AgBioForum, 24(2): 187-195. ©2022 ***AgBioForum***

Heath Forest as a Source of Medicinal Plants for the Maanyan Dayak Tribe in Central Kalimantan, Indonesia: Deforestation and its Relationship to Medicinal Plant Biodiversity

Kissinger
Faculty of Forestry, Universitas Lambung Mangkurat
Banjarbaru, Indonesia
Email: kissinger@ulm.ac.id

The heath forest in Kalimantan is renowned as a source of medicinal herbs for the Dayak tribe. This study seeks to examine the use of medicinal plants from heath woods by the Dayak Maanyan in Central Kalimantan and to assess the potential of medicinal plants depend on disturbances. The gathering of information on the use of medicinal herbs was conducted using semi-structured interviews. Utilizing the snowball technique, the main informant is determined. Observed forms of heath forest were classified as follows: I secondary heath forest with ancient growth, ii) relatively disturbed young secondary heath forest, and iii) burnt heath forest. Path and square measuring plots were employed to obtain data on the vegetation. The use of medicinal plants was studied using a tabulation matrix. For vegetation analysis, the number of species and the Shanon-Wieneer diversity index (H') was employed as parameters. As medicinal resources, the Dayak Maanyan people use thirty kinds of trees and fifteen types of undergrowth from the heath forest. 24 of 27 species of old-growth heath forest trees were utilized for medicinal purposes. The remaining 12 species of the 17 species of slightly damaged juvenile heath forest trees were employed as therapeutic ingredients. Only four of the remaining five tree species in burnt heath woodlands were recorded as being used as medicinal ingredients. In old-growth heath forests, tree diversity and regrowth index were in the low range (H'=2.6-2.87). The tree diversity and regeneration index of young heath forests fell within the low to moderate range (H'= 1.09 – 2.56). The index of burnt heath forest's tree variety and regeneration is poor (H' = 0.98 – 1.5). In heath woods, disturbance and deforestation affect medicinal plant biodiversity.

Key words: Biodiversity, deforestation, heath forest, Dayak Maanyan tribe, medicinal plant.

1. INTRODUCTION

Central Kalimantan, with a land size of 15,514,811.71 hectares, is one of the world's largest forest cover regions (Government, 2015). The recorded forest area in Central Kalimantan is 12,697,165 hectares ((INCAS), 2022). Forest regions store medicinal plant germplasm as a kind of biodiversity. The indigenous population has employed plants as ingredients in traditional medicine. Society believes traditional ingredients derived from plant parts, such as roots, leaves, flowers, and wood, can cure many maladies (Suparni, 2012).

The Dayak Maanyan tribe in Dusun Selatan District, South Barito Regency, Central Kalimantan Province has been identified as utilizing the forest for medicinal purposes. The vegetation community surrounding the Dusun Selatan subdistrict is a heath forest.

Low-fertility heath woodland is based on soil characteristics dominated by sand layers (Adawiyah, 2019). In heath woods, podzolic soils and low soil pH are prevalent (Miyamoto et al., 2016). In heath forests, few types of vegetation can adapt and thrive due to the soil's infertility (Kartawinata, 1980).

Heath forest vegetation communities can yield therapeutic plants. It is believed that the ability of plants to create secondary metabolites, which are the basis for employing plants as a source of medicinal substances, is tied to their ability to adapt to new plants (Kissinger et al., 2013). The heath woodland provides traditional remedies. Communities have utilized the heath forest's richness of medicinal plants as a source of medicinal herbs (Adawiyah, 2019).

In Indonesia, numerous forests, including heath forests, have been deforested. In 2017-2018, deforestation in Indonesia reached 0.48 million hectares per year, and in Central Kalimantan, it reached 27,240.2 hectares per year (KLHK, 2018). Land conversion for infrastructure, communities, agriculture, mining, plantations, and forest fires can cause deforestation.

In 2015, 1,7 million hectares of Indonesian forest were affected by flames. This fire affects transportation, health, the economy, and the environment (Adiputra, 2018). Deforestation caused by forest fires increases global warming. Due to land conversion, logging, and forest fires, heath forests in the Dusun Selatan subdistrict also sustained destruction, according to field observations.

Deforestation can potentially diminish forest biodiversity, particularly heath forest medicinal plant supplies.

Managing the potential of plant species variety as a source of medicinal components is one of the conservation strategies to decrease heath forest destruction. Documenting and analyzing the community's use of medicinal plants must precede the management of heath forest medicinal plants. Establishing local community knowledge regarding the utilization of plant resources can significantly aid in the conservation of biodiversity and the domestication of high-value medicinal plants. This study aims to examine the utilization of heath forest medicinal plants by the Dayak Maanyan people in Dusun Selatan District, South Barito Regency, Central Kalimantan, as well as compare the potential of medicinal plants based on the extent of heath forest disturbance caused by deforestation.

2. RESEARCH METHOD

2.1 Location, Object, And Research Equipment

Dusun Selatan District, South Barito Regency, Central Kalimantan, Indonesia, was the location of the study. The focus of this study is the flora of the heath woodland in Madara Village, Dusun Selatan District. People from the Dayak Maanyan subdistrict of Dusun Selatan who are knowledgeable about traditional medicine provided information on medicinal plants. Figure 1 illustrates the position of the heath forest.

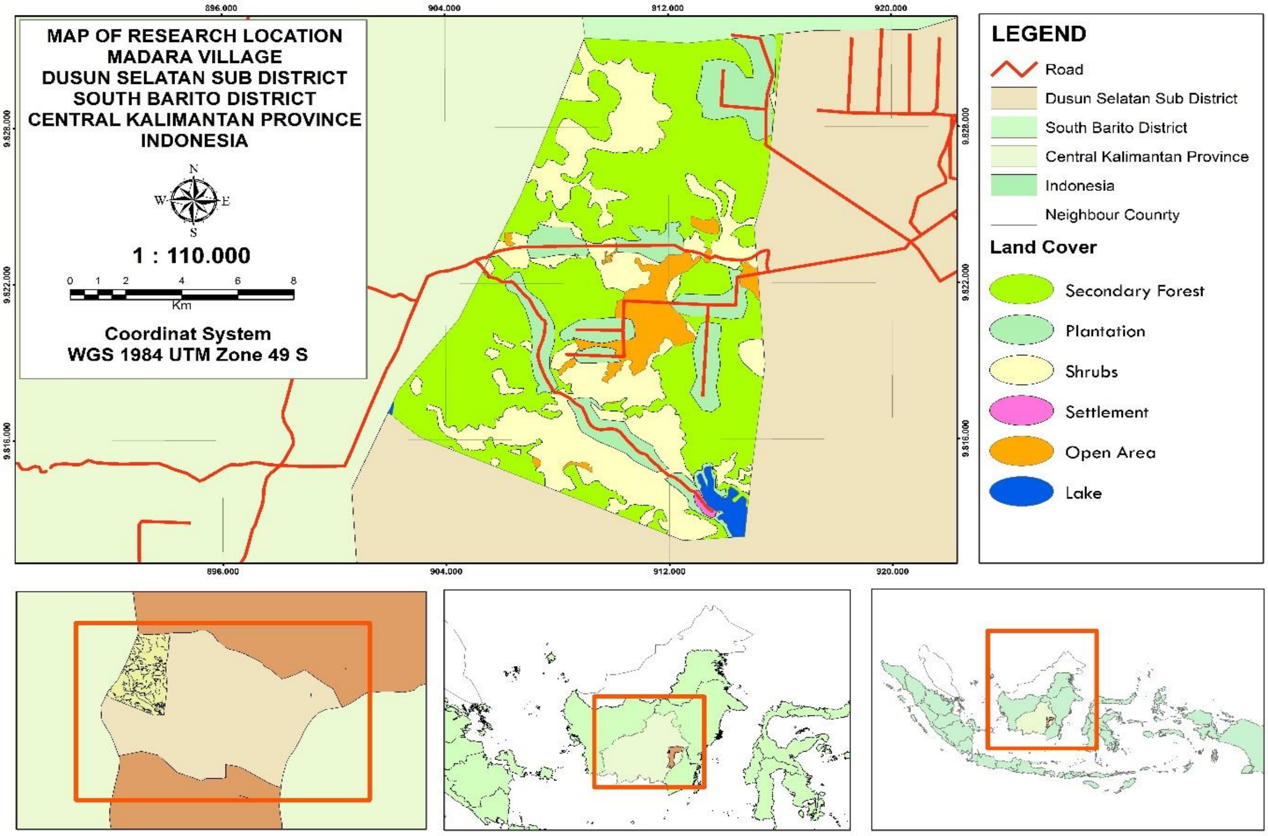

Figure 1: Location of sampling of heath forest vegetation

The research equipment included survey equipment (GPS to establish location, phi band to measure diameter, a compass to determine direction, and tally sheets), documentation equipment, interview equipment such as a questionnaire list on the therapeutic use of forest plants, and writing instruments.

2.2 Data collection

Interviews and measuring plots were utilized to collect information. Semi-structured interviews were used to collect information on the effectiveness and application of medicinal herbs (Kissinger et al., 2013). People from the Dayak Maanyan tribe who are knowledgeable about the medicinal usage of plants were interviewed. Several informants chosen using a purposive sampling method were interviewed informally using an interview guide (selected directly). The acquired data were completed using a combination of informant selection and snowball sampling. This study's data source sampling technique is depicted in Figure 2. (Sugiyono, 2009).

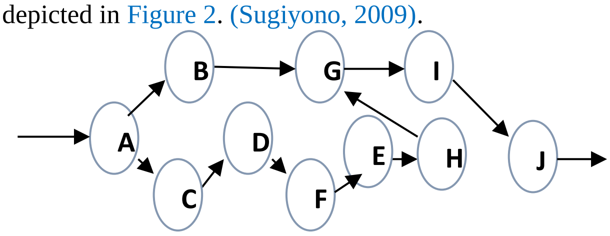

Figure 2. The process of collecting data samples with a combination of purposive and snowball techniques.

Identifying the first informant A (the crucial informant) was deliberate. Using the information provided by A, they proceed to B and C. Because there is still a shortage of information, they eventually dig up to D, then F, and because they still have not uncovered a great deal of information (they are not saturated), they are forwarded to E, H, G, I, and finally J. Until J, the data is complete or contains no new information, and there are sufficient informants, so there is no need to add more. Community leaders, traditional leaders, traditional healers, traditional healers, or those nominated by key informants who have experience using medicinal herbs as traditional medicine were recruited as informants.

To obtain data on vegetation, measurement plots were established in a heath forest. Combining routes with square observation plots or plot lines creates measurement plots. The length of the path is 1 kilometer. For vegetation measurement activities, two lanes were created for the old secondary forest, undisturbed (old growth), and the new secondary heath forest, relatively disturbed. After 5 years of burning, one lane is created in the heath forest. The square plots within the lane are 20m x 20m in size (Soerianegara and Indrawan, 2002). Systematically, 20m x 20m square plots are put out in lanes with 100 m between each plot. 25 observation plots of 20m x 20m were created for each old secondary forest and juvenile secondary forest. Each 20m x 20m observation plot contained sub-plots of 2m x 2m (measurement of seedling level), 5m x 5m (measurement of sapling level), 10m x 10m (measurement of pile level), and 20m x 20m (measurement of pile level) (level measurement for trees). The determination of the growth rate is based on Kusmana (1997)'s criteria for growth rate. The obtained information comprised the species and quantity of individuals at each stage of vegetative development (seedlings, saplings, poles, and trees). The growth rate of poles and trees was evaluated by measuring their diameters.

2.3 Data analysis

A tabulation matrix containing local names, scientific names, and forms of consumption was used to examine the species makeup at each level. Old-growth secondary heath forests (largely undisturbed), young-growth secondary heath forests (somewhat disturbed), and burnt heath forests were compared. Comparable parameters included stand potential, variety index, varieties of medicinal plants, and plant parts. Using a method based on the number of individuals per hectare, stand potential was assessed (Almarief, 2018). The following equation is used to calculate the potential (N/ha):

$$\text{Potential of a species} = \frac{\text{Number of individuals of a species}}{\text{Sample plot area)}}$$

Vegetation diversity values were measured using the Shannon-Wienner diversity index approach (Ludwig & Reynolds, 1988). The calculation of the Shannon-Wienner index value (H') uses the following equation:

$$H' = -\sum Pi \ln Pi$$

where $Pi = (\frac{Ni}{N})$

H' = Diversity Index of Shannon-Wienner
Pi = Proportion of i-th species
Ni = number of individuals of type i
N = number of individuals of all species

The diversity index criteria used follow the species diversity index criteria, according to Odum (1993), as in Table 1.

Table 1. Diversity Index Criteria

Diversity Index	Criteria
H' ≥ 3.00	Tall
2 ≥ H' <3.00	Currently
H' < 2	Low

The potency of medicinal plants was determined based on the quantity of medicinal plants and the community of Dayak Maanyan's recognition of their medical properties. Reference data supplement the efficacy of medicinal plants and the portions of the plants employed Kissinger et al., 2013). A comparison matrix was developed to examine differences in the biodiversity of medicinal plants based on the disturbance degree of heath forest.

3. RESULT AND DISCUSSION

Table 2 displays the findings of the investigation of species composition and vegetative potential in secondary heath forests of ancient growth.

Table 2 demonstrates that old-growth secondary forest has a total of 27 plant species. The range of species between vegetation levels is between 16 and 20 species. There are 17 species of saplings, 16 species of poles, and 19 species of trees in the vegetative seedling stage. At the study site, there were fewer species in the seedling and sapling stages than in the old-growth heath forest of the Nyaru Menteng Arboretum Palangkaraya, Central Kalimantan (23 and 24 species for the seedling and sapling stages). At the same time, the number of poles and tree species was greater in the research area. Nyaru Menteng Arboretum's old-growth heath woodland contains 14 species at the pole level and 13 species at the tree level (Azizah, 2020). The species composition of heath forest is inferior to that of old-growth peat swamp forest, which contains 99 species of trees and regrowth (Kalima, 2019).

The species composition depicted in Table 2 demonstrates that the species that grow and thrive in the ancient heath forest are introduced species. Seventeen families have been found in heath forests, with Dipterocarpaceae and Myrtaceae being the most prevalent (Bruenig et al., 1996). The growth rates of 10 types of vegetation at the tree, pole, sapling, and seedling levels were identified. This occurrence suggests that the regeneration of the plant species that comprise the old-growth heath forest is well begun. The vegetation types S.balangeran, Callophylum sp., C.arborescens, T.obovata, and C.rotundatus are typical in heath forests (Kartawinata, 1980). Table 3 displays the composition of tree-level vegetation species and regeneration in young (relatively damaged) secondary heath forests.

Table 2. The composition of vegetation in old-growth secondary forest

Nu	Local name	Scientific name	family	N/Ha of Vegetation Level			
				seedling	sapling	pole	tree
1	Alaban	*Vitex pubescens*	Verbenaceae	-	-	-	8
2	Balangeran	*Shorea balangeran*	Dipterocarps	400	40	20	12
3	Balik Angin	*Mallotus paniculatus*	Euphorbiaceae	500	-	50	-
4	Bangkirai	*Shorea laevis*	Dipterocarps	300	48	50	12
5	Bati-bati	*Adina minutiflora*	Rubiaceae	-	48	-	-
6	Bintangur	*Callophylum sp*	Dipterocarps	1200	80	-	12
7	Irat	*Cratoxylon arborescens*	Gutiferae	300	-	-	8
8	Jambu Burung	*Syzygium inophylla*	Myrtaceae	800	176	40	12
9	Kelumpang	*Sterculia foetida*	Malvaceae	-	-	-	4
10	Kemisi	*Syzygium tetrapetrum*	Myrtaceae	200	48	-	-
11	Kemuning	*Xanthophyllum stipitatum*	Polygalaceae	300	-	-	-
12	Kuranji	*Dialium larium*	Fabaceae	500	80	50	8
13	Madang	*Litsea sp*	Euphorbiaceae	800	128	70	8
14	Masupang	*Shorea velunosa*	Dipterocarps	1400	256	50	24
15	Meranti	*Shorea coreacea*	Dipterocarps	200	20	20	12
16	Meranti Lilin	*Shorea teysmanniana*	Dipterocarps	500	60	40	16
17	Nyatoh	*Palaquim sp*	Sapotaceae	-	32	10	8
18	Palawan	*Tristaniopsis obovata*	Myrtaceae	400	-	-	-
19	Pasak Bumi	*Eurycoma longifolia*	Simaroubaceae	400	48	-	-
20	Rengas	*Gluta renghas*	Anacardiaceae	300	-	80	16
21	Resak	*Vatica Rassak*	Dipterocarps	400	-	50	4
22	Simpur	*Dillenia indica*	Dilleniaceae	-	-	-	8
23	Tarap	*Artocarpus elasticus*	Moraceae	500	128	40	8
24	Punak	*Tetramerista glabra.*	Tetrameristicaceae	-	-	-	4
25	Tiwadak	*Arthocarpus champeden*	Moraceae	-	80	20	-
26	Tumih	*Combretocarpus rotundatus*	Rhizoporaceae	300	16	50	-
27	Tutup Kabali	*Diospyros borneensis*	Ebenaceae	700	112	20	4
	SUMMARY			10400	1400	660	188

Table 3: The composition of vegetation in young secondary forest (relatively disturbed)

Nu	Local name	Scientific name	family	N/Ha of Vegetation Level			
				seedling	sapling	pole	tree
1	Akasia	*Acacia mangium*	Fabaceae	-	-	80	10
2	Alaban	*Vitex pubescens*	Verbenaceae	1700	80	40	-
3	Balangeran	*Shorea belangeran*	Dipterocarps	500	224	120	30
4	Durian	*Durio zibethinus*Murr	Bombaceae	-	-	70	20
5	Irat	*Cratoxylon arborescens*	Gutiferae	100	16	30	-
6	Jambu burung	*Syzygium inophylla*	Myrtaceae	100	-	100	25
7	Jaring	*Archidendron jirninga*	Fabaceae	-	-	20	-
8	Karet	*Hevea brasiliensis*	Euphorbiaceae	300	16	50	-
9	Sepat	*Macaranga triloba*	Euphorbiaceae	-	32	40	20
10	Kuranji	*Diaulum laurium*	Fabaceae	-	-	30	-
11	Madang	*Litsea sp*	Euphorbiaceae	-	16	50	10
12	Meranti Lilin	*Shorea teysmanniana*	Dipterocarps	-	-	30	-
13	Petai	*Parkia speciosa*	Fabaceae	-	-	100	-
14	Tarap	*Artocarpus elasticus*	Moraceae	-	-	30	-
15	Tumih	*Combretocarpus rotundatus*	Rhizoporaceae		16	30	5
	SUMMARY			2700	400	820	120

As a result of land conversion for crops and settlements, young secondary heath forest deteriorates. The discovery supports that the somewhat disturbed secondary heath forest is located close to community gardens and planting sites. The greatest number of species occurred at the pole vegetation stage (15 species), while only five were present at the seedling stage. How many plant species, including Durio zibhetinus, Hevea brasiliensis, Parkia speciose, and Macaranga triloba, are planted intentionally by the community in young secondary heath forests? Acacia mangium is an imported alien species found in young secondary heath woodlands. S. balangeran is the sole species with complete seedling, sapling, pole, and tree levels of vegetation. This condition is indicative of the disturbance of forest regrowth.

Table 4 displays the species composition of tree-level and regeneration vegetation in burnt heath woods.

Table 4: The composition of vegetation in burned heath forest

Nu	Local name	Scientific name	family	N/Ha of Vegetation Level			
				seedling	sapling	pole	tree
1	Alaban	*Vitex pubescens*	Verbenaceae	1500	240	32	18
2	Balangeran	*Shorea belangeran*	Dipterocarps	7667	1227	66	21
3	Galam	*M. cajuputi*	Myrtaceae	3334	53	22	
4	Kemisi	*S. tetrapetrum*	Myrtaceae	3334	534	24	-
5	Jambu Burung	*Syzygium inophylla*	Myrtaceae	-	-	8	24
				15,835	2054	152	63

Five years after a fire, a burnt heath woodland has five tree species and is regenerating. Compared to old-growth and young secondary heath forests, the number of individuals at the seedling and sapling stages increased. In contrast, the number of individuals at the tree and pole stages declined. There are four species of seedlings and saplings, five species of poles, and three types of mature trees. Compared to prior research findings in regularly burned heath forests, the number of tree species and regeneration is far greater in these data. Repeatedly burned heath woodlands typically leave two species associations: C.rotundatus-M.cajuputi and C.rotundatus-S.balangeran (Kissinger, 2012).

The diversity and usage of vegetation types in the three analyzed regions produced distinct outcomes. Table 5 displays the size of the diversity index and the Maanyan Dayak community's exploitation of secondary heath forest vegetation as a source of medicinal components.

Table 5: Diversity index and medicinal use of vegetation from the old growth of the heath forest

Vegetation species	Diversity Index (H') of Vegetation Level				Part of vegetation for medicinal use
	seedling	sapling	pole	tree	
V. pubescens	-	-	-	0.14	leave and root for fever, diarrhea, and cought
S. balangeran	0.13	0.1	0.11	0.18	stem bark for antidiabetic, diarrhea, and malaria
M. paniculatus	0.15	-	0.20	-	Leave for wound and hepatitis, stem bark for diarrhea and inflammation
S. laevis	0.1	0.12	0.20	0.18	leave for antidiabetic, gout, cholestrol, and stamina
A. minutiflora	-	0.12	-	-	Leave for stomachache
C. soulatri	0.25	0.16		0.18	leave and stem bark for wound and analgesic
C. arborescens	0.1	-	-	0.14	leave, stem bark, and root for fever, cough, diarrhea, and wounds
S. inophylla	0.2	0.26	0.17	0.18	fruit shell and stem bark for antidiabetic
S. foetida	-	-	-	0.08	leave for constipation and back pain; stem bark for wound and scabies
S. tetrapetrum	0.08	0.12	-	-	Leave and stem bark for diarrhea, antidiabetic
X. stipitatum	0.1	-	-	-	Leave for implantation, antidiabetic
D. laurium	0.15	0.16	0.20	0.14	leave for stomach ache, diarrhea, rheumatic disease, and stamina
Litsea sp	0.2	0.22	0.24	0.14	leave for ulcer medicine
S. velunosa	0.27	0.31	0.20	0.27	-
S. coreacea	0.08	0.06	0.11	0.18	-
S. teysmanniana	0.15	0.13	0.17	0.21	leave and stem bark for wounds, stomachache, antidiabetic, and stamina
Palaquim sp	-	0.09	0.06	0.14	leave and root for wounds and diarrhea
T. obovata	0.13	-	-	-	Leave for diarrhea and stamina
E. longifolia	0.13	0.12	-	-	root for malaria and stamina
G. renghas	0.1	-	0.26	0.21	leave for itchy, fruit for fever and stomach ache, root for syphilis
V. rassak	0.13	-	0.20	0.08	leave and stem bark for antidiabetic and stomach ache
D. indica	-	-	-	0.14	Leave for antidiabetic, enteritis, wound, implantation
A. elasticus	0.15	0.22	0.17	0.14	leave for helminthic (anthelmintic), stem bark for stomach ache, back pain, and tree sap (latex) for diarrhea.
T. glabra	-	-	-	0.08	leave for skin care
A. champeden	-	0.16	0.11	-	Leave for face masking, stem bark for malaria
C. rotundatus	0.1	0.05	0.20	-	-
D. borneensis	0.18	0.2	0.11	0.08	stem bark: medicinal for fungal skin
SUM(H')	2.84	2.60	2.66	2.87	

Old-growth heath forests exhibited a modest plant diversity at all growth stages (H' = 2.6-2.87). Twenty-four varieties of heath forest vegetation can be used as medicinal herbs. Several Dipterocarpaceae plants have not been utilized as therapeutic materials by the community. Several sources show that the Dipterocarpaceae family's Dipterocarpaceae genus has therapeutic potential. Dipterocarp species such as Shorea, Hopea, and Vatica are an abundant source of oligostilbenoid (oligomer resveratrol) chemicals, flavonoids, phenylpropanoids, and triterpenoids (Atun et al., 2004; Hakim, 2002; Ito et al., 2004; Tanaka et al., 2000).

Variation in the diversity index value of young secondary heath forest vegetation was observed (relatively disturbed). There was a reduction in the number of medicinal plants found in new heath woods (Table 6).

According to Table 6, the diversity index of heath forest seedlings, saplings, and trees fall into the low group (H'= 1.09, 1.36, and 1.82, respectively), whereas the degree of pole vegetation is classified as medium (2.56). Even yet, new secondary heath woods continue to provide Dayak Maanyan with therapeutic elements. Around twelve varieties of tree vegetation and regeneration can be utilized as therapeutic components. Young secondary heath forests have a lower diversity index and fewer medicinal plant species than older heath forests.

In heath forests, forest fires are related to a reduction in biodiversity and a loss of medicinal plants. Table 7 displays the diversity and benefits of the secondary vegetation that makes up the burnt heath forest.

Overall, the vegetation diversity index values for seedlings, saplings, poles, and trees are low. M. cajuputi is an exclusive resident of burnt heath woodlands. Five plant species are employed as therapeutic substances. The number of vegetation types that can be used as therapeutic materials at the tree level is the smallest (3 species), although there are 5 such species at the pole level.

Table 8 compares numerous vegetative metrics between secondary heath forests of old growth, secondary heath forests of young development, and burnt heath forests.

Table 6: Diversity index and medicinal use of vegetation species from young secondary heath forest

Vegetation species	Diversity Index (H') of Vegetation Level				Part of vegetation for medicinal use
	seedling	sapling	pole	tree	
A. mangium	-	-	0.23	0.21	-
V. pubescens	0.29	0.32	0.15	-	Leave and root for fever, diarrhea, and caught
S. balangeran	0.31	0.32	0.28	0.35	stem bark for antidiabetic, diarrhea, and malaria
D. zibethinus	-	-	0.21	0.3	root, stem bark for antidiabetic; fruit shell for fungal diseases
C. arborescens	0.12	0.13	0.12	-	Leave, stem bark and root for fever, cough, diarrhea, and wounds
S. inophylla	0.12	-	0.26	0.33	fruit shell and stem bark for antidiabetic
A. jiringa	-	-	0.09	-	fruit shell and stem bark for antidiabetic
H. brasilisiensis	0.24	0.13	0.17	-	-
M. triloba	-	0.20	0.15	0.3	leave for digestive medicine
D. laurium	-	-	0.12	-	Leave for stomach ache, diarrhea, rheumatic disease, and stamina
Litsea sp	-	0.13	0.17	0.21	leave for ulcer medicine
S. teysmanniana	-	-	0.12	-	Leave and stem bark for wound, stomachache, antidiabetic, and stamina
P. speciosa	-	-	0.26	-	Leave for wound; fruit shell for vitality
A. elasticus	-	-	0.12	-	Leave for helminthic (anthelmintic), stem bark for stomach ache, and back pain; tree sap (latex) for diarrhea
C. rotundatus	-	0.13	0.12	0.13	-
SUM(H')	1.09	1.36	2.56	1.82	

Table 7: Diversity index and medicinal use of vegetation species from burned hemp forest

Vegetation species	Diversity Index (H') of Vegetation Level				Part of vegetation for medicinal use
	seedling	sapling	pole	tree	
V. pubescens	0.31	0.35	0.32	0.36	leave and root for fever, diarrhea, and caught
S.balangeran	0.35	0.33	0.37	0.37	stem bark for antidiabetic, diarrhea, and malaria
M. cajuputi	0.25	0.22	0.27	-	root, stem bark for antidiabetic; fruit shell for fungal diseases on skin body
S.tetrapetrum	0.09	0.08	0.28	-	Leave and stem bark for fever, cough, diarrhea, and wounds
S. inophylla	-	-	0.27	0.37	fruit shell and stem bark for antidiabetic
SUMMARY	1.00	0.98	1.50	1.09	

Table 8: Comparison of the values of several vegetation parameters between the secondary forest of old growth heath, young heath, and burnt heath

Heath Forest Type	Number of Species	Number of Families	Number of medicinal plants	Potential of Vegetation (N/ha)			
				seedling	sapling	pole	tree
Secondary forest (old growth)	27	17	24	10,400	1,400	660	188
Secondary forest (relatively disturbed)	15	10	12	2700	400	820	120
Secondary forest (burned heath)	5	3	4	15,835	2054	152	63

When the heath forest was disturbed, the number of species, families, medicinal plants and individual potency/ha decreased. Most forest fires result in the extinction of medicinal plant species. Figure 3 depicts the decreasing number of species, number of families, and number of medicinal plants in distinct types of heath forests.

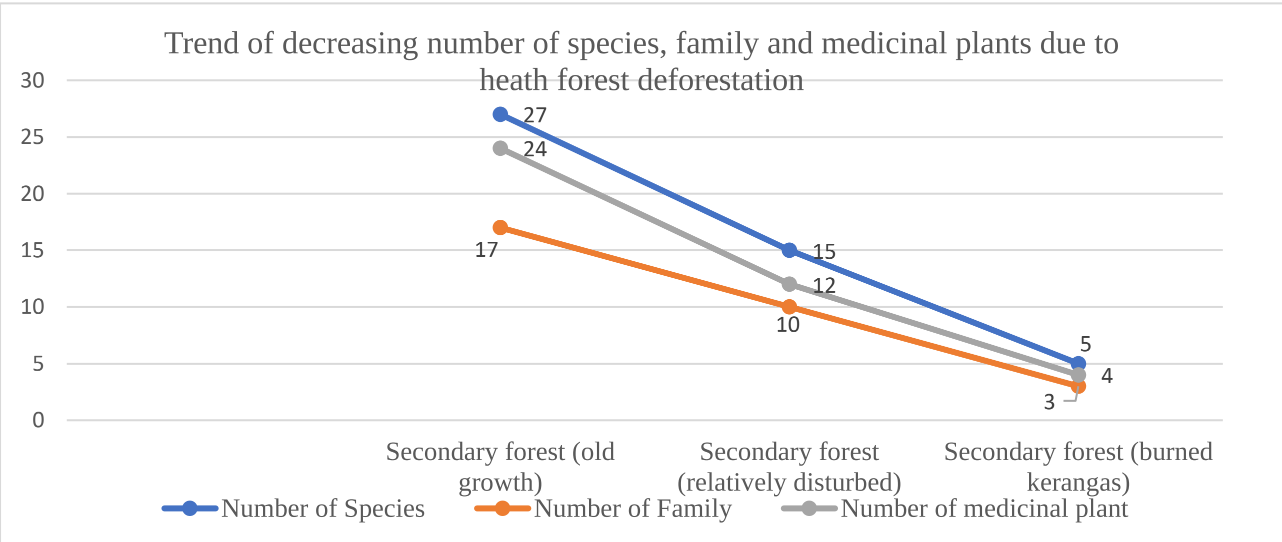

Figure 3: Comparison of the number of species, families, and medicinal plants between heath forest types

It will be difficult, especially spontaneously, to restore heath woods that have experienced damage or land degradation (Kissinger et al., 2013). Heath forest recovery after the damage is greatly impacted by vegetation structure, disturbance amount and intensity, management, and forest biotic and abiotic properties (Foster et al., 2018).

The trend of declining biodiversity due to deforestation and degradation of heath forests is also observed in the undergrowth. Table 9 displays the species makeup of the understory in old-growth heath forests, young secondary forests, and burned secondary heath forests.

Table 9: Recapitulation of the composition of the understory species found at the study site

Nu	The local name of the species	Scientific name	I	II	III	Part of vegetation for medicinal use
1	Akar Kuning	*Arcangelisa flava*	x	-	-	root for liver disease and antidiabetic
2	Alang-alang	*Imperata cylindrica*	-	x	x	root for kidney disease, hypertension
3	Bebawangan	*Dianella nemorosa*	x	x	-	Leave and root for carbuncle, acne, diarrhea
4	Karamunting	*Melastoma malabathricum*	x	x	x	leave and stem bark for stomachache, wound
5	Karepek	*Dicranopteris linearis*	-	x	x	leave, stem, and root for diarrhea, headache
6	Kelakai	*Stenochlaena palustris*	-	-	x	leave for blood booster, fever
7	Mesisin	*Rhodomyrtus tomentosa*	-	x	x	leave for stomachache, wound, and hypertension
8	Kantong Semar	*Nepenthes ampularia*	x	-	-	root for antidiabetic, stomachache, and cough
9	Kantong Semar	*Nepenthes gracilis*	x	x	x	root for antidiabetic, stomachache, and cough
10	Kantong Semar	*Nepenthes mirabilis*	x	x	-	root for antidiabetic, stomachache, and cough
11	Penawar Sampai	*Tinospora sp.*	x	-	-	leave and stem for liver disease, fever, wound, antidiabetic,
12	Rotan irit	*Calamus trachycoleus*	x	-	-	fruit for anti-nausea
13	Rumput Fatimah	*Cyperus rotundus*	x	-	-	Leave and root for dysentery, diarrhea
14	Saluang Belum	*Lavanga sarmentosa*	x	-	-	stem and root for back pain, kidney disease, vitality
15	Sarang Semut	*Mimercodia dancers*	x	-	-	tuber part for hypertension, rheumatism, gastric

where: I= old growth, II= young secondary forest, III= secondary forest after burned

There are fifteen species of undergrowth in a heath forest. There are twelve types of undergrowth in old-growth heath forests. There were seven and six species of undergrowth in the secondary forest and burned secondary heath forest as a result of disturbance to the heath forest. Due to heath forest deterioration, protected plant species (Nepenthes spp.) are also decreasing in number. In degraded heath woodland, weeds such as D. linearis, S.palustris, and I. cylindrica developed rapidly and dominated the soil surface. Stenochaena palustris was the most prevalent plant species found in a burned region of heath forest (Mojiol et al., 2010). In disturbed heath forests, the dominance of particular plants on the forest floor may hinder the natural regeneration of other species from being introduced.

Table 10 displays some of the identification results on the use of heath forests as a source of medicinal substances by the Maanyan Dayak as a whole.

Table 10: Utilization of medicinal plant species from the heath forest by the Maanyan Dayak community

Vegetation Habitus	Number of species	Number of families	Number of medicinal plants	Part of plant					
				root	leave	stem	stem bark	fruit	the others
Tree species	34	19	30	5	22	1	14	6	1
Undergrowth	15	12	15	9	6	2	2	1	1
	49	31	45	14	28	3	16	7	2

45 plant species (30 tree species and 15 undergrowth species) and 30 plant families make up the entire number of medicinal plants utilized by the Dayak Maanyan. Adawiyah (2019) observed that the heath forest in Palangkaraya, Central Kalimantan, included 28 plant species that might be utilized as medicinal materials (19 tree species and 9 undergrowth species). Iliona (2003) stated that the heath forest in the Hampangen Educational Forest, Central Kalimantan, contained 38 species and 25 families of potential medicinal plants. These findings suggest that the Dayak Maanyan group in the Dusun Selatan District of the South Barito Regency uses more medicinal plants from heath forests.

The Dayak Maanyan population uses trees more than any other habitat type, by 61.2% compared to other habitat types. The majority of medicinal plants in forest areas of Kalimantan have a tree-like habit. The Botanical Gardens of the University of Mulawarman Samarinda, which are a type of heath woodland, contain 42% of the world's tree-forming medicinal plants (Jannah, 2004). (I'ismi B, 2018) In West Kalimantan, tree species are the most favored (39.2%) source of medicinal compounds. This research suggests that trees are the predominant species in the heath forest used as a therapeutic element by the Dayak Maanyan population.

The Maanyan Dayak community uses forty percent of the plant's leaves as a source of therapeutic compounds. After the stem, bark and root are the most commonly utilized medicinal components (23% and 20%, respectively). I'ismi (2018) found that people in West Kalimantan use leaf portions as a therapeutic ingredient more than other plant parts (40.6%). Other extensively utilized plant elements include plant roots and bark. Noorhidayah (2005) discovered that the great employment of leaves in medicine is attributable to leaf material that is readily accessible, can be harvested in huge numbers, and is available year-round. The leaves are also the simplest to manipulate or combine. The high usage of these leaves is a good example of community wisdom because it has no impact on the development and growth of plant populations.

4. CONCLUSION

The Dayak Maanyan utilize heath woodland for medicinal purposes. The Dayak Maanyan community uses as many as 45 plant species (30 tree species and 15 undergrowth species) from the heath forest as therapeutic components. The Dayak Maanyan predominantly uses the plant's leaves as a medicinal component. Utilizing the relatively conserved biodiversity of medicinal plants, the use pattern of leaves is a type of community wisdom. As a result of disturbances such as logging and fires, the biodiversity of medicinal plants in heath woods declines. In burnt heath woodlands, the number of medicinal plant species decreased the most. The slow rate of recovery from damaged heath forests shows that conservation measures against damage and deforestation prevention are the greatest option for preserving the biodiversity of medicinal plants in heath forests.

REFERENCES

(INCAS), I. N. C. A. S. (2022). Central Kalimantan. Ministry of Environment and Forestry of the Republic of Indonesia. Retrieved from www.incas.menlhk.go.id/id/data/central-kalimantan/

Adawiyah R, M. S., Rosawanti P. (2019). Diversity of Traditional Medicinal Potential Plants in Pasir Putih Heath Forest, The Forestsarea with Special Purpose of Muhammadiyah University of Palangkaraya. Proceeding of ALENTA Conference Series. Available online at. 73-79. Retrieved from https://talentaconfseries.usu.ac.id

Adiputra, A., Barus, B. (2018). Analysis of Forest and Land Fire Disaster Risk on Bengkalis Island. *Journal of Geography Education and Environment*, *1*(2), 55–62.

Almarief, A. A. (2018). Analysis of Standing Potential Results of the Nunukan KPHP Forest Inventory Unit IV in Nunukan Regency, North Kalimantan Province. *AGRIFOR Journal*, *XVII*, 2503-4960.

Atun, S., Achmad, S. A., Ghisalberti, E. L., Hakim, E. H., Makmur, L., & Syah, Y. M. (2004). Oligostilbenoids from vatica umbonata (Dipterocarpaceae). *Biochemical systematics and ecology*, *32*(11), 1051-1053. doi: https://doi.org/10.1016/j.bse.2004.04.001

Azizah SA, K., Nugroho Y., Fauzi H. (2020). Vegetation Analysis of Kerangas Forest ag the Arboretum of Nyaru Menteng, Central Kalimantan. *Porch Engineering*, *5*(1), 861–867. Retrieved from https://ojs.serambimekkah.ac.id/jse/article/view/861-867

Bruenig, E. F., & Geldenhuys, C. J. (1996). Conservation and Management of Tropical Rainforests: An Integrated Approach To Sustainability. In (Vol. 177): Taylor & Francis. doi:https://doi.org/10.1080/00382167.1996.9629721.

Foster, C. N., Barton, P. S., MacGregor, C. I., Catford, J. A., Blanchard, W., & Lindenmayer, D. B. (2018). Effects of fire regime on plant species richness and composition differ among forest, woodland and heath vegetation. *Applied Vegetation Science*, *21*(1), 132-143. doi: https://doi.org/10.1111/avsc.12345

Government, C. K. P. (2015). Regional Regulation of Central Kalimantan Province Number 5 of 2015 concerning Spatial Planning of Central Kalimantan Province 2015 – 2035. Regional Sheet of Central Kalimantan Province.

Hakim, E. (2002). Oligostilbenoid dari tumbuh-tumbuhan Dipterocarpaceae. *Bull. Soc. Nat. Prod. Chem*, *2*, 1-9.

I'ismi B, H. R., Muflihati. (2018). Utilization of medicinal plants by people around IUPHHK-HTIPT. BHATARA ALAM in Mempawah Regency. *Sustainable Forest Journal* *6*(1), 16–24.

Iliona, M. (2003). Analysis, Identification and Characteristics of Medicinal Plants in Hampangen Education Forest University of Palangkaraya. Thesis. Master Program of the University of Mulawarman.

Ito, T., Tanaka, T., Iinuma, M., et al. (2004). Two New Resveratrol (= 5-[(1E)-2-(4-Hydroxyphenyl) ethenyl] benzene-1, 3-diol) Tetramers with a Tetrahydrofuran Ring from Dipterocarpus grandiflorus. *Helvetica Chimica Acta*, *87*(2), 479-495. doi: https://doi.org/10.1002/hlca.200490046

Jannah, U. N. (2004). Inventory of Medicinal Plants Species in the Botanical Gardens of Mulawarman University, Samarinda. University of Mulawarman East Kalimantan, Indonesia.

Kalima T, D. (2019). Species Composition and Peat Swamp Forest Structure in Sebangau National Park, Central Kalimantan. *Journal of Forestry Research and Nature Conservation*, *16*(1), 51-72. Retrieved from http://ejournal.forda-mof.org/ejournal-litbang/index.php/JPHKA

Kartawinata, K. (1980). A Note on A Kerangas (Heath) Forest At Sebulu, East Kalimantan. *Reinwardtia*, *9*(4), 429-447. doi: http://dx.doi.org/10.14203/reinwardtia.v9i4.925

Kissinger. (2012). Bioprospecting of Kerangas Forest: Analyze of Nephentes gracilis Korth. as a Conservation Stimulus. Dissertation. Doctoral Program of Bogor Agricultural Institute.

Kissinger., Zuhud, E. A M., Darusman, L. K., Siregar, I. Z. (2013). Diversity of Medicinal Plants from Heath Forest. *Journal of Tropical Forests*, *1*(1), 17-23.

KLHK. (2018). Statistics for Forestry Planning and Environmental Management in 2018. Ministry of Environment and Forestry (KLHK) of the Republic of Indonesia.

Kusmana, C. (1997). Vegetation survey method. *Bogor*

University of Agriculture. Bogor.

Ludwig, J.A. and Reynolds, J.F. (1988). *Statistical Ecology: A Primer on Methods and Computing*. Wiley-Interscience Pub., New York.

Miyamoto, K., Wagai, R., Aiba, S.-i., & Nilus, R. (2016). Variation in the aboveground stand structure and fine-root biomass of Bornean heath (kerangas) forests in relation to altitude and soil nitrogen availability. *Trees, 30*(2), 385-394. doi: https://doi.org/10.1007/s00468-015-1210-7

Mojiol, A. R., Adella, A., Kodoh, J., Lintangah, W., & Wahab, R. (2010). Common medicinal plants species found at burned and unburned areas of Klias peat swamp forest, Beaufort, Sabah Malaysia. *Journal of Sustainable Development*, *3*(1), 109. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/7641332/5356-16569-1-PB-libre.pdf?1390852538

Noorhidayah, K. S. (2005). Diversity of medicinal plants in Kutai National Park, East Kalimantan. *Journal of Forest Policy Analysis*, *2*(2), 115-128.

Odum. (1993). Fundamental Ecology. Gadjah Mada University Press. Yogyakarta.

Sugiyono. (2009). Method of Quantitative, Qualitative Research and R&D. Bandung. Alfabeta.

Suparni, I., Wulandari A. (2012). Nusantara Herbs, 1001 Authentic Indonesian Traditional Herbs. Yogyakarta: ANDI.

Tanaka, T., Ito, T., Nakaya, K.-i., Iinuma, M., & Riswan, S. (2000). Oligostilbenoids in stem bark of Vatica rassak. *Phytochemistry*, *54*(1), 63-69. doi: https://doi.org/10.1016/S0031-9422(00)00026-1