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Inventory of Montane Zone Weeds in the Selo Tourism Area, Boyolali Regency, Central Java

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ABSTRACT

The weed is a plant that develops in undesirable areas and harms surrounding plants. Nonetheless, this herb can be used as a source of organic material, as a soil coating to prevent erosion, and as a traditional medicine. Weed growth can vary depending on the weed's characteristics and environmental conditions. The Selo region is a verdant tourist destination in the montane zone's highlands. The land clearing caused a change in the area's vegetation. This study seeks to determine the Montane zone's weed vegetation varieties, composition, and structure. It is also connected to the release of land in Selo as a tourist area. This form of research is conducted at three different altitudes (1.600m asl, 1.700m asl, dan 1.800m asl). The intercept-point and exploration method is used, as well as data analysis involving the determination of summed dominance ratio (SDR) values and diversity index analysis. Consequently, there are variations in the composition and dominance of herbaceous vegetation at each height. There are 27 species of vegetation, with Imperata cylindrica (SDR 55.67% and 27.73% at 1.600m asl and 1.800m asl, respectively) dominating at 1.600m asl and 1.800m asl, and Ageratina riparia (SDR 20.86%) dominating at 1.700m asl. The highest diversity of grass species at the altitude of 1.800 m asl (H' 2,17). The highest sorensen's similarity index is at altitudes of 1.600 m asl and 1.700 m asl (SSI 52,17%). The ecosystem conditions influenced by abiotic factors and the management of ecosystems impact the diversity and uniformity of grass species in the mountainous region of the Selo Tourist Area.

1. INTRODUCTION

The weed is all plants that thrive in an area the farmer does not want them to, so their presence can harm other plants or the tree plant (Oksari, 2017). Due to competition for nutrients, water, light, and other essential development elements, weeds can be detrimental to the growth and yield of plants in agriculture (Faisal, et al., 2011). However, weeds can be used as a source of organic material, soil coating to prevent erosion, and as constituents in traditional medicines (Hasan, 2019). Competition between weeds and plants is affected by the type and density of weeds, horticultural culture, plant varieties, fertilization, soil conditions, and climate (Tantra & Santosa, 2016). The risky characteristic of weed, namely that it can germinate and grow in conditions of low light and water, that its seeds do not die or go dormant when the environment is less conducive for its growth, and that its vegetative growth and development are rapid (Widaryanto & Zaini, 2021). The stems are generally triangular, occasionally spherical, and typically not loose; the leaves are arranged in three rows and lack leaf languages (ligula) (Nugraha, 2023).

Montane zone is situated between 1.500 and 2.400 m asl (Rozak, 2016). The zone is characterized by dense vegetation, decreasing stem diameter, and abundant wood-dwelling mollusks and nails. This area has a variety of trees that are decreasing in number. The vegetation

formation above is becoming increasingly open, allowing more sunlight to enter the forest and increasing the presence of weed and weed (Anesta, 2020). Different climates can cause differences in the species and population's vegetation in response to differences in height (Budi, 2018). Weed growth varies based on the weed's characteristics or constitution, environmental conditions, treatment, and environmental adaptability (Andalusia, 2018). Research on weed species is required to understand the distinctions in type, dominance, density, and distribution of weeds in the montane zone. In addition, more research needs to be conducted on vegetation in the tropical montane zone.

Selo area is a Mount Merapi Montane region municipality in Boyolali district, Central Java Province. It is situated on the foothills of Mounts Merapi and Merbabu (Suyana, 2020). Where the topography of Selo's territory ranges from 1.600 to 1.800 m asl. The region offers a variety of tourist destinations with breathtaking natural scenery. The creation of a tourist destination necessitates a large amount of land for its management in order for the land to serve its purpose. The opening of land by humans can alter the structure of previously extant plant life (Blegur, 2022). During land preparation, vegetation control is typically accomplished by soil processing. This causes a change or transition in the plant life in an area, including the growth of weeds.

As a foundation for using and conserving biodiversity and other natural resources, vegetation data is indispensable. These vegetation data are used for scientific purposes and a variety of practical applications, such as forest harvesting, land use, soil protection, water management, mining, etc (Julianto, Putri, and Safi'i, 2020). Selo is one of the tourist destinations close to Mount Merapi, which transforms this region into the high plains. In addition, the region is rich in vegetation, with weed being one of the lesser-known species. Where inventory research has been limited and information on the types of weed in the area to be studied is unavailable, it is necessary to gather data on the types of cereal in the Selo Area. This research is required to identify the zone montane weeds type, particularly in the tropics. In addition, understanding the type of weed vegetation is essential for determining the success of a society's weed control efforts. The land opening causes a shift in the region's vegetation, so it is necessary to update the vegetation data of the weeds zone of the Selo Tourism Area's montane. Therefore, this study aims to identify the weed varieties, composition, and structure of the montane weed zone in the Selo Tourism Area, Boyolali, Central Java.

2. MATERIALS AND METHODS

Sampling Location and Sampling

Observational investigation on the inventory of montane zone weeds in the Selo Tourism Area, Boyolali Prefecture, Central Java at coordinates -7.512369°,110.453935° (1.600m asl), -7.515583°,110,453307 (1.700m asl), and -7.519806°,110452495 (1.800m asl), sampling is conducted. The region's topography consists of highlands in mountainous regions with altitudes between 1.600m asl and 1.800m asl and brown lithosol and grey regosol soil types. This region has a climate of type C, which is sufficiently moist to support agricultural endeavors. This region's average temperature and humidity range from 24-28°C and 75-90%, respectively. In the monsoon season, precipitation ranges from 0 to 256 mm^3, whereas in the dry season, it ranges from 277 to 439 mm^3. The air pressure is between 1.008,80 and 1.011,00 mb, and the wind speed is between 6,90 and 11,00 kph. In the interim, the solar eclipse was between 61 and 86%.

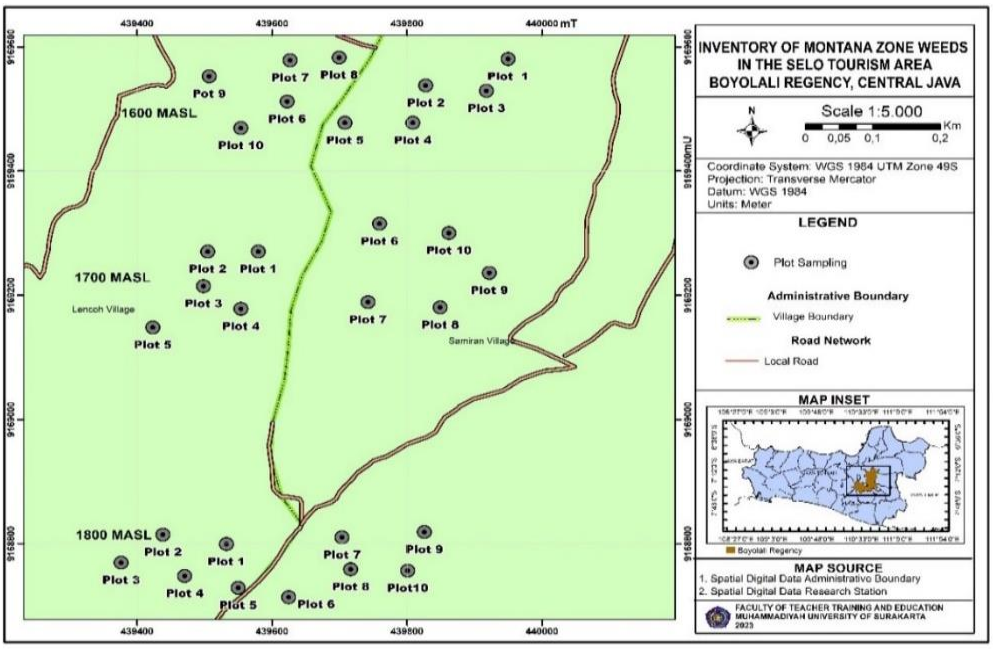

Figure 1. Map and location of research

The study was conducted at three distinct altitudes: 1.600 m asl, 1.700 m asl, and 1.800 m asl. Intercep-point and exploration are the methodologies used. According to Firmansyah et al. (2020), plot placement is conducted using a technique based on the large quantity of weed vegetation. Sampling each plot's weed vegetation using 100cm x 100cm squares (Kartawinata & Abdulhadi, 2016). Roll meters, rafia rope, wooden rods, and small square meter sampling instruments for vegetation are utilized for plotting. The thermohygrometer, altimeter, and soil tester are the instruments that are used to determine environmental conditions. Cutter, plastic bags, cameras, sprayers, petri containers, lups, and writing instruments are employed for plant sampling. Where weed vegetation at various altitudes of the montane zone area (1.600m asl, 1.700m asl, and 1.8000m asl) in the Selo Tourism Area, Boyolali Prefecture, Central Java was utilized for this study.

Figure 2. Sampling tools square meters (1m x 1m)

Herbarium Specimen Collection and Identification

Herbarium collections by gathering specimens of all vegetation species discovered. Thus, the results of the herbarium were identified at the Muhammadiyah University of Surakarta's Biological Laboratory. Identification and nomenclature are accomplished through desk research utilizing the books Flora (Steenis, C.G. G.J., 2013) and Flora of Java (C.A. Backer, R.C. Bakhuizen Van Den Berg, 1963).

Data Analysis

Summed Dominance Ratio (SDR) values are calculated based on Cox (1967) and Mueller-Dombois and Ellenberg's (1974), i.e., the SDR values are derived from the calculation of the Relative Species Density (RD), the Dominance of a Species (RDo), and the Frequency of Reference of a Species (RF), and the Important Value (IV). We also calculated the species diversity index (Shannon & Wiener, 1963) and sorensen's similarity index (Mueller-Dumbois & Ellenberg, 1974).

3. RESULTS AND DISCUSSION

The structure and composition of the weed species found in the ecosystem of the montane zone in the Selo Tourist Area consists of 27 species from 11 families identified during the investigation at three altitude points (1.600m asl, 1.700m asl and 1.800m asl). At an altitude of 1.600m asl, 9 species of vegetation from 3 families were discovered; at 1.700m asl, 14 species from 7 families; and at 1.800m asl, 17 species from 7 families. Asteraceae, Poaceae, Balsaminaceae, Onagraceae, Cyperaceae, Polygalaceae, Urticaceae, Marsileaceae, Umbelliferae, Caryophyllaceae, and Melastomataceae are families of herb species discovered there.

The classification of wheat based on its morphology yields two categories of weed: Large leaf and narrow leaf grass. Large leafy weed is a weed whose blade breadth exceeds half its length. The leaf shapes are oblong, round, triangular, long, round, or kidney-shaped (Tosang, 2019). Typically, the return of the leaves of this group, i.e., the stitching, is dominated by the typical Dicotyledoneae plant group. The narrow-leafed weed is one in which the leaf length and width are tiny or narrow. The shape of the foliage is tapered, linear, needle-like, and elongated. This group's leaf returns are typically straight or linear and dominated by Monocotyledoneae (Firmansyah, 2017). At three different altitudes, it is determined that weedes with broad leaves are the most prevalent (Figure 3). The abundance of broad-leaved weeds makes them the predominant vegetation in the ecosystem, and they can inhibit the growth of weeds. This is due to the fact that seeds are used to cultivate the majority of weed foliage. At the time of soil processing, the seeds in the soil are extracted and germinated if water and light requirements are met (Putra et al., 2018). In addition, broad-leaved weeds are more resistant to heat, water, and light than weeds, stitching, and spotting weeds (Ramlan et al., 2019). Therefore, weeds with broad leaves tend to be more adaptable than narrow ones (Suryanto et al., 2017).

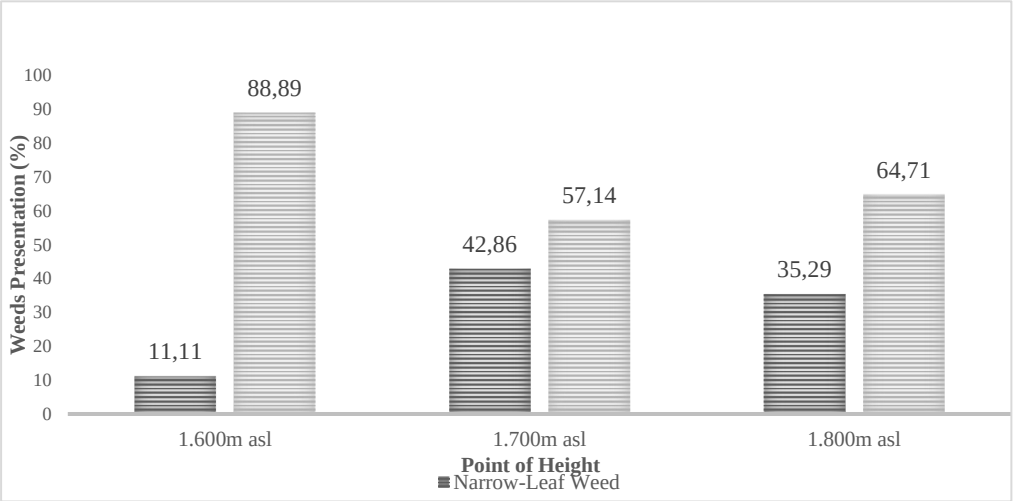

Figure 3. Three-dimensional visualization of the number of large leaf and narrow leaf weed types

The importance of each variety of weed can be used to determine the dominant type of weed in an ecosystem. The variety of weeds that grows in the Selo Tourist Area's montane zone has significant value differences. At 1.600 m asl and 1.800m asl, *Imperata cylindrica* has the highest

significant value and summed dominance ratio (SDR) value (Tables 1 and 3), whereas, at 1.700m asl, *Ageratina riparia* has the highest significant value and Summed Dominance Ratio (S DR) value (Table 2). Where, according to the results of calculations, species *Imperata cylindria* (SDR 55.67%), *Tridax procumbens* (SDS 12.3%), and *Ageratina riparia* (SDR 8.89%) dominate at an altitude of 1.600m asl. At an altitude of 1.700m asl, *Ageratina riparia* (SDR 20.86%), *Pennisetum purpureum* (SDR 18,8%), and *Imperata cylindria* (SDR 18.36%) were found to be the dominant species. At an altitude of 1.800m asl, it was determined that *Imperata cylindria* (SDR 27.73%), *Ageratina riparia* (SDR 17.46%), and *Cyperus odoratus* (SDR 9.68%) predominated. This indicates that *Imperata cylindrica* and *Ageratina riparia* dominate the ecosystem of the Selo Tourist Area's montane zone.

Table 1. Important Value (IV) and Summed Dominance Ratio (SDR) of weed montane zone vegetation at 1.600m asl altitude, in The Tourist Area of Selo, Boyolali, Central Java

No	Name of Species	RD (%)	RF (%)	RDo (%)	IV (%)	SDR (%)
1.	*Imperata cylindrica* Beauv	64.29	31.25	71.45	167	55.67
2.	*Tridax procumbens* L.	13.14	12.5	11.26	36.9	12.3
3.	*Ageratina riparia* (Regel) King & H. Rob.	9.06	9.37	8.51	26.94	8.98
4.	*Bidens tripartita* L.	4.44	9.37	4.52	18.34	6.11
5.	*Ageratum conyzoides* L.	1.59	12.5	1.68	15.78	5.26
6.	*Artemisia vulgaris* L.	4.44	9.37	0.89	14.7	4.9
7.	*Cosmos caudatus* H.B.K	1.95	6.25	0.79	9.002	3
8.	*Crassocephalum crepidioides* (Benth.)	0.71	6.25	0.79	7.76	2.59
9.	*Impatiens platypelata*	0.36	3.12	0.08	3.57	1.19
	Total	100	100	100	300	100

Table 2. Important Value (IV) and Summed Dominance Ratio (SDR) of weed montane zone vegetation at 1.700m asl altitude, in The Tourist Area of Selo, Boyolali, Central Java.

No	**Name of species**	**RD (%)**	**RF (%)**	**RDo (%)**	**IV (%)**	**SDR(%)**
1.	*Ageratina riparia*	28.07	15.22	19.29	62.57	20.86
2.	*Pennisetum purpureum*	17.68	15.22	23.5	56.4	18.8
3.	*Imperata cylindrica* Beauv	15.03	13	27.07	55.14	18.38
4.	*Artharaxon hispidus*	13.15	6.52	10.21	29.88	9.96
5.	*Parietaria judaica* L.	9.39	6.52	4.13	20.05	6.68
6.	*Ludwigia palustris* (L.) Elliot	7.51	2.17	3.4	13.09	4.36
7.	*Crassocephalum crepidioides*	1.88	6.52	4.05	12.45	4.15
8.	*Cyperatus cyperoides*	1.22	8.69	1.13	11.05	3.68
9.	*Tridax procumbens* L.	2.43	4.35	3.57	10.34	3.45
10.	*Cyperatus odoratus*	1.22	6.52	0.57	8.3	2.77
11.	*Polygala paniculata*	1.1	4.35	1.29	6.75	2.25
12.	*Solidago canadensis* var. lepida L.	0.33	4.35	0.24	4.92	1.64
13.	*Ageratum conyzoides*	0.22	4.35	0.32	4.89	1.63

14.	*Impatiens platypelata*	0.77	2.17	1.22	4.16	1.39
	Total	100	100	100	300	100

Table 3. Important Value (IV) and Summed Dominance Ratio (SDR) of weed montane zone vegetation at 1.800m asl altitude, in The Tourist Area of Selo, Boyolali, Central Java

No	Name of Species	RD (%)	RF (%)	RDo (%)	IV (%)	SDR (%)
1.	*Imperata cylindrica* Beauv	24.93	15,.22	43.1	83.2	27.73
2.	*Ageratina riparia* (Regel) King & H. Rob.	26.6	8.7	17.1	52.37	17.46
3.	*Cyperus odoratus* L.	9.9	6.52	12.62	29.04	9.68
4.	*Parthenium hysterophorus* L.	3.73	15.22	2.14	21.1	7.03
5.	*Eclipta prostrata*	9.25	4.35	6.83	20.43	6.81
6.	*Drymaria cordata* Willd	6.04	4.35	3.1	13.48	4.5
7.	*Centella asiatica* Urb.	3.21	6.52	1.75	11.48	3.83
8.	*Arthraxon hispidus* (Thunb.) Makino	4.11	4.35	1.99	10.44	3.48
9.	*Conyza sumatresis*	1.16	6.52	1.51	9.19	3.06
10.	*Tridax procumbens* L.	3.6	2.17	3.1	8.87	2.96
11.	*Marsilea crenata*	2.7	4.35	0.87	7.92	2.64
12.	*Eleusine indica* Gaertn	0.77	4.35	1.91	7.03	2.34
13.	*Briza minor*	1.16	4.35	1.27	6.78	2.26
14.	*Crassocephalum crepidioides* (Benth.)	1.54	4.35	0.71	6.61	2.2
15.	*Ageratum conyzoides* L.	0.64	4.35	1.35	6.34	2.11
16.	*Gamochaeta purpurea (*L.) Cabrera	0.39	2.17	0.4	2.96	0.99
17.	*Melastoma candidum*	0.26	2.17	0.32	2.75	0.92
	Total	100	100	100	300	100

Important value and value of high Summed Dominance Ratio *Imperata cylindrica* are attributable to the weed's ability to survive in extreme conditions, allowing it to develop to nearly any height on the territory. *Imperata cylindrica* can proliferate wildly in various soil types, particularly on unused and infertile soils with few migrants (Subagia et al., 2021). *Impera cylindrica* is aggressive and invasive because its primary organ is a crust. This is consistent with Sayfulloh's study (2020), which has been categorized as one of the most invasive plants, particularly in tropical and subtropical regions of the world (Invasive Species Specialist Group, 2008) due to its capacity to grow rapidly on formerly processed soils such as gardens, open land for buildings, and roadside. Because it grows in the forest, *Ageratina riparia* also governs the ecosystem of the Montane Zone in the Selo Area. This plant thrives in a subtropical climate between 975 and 1.706 m asl. This plant is dominant because it is a member of a group of invasive species yuliare capable of rapid growth, particularly in tropical regions (Perianto, 2019). In addition, this plant can thrive anywhere, particularly in wet environments, such as open forests and lawns with heavy precipitation (Respitosari & Pujiastuti, 2022).

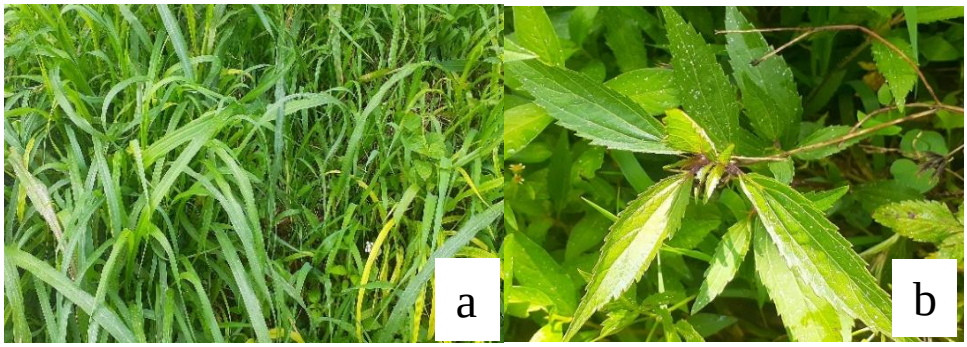

Figure 4. *Imperata cylindrica* (a) dan *Ageratina riparia* (b)

It has been stated that the diversity of grass species with H'<1 includes low, 1 < H' <3 includes medium, and H' >3 includes high. The result of the level of diversity of weed species at three points of altitude in the Selo Tourist Area's montane zone is medium, with the highest Shannon-Wiener diversity index (H') at 1.800m asl and the lowest diversity index at 1.600m asl (Table 4). The diversity values of the grain varieties obtained indicate that differences in ecosystem conditions significantly impact the diversity of grain species because if the ecological environment is not conducive to growth, the weed weeds will go dormant. However, if the ecosystem environment is conducive to flora, then the weed propagules will germinate and develop into weed vegetation, which can cause problems for the primary plants (Setiawan & Sarjiyah, 2021). In addition to the conditions of ecosystems, weed species diversity is also affected by ecosystem management.

Table 4. Type diversity index (H') vegetation weeds zona montane on Selo, Boyolali, Central Java Tourist Areas

Point of Height (m asl)	H’
1.600	1.24 (Medium)
1.700	2.02 (Medium)
1.800	2.17 (Medium)

The condition of the ecosystem in the Selo Tourism Area's montane zone can be determined by measuring the abiotic factor. Differences in height, soil pH, atmospheric pressure, light intensity, temperature, and humidity exist between the ecosystems of three altitude locations (Table 5). The weed's development can be affected by the weed's height. The investigation by Sintayehu (2019) indicates that weed can grow well up to 2.400m asl. There is a highest diversity of vegetation species at higher elevations than at lower elevations. Among the three altitude locations, the type diversity index is at an altitude of 1.800m asl highest compared to 1.600m asl. These differences in height impact the diversity of weedes because they result in variations in climate conditions, such as temperature and humidity, which influence weed growth (Nurnasari & Djumali, 2010).

The measurements of abiotic factors revealed a highly significant correlation between the intensity of light at three different altitudes and abiotic factors (Table 5). The relationship between light intensity and the ecophysiological processes of plants is close. The intensity of light has a significant impact on the efficacy of photosynthesis in plants. Adaptation of shadow plants and heat-resistant plants to the intensity of light results in efficient photosynthesis, allowing both types of plants to survive and produce abundantly (Yustiningsih, 2019). *Imperata cylindrica* plants are C4 plants; these plants require a high intensity of sunlight for photosynthesis and thrive on open ground (Fujiyanto, 2015). Therefore, *Imperata cylindrica* is found near all elevations. The *Ageratina* riparia plant is a C3 plant, so it is typically found in frigid climates and can photosynthesize more efficiently than a C4 plant at 25°C. In addition, a higher tree cover at 1.800m asl than at other heights influenced the diversity of the herbicides discovered.

In addition to the abiotic factors described previously, using herbicides and managing the mountain ecosystem in the Selo Tourism Area are human-controllable factors that can influence the diversity of weed species. Observations indicate that local communities at an altitude of 1.600m asl tend to employ herbicides as weed degradants, thereby reducing the diversity of weeds at that altitude. This is due to herbicidal properties that inhibit or destroy certain types of weeds without harming the crops (Yuliana & Ami, 2020). Furthermore, vegetation is also routinely carved at the height of 1.600m asl, unlike at 1.700m asl and 1.800m asl. Thus, the diversity of vegetation species at an altitude of 1.800m asl is highest than at other research sites.

It has been stated that grass similarity rates >75% are incredibly high, 50%-75% are high, 25%-50% are low, and 25% are deficient. Following the differences in the presence of grass species as measured by the Sorensen diversity index (Table 6), the diversity indices at an elevation of 1,600m dpl and 1,700m dple was 52.17 percent. corresponds to the mean as indicated by the index value. However, the diversity index at altitudes of 1.600 m asl and 1.800 m asl was low at 38.46%, and the diversity index at altitudes of 1.700 m asl and 1.800 m asl was also low at 45.16%. This is due to a variety of ecosystem conditions, including altitude, air temperature, soil pH, and air humidity. At altitudes of 1.600m asl and 1.800m asl, there is a slight variation in weed species due to differences in abiotic factors; consequently, the varieties of weeds that grow at these altitudes are quite distinct from one another. This is evidenced by the morphology of weed at an altitude of 1.600m asl, which tends to be more broad-leafed than weed at 1.800m asl. This weed leaf morphology is related to the light intensity and tree cover at each altitude, where the light intensity at an altitude of 1.600m asl is highest than at altitudes of 1.700m asl and 1.800m asl.

Table 5. Montane zone abiotic factors in Selo, Boyolali, Central Java

Abiotic Factors	Point of Height		
	1.600m asl	**1.700m asl**	**1.800m asl**
Temperature of air (°C)	28.7	20.6	21.3
Humidity of the air (%)	57	94	73
pH of soil	6	5,5	6
The atmospheric pressure (atm)	835.4	825.3	815.6
The intensity of light (Cd)	18200	11460	2180

Table 6. Sorensen's Similarity Index (SSI) vegetation weeds montane zone in Selo, Boyolali, Central Java Tourist Areas

Point of Height	SSI (%)
1.600m asl and 1.700m asl	52,17 (High)
1.600m asl and 1.800m asl	38,46 (Low)
1.700m asl and 1.800m asl	45,16 (Low)

According to the vegetation data of the mountain weeds zone in the Selo Tourism Area, the composition of the region's weeds is highly diverse. This research's conclusions can be utilized as a supplement material for biodiversity-related education in schools. For further research, students can use these accounts as references for future research. For the community to provide information about the various vegetation of the plant weed zone Montana in the Selo Tourism Area, it can take advantage of the types of weeds that exist (potential use) and know the weed control techniques in the montane zone.

4. CONCLUSIONS

In research related to the inventory of montane zones, disparities in composition and dominance of weed vegetation at each height (1.600m asl, 1.700m asl, and 1.800m asl) were discovered in the Selo Tourist Area. The quantity of weeds at each ecosystem height varies, with a total of 27 weeds belonging to 11 families. The vegetation species *Imperata cylindrica* and *Ageratina riparia* are the most prevalent. The diversity of vegetation species in the mountainous zone ecosystem of the Tourist Area at an altitude of 1.800 m asl is highest than at altitudes of 1.700 m asl and 1.600 m asl. At an altitude of 1.600m asl and a height of 1.700m asl, the sorensen's similarity index of vegetation species in the ecosystem is high. The conditions of the ecosystem are influenced by abiotic factors and the management of ecosystems impacts the diversity and uniformity of weed species in the mountainous region of the Selo Tourist Area. Where the research is limited to a certain height (1.600-1.800m asl), it is necessary to conduct additional inventory at higher montana heights (>1.800 m asl) in order to increase the data on montane weeds vegetation. The data on this region's vegetation must be continuously updated because this region is becoming a tourist destination, necessitating advanced research.

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6. REFERENCES

Andalusia, S. N. (2018). Inventarisasi Gulma Pada Tanaman Jagung (Zea Mays L.) di Dataran Rendah dan Dataran Tinggi (Doctoral Dissertation, Universitas Brawijaya).

Anesta, A. F., Fatman, A. F., & Sugandi, M. (2020). Zonasi Distribusi Tanaman Hutan di Taman Nasional Gunung Semeru Berdasarkan Integrasi Nilai Indeks Vegetasi dan Digital Elevation Model. Jurnal Geosains dan Remote Sensing 1(2): 64-70. DOI: 10.23960/jgrs.2020.v1i2.30

Blegur, W. A., & Binsasi, R. (2022). Ancaman Spesies Invasif di Hutan Produksi Oinbit Kabupaten Timor Tengah Utara. Syntax Idea 4(1): 228-239. DOI: 10.46799/syntax-idea.v4i1.1739

Budi, G. P. (2018). Analisis Vegetasi dan Penentuan Dominansi Gulma pada Pertanaman Jagung di Beberapa Ketinggian Tempat. Agritech: Jurnal Fakultas Pertanian Universitas Muhammadiyah Purwokerto 20(1): 13-18. DOI: 10.30595/ agritech.v20i1.3417

Faisal, R., Siregar, E. B. M., & Anna, N. (2011). Inventarisasi Gulma pada Tegakan Tanaman Muda Eucalyptus Spp (Weed Inventory On Stand Of Young Eucalyptus spp.). Peronema Forestry Science Journal 2(2): 44-49.

Firmansyah, A. P. (2017). Pengantar Pelindungan Tanaman. Makassar : Penerbit CV. INTI MEDIATAMA.

Firmansyah, N., Khusrizal, Handayani, R. S., Maisura, & Baidhawi. (2020). Dominansi Gulma Invasif pada Beberapa Tipe Pemanfaatan Lahan di Kecamatan Sawang Kabupaten Aceh Utara. Jurnal Agrium 17(2): 144–148. DOI: 10.29103/agrium.v17i2.2926

Fujiyanto, Z., Prihastanti, E., & Haryanti, S. (2015). Karakteristik Kondisi Lingkungan, Jumlah Stomata, Morfometri, Alang-Alang yang Tumbuh di Daerah Padang Terbuka di Kabupaten Blora dan Ungaran. Buletin Anatomi dan Fisiologi 23(2): 48-53. DOI: 10.14710/baf.v23i2.10011

Hasan, I. S. (2019). Hijauan Pakan Tropik. Bogor: PT Penerbit IPB Press.

Imaniasita, V., Liana, T., & Pamungkas, D. S. (2020). Identifikasi Keragaman dan Dominansi Gulma pada Lahan Pertanaman Kedelai. Agrotechnology Research Journal 4(1): 11–16. DOI: 10.20961/agrotechresj.v4i1.36449

Kartawinata, K., & Abdulhadi, R. (2016). Ekologi Vegetasi Tujuan dan Metode. Jakarta : LIPI Press.

Nugraha, E., Noertjahyani, N., & Parlinah, L. (2023). Pengaruh Konsentrasi Pgpr (Plant Growth Promoting Rhizobacteria) terhadap Pertumbuhan dan Hasil Tanaman Kangkung (Ipomoea Reptans Poir) Varietas Bika. OrchidAgro 3(1): 12-19. DOI: 10.35138/orchidagro.v3i1.513

Nurnasari, E., & Djumali. (2010). Effect of Altitude Conditions on the Production and Quality of Temanggung Tobacco. Buletin Tanaman Tembakau, Serat & Minyak Industri 2(2): 45–59. DOI: 10.14203/beritabiologi.v13i1.648

Perianto, L. H., Soejono, A. T., & Astuti, Y. T. M. (2019). Komposisi Gulma pada Lahan Kelapa Sawit (Elaeis guineensis Jacq.) pada Tanaman Belum Menghasilkan dan Tanaman Menghasilkan di KP2 Ungaran. Jurnal Agromast 1(2): 1-16.

Putra, F. P., Yudono, P., & Waluyo, D. S. (2018). Perubahan Komposisi Gulma pada Sistem Tumpangsari Padi Gogo dengan Kedelai di Lahan Pasir Pantai. Jurnal Agronomi Indonesia (Indonesian Journal of Agronomy) 46(1): 33-39. DOI: 10.24831/jai.v46i1.17093

Ramlan, D. N., Riry, J., & Tanasale, V. L. (2019). Inventarisasi Jenis Gulma di Areal Perkebunan Karet (Hevea brasiliensis) Pada Ketinggian Tempat yang Berbeda di Negeri Liang Kecamatan Teluk Elpaputih Kabupaten Maluku Tengah. Jurnal Budidaya Pertanian 15(2): 80–91. DOI: 10.30598/jbdp.2019.15.2.80

Respitosari, N. G. M., & Pujiastuti, P. (2022). Kekayaan Jenis Tumbuhan Herba Angiospermae di Taman Hutan Raya Raden Soerjo Sub Wilayah Mojokerto. Jurnal Aaintifika 18(2): 13-13.

Rozak, A. H., Astutik, S., Mutaqien, Z., Widyatmoko, D., & Sulistyawati, E. (2016). Kekayaan jenis pohon di hutan Taman Nasional Gunung Gede Pangrango, Jawa Barat. Jurnal Penelitian Hutan dan Konservasi Alam 13(1): 1-14. DOI: 10.20886/jphka.2016.13.1.1-14

Sayfulloh, A., Riniarti, M., & Santoso, T. (2020). Jenis-Jenis Tumbuhan Asing Invasif di Resort Sukaraja Atas, Taman Nasional Bukit Barisan Selatan (Invasive Alien Species Plants in Sukaraja Atas Resort, Bukit Barisan Selatan National Park). Jurnal Sylva Lestari 8(1): 109-120. DOI: 10.23960/jsl18109-120

Setiawan, A. N., & Sarjiyah. (2021). Keanekaragaman dan Kelimpahan Gulma pada Tumpangsari Jagung Manis dengan Kacangan. Bioeksperimen 7(2): 1443–153. DOI: 10.23917/bioeksperimen.v7i2.10814

Sintayehu, A. (2019). African Journal of Agricultural Research Weed Flora Survey in Field Crops of Northwestern Ethiopia. African Journal of Agricultural 14(16): 749–758. DOI: 10.5897/AJAR2019.13947

Subagia, I. N., Suwantana, I. G., Sudiana, I. G. N., Surada, I. M., I Nyoman Rema, Tirta, I. M. D., Adnyana, P. E. S., Giri, I. P. A. A., & · I. M. P. A. (2021). Tanaman Upakara. Bali : Nilacakra.

Suryanto, P., Tohari, Sulistyaningsih, E., Putra, E. T. S., Kastono, D., & Alam, T. (2017). Estimation of Critical Period for Weed Control in Soybean on Agroforestry System with Kayu Putih. Asian Journal of Crop Science 9(3): 82–91. DOI: 10.22146/ipas.17700

Suyana, J. (2020). Profil Desa Wisata Samiran di Lereng Merbabu-Merapi Kecamatan Selo Kabupaten Boyolali Propinsi Jawa Tengah. SEMAR (Jurnal Ilmu Pengetahuan, Teknologi, dan Seni bagi Masyarakat) 9(1): 27-35. DOI: 10.20961/semar.v9i1.42015

Tantra, A. W., & Santosa, E. (2016). Manajemen Gulma di Kebun Kelapa Sawit Bangun Bandar: Analisis Vegetasi Dan Seedbank Gulma. Buletin Agrohorti 4(2): 138-143. DOI: 10.29244/agrob.v4i2.15012

Tosang, R. (2019). Inventarisasi Jenis-Jenis Gulma Berdaun Lebar pada Lahan Tanaman Jagung Zea Mays L. di Desa Samangki Kecamatan Simbang Kabupaten Maros (Doctoral Dissertation, Universitas Hasanuddin).

Widaryanto, E., & Zaini, A. H. (2021). Teknologi Pengendalian Gulma. Malang: Universitas Brawijaya Press.

Yuliana, A. I., & Ami, M. S. (2020). Analisis Vegetasi dan Potensi Pemanfaatan Gulma Lahan Persawahan. Jombang: LPPM Universitas KH. A. Wahab Hasbullah.

Yustiningsih, M. (2019). Intensitas Cahaya dan Efisiensi Fotosintesis pada Tanaman Naungan dan Tanaman Terpapar Cahaya Langsung. BIO-EDU: Jurnal Pendidikan Biologi 4(2): 44-49. DOI: 10.32938/jbe.v4i2.385