           | -       |
| Generalist           | 8                        | 7          | 5       | 6           | 10      | 15          |         |

The results also showed differences in the species richness of butterflies in each age of burnt land. The richness value of the largest butterfly species was found in the 2-year-old burnt land (6.42), followed by the 4-year-old burnt land (5.7), and the 1-year-old burnt land (5.18). On the contrary, another study found that the richness of butterfly species will increase over the years since the fires due to the increased
diversity of plants and their ecological niches [29]. The difference is accounted for the differences in the physical condition of the habitat, especially in terms of the altitude of the place, because the location of burnt land aged 2 years is relatively higher compared to the other two locations, which is around 250 - 300 masl. The higher altitude of the place has a lower diversity of butterfly species [30]. The relative value of butterfly species was relatively low in the 1-year-old burnt land (5.18). It is strongly suspected to be also related to the absence of water sources at the location, even though the water sources have an important role and become a large influence on the presence of butterflies in a location [31], so the availability of water sources in a habitat is closely related to the diversity of discovered butterflies.

The value species diversity of butterflies also showed differences in each age of post-burnt land. The highest diversity value of butterflies was found in 1-year-old post-burnt land (2.78) comparing with unburnt land (2.37), and the lowest in 2-year-old post-burnt land (2.17) comparing with unburnt land (2.78), while the value in 4-year-old burnt land was 2.65 compared with unburnt land was 2.66. The diversity values in the three age categories of burnt land were not much different. According to Magurran (2004) [16], based on the Shannon-Wiener index, the values obtained are quite difficult to interpret, and it cannot be concluded that the age difference of burnt land have the same species diversity or substantially different butterflies, because the value of species diversity is not only determined by the number of species but also determined by the number of individuals in each species [32]. Data from the inventory showed that although the number of butterfly species discovered in 1-year-old burnt land was few, there were quite many individuals (80 individuals). Meanwhile, 67 individuals were discovered in burnt land aged 2 years. One of the suspected environmental factors was cause to this condition is the difference of temperature and humidity between the two burnt land ages. As is known, butterflies are classified as polyclyothermic animals whose body temperature is affected by air temperature, so the fluctuation in air temperature of a location will have an impact on the presence of butterflies at that location.

The evenness value of butterflies in the three burnt land ages indicate that there were differences, but in general, the distribution of species evenness values in the three locations was relatively high, because it approached the number 1, namely with the distribution of values ranging from 0.65 to 0.9 (Figure 2). As is known, the evenness of species indicates the size of the same number of species in an abundance. Thus, with the relatively similar and high values of distribution in the three locations, it can be interpreted that the type of butterfly found in the third age of burnt land was evenly distributed because it had an almost equal abundance and the absence of a dominant butterfly species found in each observation track in all three burnt land ages. A high evenness value indicates that most species have the same abundance [16].

![Figure 2. The evenness value of butterflies in each age of burnt land in Mount Ciremai National Park.](image)

### 3.2.2. Composition of Butterfly Species

The results of the Community Similarity Index of the butterfly between the burnt and unburnt land (control) in the three categories of burnt land age showed that in general there were differences. The highest Community Similarity Index was found in 1-year-old burnt land with control of 0.55, while the lowest value was in 4-year-old land which was 0.24, while for the 2-year-old land area was 0.43 (Table 6). Based on the Community Similarity value obtained in this research, the highest similarity value of butterflies between burnt land and unburnt land was in the 1-year-old land by 55% followed by the 2-year-old land of 43% and the lowest in the 4-year-old land was 24%. This condition can be interpreted
because of the similarity of habitat characteristics between burnt and unburnt land in the observation lanes. The high species similarity can occur because the two habitats have almost the same characteristics [33]. While differences in community similarity between the three land age categories are thought to be related to differences in habitat characteristics as indicated by differences in vegetation due to fires in the observation lanes. It means that differences in environmental factors between one habitat type with another lead to differences in diversity, distribution patterns, and the abundance of butterflies [34, 35].

### Table 5. Similarity index of butterfly communities in burnt and unburnt (control) land in Mount Ciremai National Park.

| Similarity Index | 1 year old | 2 years old | 4 years old |
|------------------|------------|-------------|-------------|
| 1 year old       | 0.55       | -           | -           |
| 2 years old      | -          | 0.43        | -           |
| 4 years old      | -          | -           | 0.24        |

The similarity index of the butterfly community showed that the highest value was in 1-year-old and 4-year-old burnt land at 0.15 whereas the lowest community similarity was found in burnt land aged 2-years-old and 4-years-old at 0.1 (Table 7). These results can be interpreted that the three sites with different burnt land ages have quite different habitat characteristics from each other and only have a similarity of the butterfly community on average by 1%. This can also be confirmed by looking at the results of plant communities in the three burnt land age categories as described above, which show a low similarity value of plant communities at around 0.03-0.11. This means that the vegetation conditions in the three burnt land ages are indeed different and only have a community similarity of around 0.3%-0.1%.

### Table 6. Community Similarity Index of butterfly in every burnt land age in Mount Ciremai National Park.

| Similarity Index | 1 year old | 2 years old | 4 years old |
|------------------|------------|-------------|-------------|
| 1 year old       |            | 0.13        | 0.15        |
| 2 years old      | -          |            | 0.1         |
| 4 years old      | -          | -          |             |

3.3. Losses and Gains of Butterfly Species Diversity

The result of this research showed that the amount of loss and gain, as well as the number of butterfly species that survived in the three age categories of burnt land, was different. The highest species number of survived butterflies due to fire on 1-year-old burnt land was 20 species, followed by 19 species in 2-year-old burnt land, and 10 species in 4-year-old. The highest gain in land aged 4 years after burning was 16 species, 9 species in the land aged 2 years, and 5 species in the land aged 1 year. While the highest lost was found in 2-year-old land (16 species), followed by 1-year-old land (10 species), and the lowest was 4 years after fire (9 species). The results of the percentage of loss and gain of butterfly species due to fire showed that burnt land aged 4 years had the highest percentage of loss and gain of butterfly species as many as 47.36% and 84.21%, respectively. The percentage of land aged 2 years was 45.71% and 25.71%, respectively, and the lowest in the 1-year-old burnt land area was 33.37% and 16.67% (Figure 3). This difference in the number and percentage of butterflies after a fire can be related to the ability of a type of butterfly to gain access to newly grown vegetation in burnt locations[10]. Butterflies that have a strong ability to fly will be abundant in burnt land, while specialist butterflies will have less abundance because they require specific environmental conditions for their lives[36].
Figure 3 shows the differences in endurance, adaptability, and responsiveness of each type of butterfly due to forest fires. Butterflies are insects that can adapt after a fire in response to environmental changes [10]. Also, butterflies are insects that have strong flying abilities with large wings so that they can respond quickly to changes in vegetation after fires [11]. The results of this research confirm the statement, one of which is through the species of butterflies that are lost or cannot survive due to forest fires namely the Faunis canens from the family of Nymphalidae (Figure 4). Through observations, it is known that this species is commonly found in unburnt land (control or reference) in the post-burnt land aged 4 years which has a fairly dense mixed forest cover. It indicates that this species requires a fairly closed land, and vulnerable to fires that open land cover, causing on the potential loss of this species. This fact is in line with prior research stating that Faunis canens butterfly likes shady places [37], and it often rests between leaves on the forest floor or perched in bushes [38].

Figure 4. Faunis canens, butterfly species that experienced losses due to forest fires.

4. Conclusion
In conclusion, there are few important points of this research as follows: (1) The general condition of the three burnt land age categories as butterfly habitats is different in the constituent components of the habitat both from the number of vegetation types, the community similarity index, the number of butterfly feed plant species, as well as from the physical elements of the environment namely the altitude, temperature and humidity. The total number of butterfly feed plants in the three burnt land age categories is 51 species, with the most found in the 4-year-old burnt land area, namely 14 larval feed plants and 15 adult butterfly feed plants, with the condition of temperature and humidity is in the range of temperature and humidity following the needs of life of butterflies (27-32.5°C and 60-88%); (2) The total number of butterfly species were found in burnt land aged 1 year, 2 years and 4 years was 76 species with a total of 542 individuals. The richness of butterfly species is highest in burnt land aged 2 years followed by 4-year-old burnt land and the lowest is 1-year-old burnt land. The diversity value of butterfly species has a range of 2.17-2.87, and the butterfly species in each location are spread evenly because they have a value of evenness of species that is close to 1. The highest community similarity index is in 1-year burnt land which is 0.55 and its value decreases based on the age of the burnt land. There are 4 species of butterflies found in protected status according to the IUCN Red List with the category of Least Concern (LC), namely Junonia almana, Mycalesis janardana, Crystis themire, and
Eurema brigitta; (3) The highest gain value of butterflies due to fire in 4-year-old land is 84.21%, while the highest value of butterfly loss in 2-year-old burnt land is 45.71%. The numbers of butterfly species that survive a fire show that butterflies can adapt to environmental changes after a fire. One of the butterfly species that is lost because it cannot survive after a fire is Faunis canens.

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