

ACTIVITY REPORT: DETERMINATION OF COLLECTED PLANT MATERIAL IN THE MATAVÉN FOREST

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This study was conducted within the framework of the REDD+ Matavén Project, aimed at identifying the flora species that are part of this significant but understudied Colombian biome.

Fieldwork for the collection of plant material took place from April 10 to April 21, 2022. The fieldwork commenced with a workshop for the personnel conducting the field activities, which included six REDD+ Matavén zonal coordinators, all of whom are indigenous and two field professionals from the Project. The field team members were Luis Manuel Cariban, Félix Norberto Castillo, Juan Bautista Nariño, Jhony Hernández, Luis Emilio Gaitán, and the motorist and logistics support Gregorio Camacho. The commission was also accompanied by the co-director of the REDD+ Matavén Project, Alejandro Camacho, the biologist Luis Alonso Merizalde, and the field director of the Project, Juan Carlos Silva. They were trained in field techniques for collecting, preserving, pressing, and conserving the collected plant samples. Additionally, the biologist Paul Wilder Peña Castañeda, a specialist in canopy work and plant material collection, participated in this training.

After the training workshop, the field team was prepared to begin the survey across eight plots, two in each of the four identified biomes. The collection involved parts of leaves, flowers, and fruits from forest species present in the selected plots (Peinobiome, Zonobiome, Helobiome, and Lithobiome).

Table 1 presents the data of the selected plots with the collection dates for each plot and their respective georeferencing.

Table 1. Sampling plots for forest species collection

Collection Site	Study Location	Start Date	End Date	Geographic Coordinates	
				Latitude	Longitude
1	Sector 2: Matsuldani y Boponé	11-04-2022	12-04-2022	4,36649	-69,79737
2	Sector 2: Matsuldani y Boponé	13-04-2022	13-04-2022	4,36674	-69,79758
3	Sector 3 ^a : Camonianae	16-04-2022	17-04-2022	4,33314	-69,04617
4	Sector 3 ^a : Camonianae	18-04-2022	18-04-2022	4,33435	-69,04579
5	Sector 7: Pueblo Escondido	21-04-2022	21-04-2022	4,35315	-67,83369
6	Sector 7: Pueblo Escondido	22-04-2022	22-04-2022	4,35465	-67,83966
7	Sector 15: Giro	25-04-2022	25-04-2022	3,90092	-69,00761
8	Sector 10: Caño Pavita	26-04-2022	26-04-2022	4,00805	-68,42939

After collecting all the plant material, it was preserved in 80% alcohol to ensure proper preservation. The samples were then packed and sent to two herbaria for drying, which is crucial for accurate identification. Table 2 lists the two herbaria that performed the drying process and the number of plant samples each received.

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Table 2. Herbaria responsible for drying and number of plant samples per herbarium

Tropical Herbarium	INCCA Herbarium	Total
280 specimens	101 specimens	381 specimens

With the plant material properly dried, a review and taxonomic determination were conducted for 66 collection numbers of plant material collected in the Matavén Forest (Vichada, Colombia). This activity utilized specialized literature, such as the article by Cárdenas D., Mendoza, H., González M.F., & Sua S. (2016) titled "*Flora de la Cuenca del Río Orinoco en Colombia: Grado de conocimiento, uso y conservación.*" Additionally, four virtual herbaria, two international and two national, were consulted for taxonomic determination. The virtual herbaria consulted were:

- New York Botanical Garden (NYBG)
- Neotropical Herbarium Specimens - Field Museum (FM)
- Herbario Amazónico Colombiano Sinchi (COAH)
- Herbaria Nacional colombiano (COL)

A total of 66 records were determined, comprising 130 specimens from 20 families, distributed across 37 genera and 51 species.

Tabla 3. List of Identified Specimens

#	Family	Genus	Species	Specimens
1	Lamiaceae	1	1	2
2	Lauraceae	4	5	16
3	Lecythidaceae	1	2	4
4	Malvaceae	3	3	6
5	Melastomataceae	2	3	8
6	Moraceae	7	11	34
7	Myristicaceae	1	3	10
8	Myrtaceae	2	3	10
9	Nyctaginaceae	1	2	4
10	Olacaceae	3	3	8
11	Opiliaceae	1	1	2
12	Polygonaceae	1	1	2
13	Simaroubaceae	1	1	1
14	Urticaceae	2	4	7
15	Violaceae	1	1	2
16	Salicaceae	2	2	4
17	Apocynaceae	1	1	2
18	Burseraceae	1	1	2
19	Elaeocarpaceae	1	2	4
20	Euphorbiaceae	1	1	2
	Total 20	37	51	130

Results

From the inventories and identification of plant material conducted in 2022, significant progress was made in identifying the species present in the four biomes across eight plots. A total of 140 species were identified, distributed across 103 genera and 36 families, all representing the primary forest of the Matavén Forest (Table 4).

Table 4. Number of species, genera, and families by biome

Taxa	Families	Genera	Species
Helobiome	29	53	65
Lithobiome	17	22	22
Peinobiome	17	31	36
Zonobiome	22	37	44

The families richest in species were Orchidaceae with 15 species, Fabaceae with 12 species, Moraceae with 11 species, Euphorbiaceae and Burseraceae with 8 species each, and the remaining families with fewer than 7 species each.

The families richest in genera were Orchidaceae with 14 genera, Moraceae and Euphorbiaceae with 7 genera each, and Rubiaceae with 6 genera. Among the genera richest in species, Protium was recognized with 6 species, while Brosimum, Sloanea, Pourouma, and Virola each had 3 species.

The species represented in all four biomes was *Qualea paraensis*. Species present in three biomes included *Dacryodes belemensis*, *Myrcia neospeciosa*, *Pouteria caimito*, and *Protium decandrum*.

Table 5. Number of species and genera by families in each biome

No.	Subplots	H26-H27	L10A-L21A	P30-P32	Z20-Z33	Total
	Biome	Helobiome	Lithobiome	Peinobiome	Zonobiome	
1	<i>Abarema microcaly</i>	0	1	0	0	1
2	<i>Abrus fruticosus</i>	1	0	0	0	1
3	<i>Acianthera capillaris</i>	1	0	0	0	1
4	<i>Agonandra brasiliensis</i>	0	1	0	0	1
5	<i>Agouticarpa sp.</i>	0	0	0	1	1
6	<i>Alchornea triplinervia</i>	1	0	0	0	1
7	<i>Alchornea triplinervia var. laevigata</i>	1	0	0	0	1
8	<i>Andira inermis</i>	0	0	1	0	1
9	<i>Aniba cylindriflora</i>	0	0	0	1	1
10	<i>Annona montana</i>	0	0	1	0	1
11	<i>Annona sp.1</i>	0	0	0	1	1
12	<i>Apeiba membranacea</i>	1	0	0	0	1
13	<i>Aptandra tubicina</i>	0	0	0	1	1

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No.	Subplots	H26-H27	L10A-L21A	P30-P32	Z20-Z33	Total
	Biome	Helobiome	Lithobiome	Peinobiome	Zonobiome	
14	<i>Aspidosperma excelsum</i>	1	0	0	0	1
15	<i>Aspidosperma spruceanum</i>	1	0	0	0	1
16	<i>Aspidosperma sp.</i>	1	0	0	0	1
17	<i>Beilschmiedia tovarensis</i>	1	0	0	0	1
18	<i>Brosimum guianense</i>	0	0	0	1	1
19	<i>Brosimum lactescens</i>	0	0	0	1	1
20	<i>Brosimum utile</i>	0	0	1	0	1
21	<i>Caraipa llanorum</i>	0	1	0	0	1
22	<i>Casearia pitumba</i>	1	0	0	0	1
23	<i>Catasetum sp. 1</i>	1	0	0	0	1
24	<i>Cecropia angustifolia</i>	0	0	0	1	1
25	<i>Chamaecrista duartei</i>	0	1	0	0	1
26	<i>Chimarrhis gentryana</i>	0	0	0	1	1
27	<i>Chrysophyllum sanguinolentum</i>	0	0	0	1	1
28	<i>Clarisia racemosa</i>	1	0	0	0	1
29	<i>Clathrotropis macrocarpa</i>	0	0	1	0	1
30	<i>Coccoloba sp.</i>	0	0	0	1	1
31	<i>Conceveiba guianensis</i>	0	1	0	1	2
32	<i>Conceveiba rhytidocarpa</i>	0	0	1	0	1
33	<i>Couepia guianensis subsp. glandulosa</i>	1	1	0	0	2
34	<i>Couma macrocarpa</i>	0	0	0	1	1
35	<i>Crudia oblonga</i>	1	0	0	0	1
36	<i>Cyathea andina</i>	0	0	1	0	1
37	<i>Dacryodes belemensis</i>	1	0	1	1	3
38	<i>Dacryodes chimantensis</i>	0	0	1	1	2
39	<i>Duquetia antioquensis</i>	1	0	0	0	1
40	<i>Enterolobium schomburgkii</i>	1	0	0	0	1
41	<i>Epidendrum sp.</i>	1	0	0	0	1
42	<i>Erisma laurifolium</i>	0	0	1	1	2
43	<i>Erisma uncinatum</i>	1	0	0	0	1
44	<i>Erisma sp. 1</i>	0	0	0	1	1
45	<i>Eschweilera ovalifolia</i>	0	0	0	1	1
46	<i>Eschweilera parvifolia</i>	1	0	0	0	1
47	<i>Euterpe precatória</i>	0	0	1	0	1
48	<i>Faramea anisocalyx</i>	0	0	0	1	1
49	<i>Ferdinandusa uaupensis</i>	0	0	1	0	1
50	<i>Ficus americana</i>	0	0	1	0	1
51	<i>Ficus crassivenosa</i>	0	0	1	1	2
52	<i>Garcinia madruno</i>	1	0	0	0	1
53	<i>Geissospermum reticulatum</i>	1	0	0	0	1
54	<i>Gongora scaphephorus</i>	0	0	1	0	1



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	Biome	Helobiome	Lithobiome	Peinobiome	Zonobiome	
55	<i>Goupia glabra</i>	1	0	0	0	1
56	<i>Guatteria liesneri</i>	0	1	0	0	1
57	<i>Heisteria ovata</i>	1	0	0	1	2
58	<i>Helicostylis tomentosa</i>	1	0	0	0	1
59	<i>Heterotaxis superflua</i>	0	0	1	1	2
60	<i>Hirtella racemosa</i>	0	1	0	0	1
61	<i>Homalolepis cedron</i>	1	0	0	0	1
62	<i>Humiriastrum cuspidatum</i>	0	0	1	0	1
63	<i>Humiriastrum procerum</i>	0	1	0	0	1
64	<i>Hymenaea oblongifolia</i>	1	0	0	0	1
65	<i>Iriartella setigera</i>	0	0	1	0	1
66	<i>Jacaranda obovata</i>	0	0	0	1	1
67	<i>Ladenbergia macrocarpa</i>	0	1	1	0	2
68	<i>Laetia procera</i>	0	1	0	0	1
69	<i>Leonia cymosa</i>	0	0	1	0	1
70	<i>Licania hypoleuca</i>	0	0	1	0	1
71	<i>Licania micrantha</i>	0	0	0	1	1
72	<i>Machaerium leiophyllum var. colombiense</i>	0	0	0	1	1
73	<i>Macradenia sp. 1</i>	0	0	1	0	1
74	<i>Maprounea guianensis</i>	1	0	0	0	1
75	<i>Maquira calophylla</i>	1	0	0	0	1
76	<i>Maquira coriacea</i>	1	0	0	0	1
77	<i>Maxillaria xylobiflora</i>	0	0	0	1	1
78	<i>Maxillaria sp.</i>	1	0	0	0	1
79	<i>Miconia biglandulosa</i>	1	0	0	0	1
80	<i>Micrandra spruceana</i>	0	0	1	0	1
81	<i>Micropholis egensis</i>	0	0	1	1	2
82	<i>Micropholis venulosa</i>	0	0	0	1	1
83	<i>Mouriri chamissoana</i>	1	0	0	0	1
84	<i>Mouriri collocarpa</i>	0	1	1	0	2
85	<i>Myrcia neospeciosa</i>	0	1	1	1	3
86	<i>Myoxanthus sp.1</i>	0	0	1	1	2
87	<i>Myrcia splendens</i>	0	1	0	0	1
88	<i>Nectandra crassiloba</i>	0	1	0	0	1
89	<i>Neea divaricata</i>	1	0	0	0	1
90	<i>Neea obovata</i>	0	0	0	1	1
91	<i>Ocotea aciphylla</i>	0	1	0	0	1
92	<i>Ocotea floribunda</i>	0	0	1	1	2
93	<i>Ocotea sp.</i>	1	0	0	0	1
94	<i>Oenocarpus bataua</i>	0	0	1	0	1
95	<i>Oenocarpus mapora</i>	0	0	1	0	1



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	Biome	Helobiome	Lithobiome	Peinobiome	Zonobiome	
96	<i>Olax macrophylla</i>	0	0	0	1	1
97	<i>Orchidiaceae sp.1</i>	0	1	0	0	1
98	<i>Ormosia macrophylla</i>	0	1	0	0	1
99	<i>Oxandra mediocris</i>	1	0	0	0	1
100	<i>Pachira nitida</i>	1	0	0	0	1
101	<i>Parahancornia oblonga</i>	1	0	0	0	1
102	<i>Platymiscium pinnatum</i>	1	0	0	0	1
103	<i>Pourouma acuminata</i>	1	1	0	0	2
104	<i>Pourouma bicolor</i>	1	0	0	0	1
105	<i>Pourouma minor</i>	1	0	0	0	1
106	<i>Pouteria caimito</i>	1	0	1	1	3
107	<i>Prosthechea vespa</i>	1	0	0	0	1
108	<i>Prosthechea sp. 1</i>	1	0	0	0	1
109	<i>Protium apiculatum</i>	1	0	0	0	1
110	<i>Protium aracouchini</i>	1	0	0	0	1
111	<i>Protium crassipetalum</i>	1	0	0	1	2
112	<i>Protium decandrum</i>	0	1	1	1	3
113	<i>Protium pittieri</i>	1	0	0	0	1
114	<i>Protium sp. 1</i>	0	0	0	1	1
115	<i>Pseudolmedia laevigata</i>	0	0	0	1	1
116	<i>Psidium salutare</i>	1	0	0	0	1
117	<i>Psychotria sp.</i>	1	0	0	0	1
118	<i>Pterocarpus officinalis</i>	1	0	0	0	1
119	<i>Qualea paraensis</i>	1	1	1	1	4
120	<i>Rudolfiella sp.</i>	1	0	0	0	1
121	<i>Sandwithia heterocalyx</i>	0	0	1	1	2
122	<i>Sapotaceae sp.1</i>	0	0	1	0	1
123	<i>Sloanea guianensis</i>	0	0	0	1	1
124	<i>Sloanea macrophylla</i>	1	0	0	0	1
125	<i>Sloanea sp.</i>	1	0	0	0	1
126	<i>Spondias mombin</i>	1	0	0	0	1
127	<i>Stanhopea candida</i>	0	0	0	1	1
128	<i>Tapirira guianensis</i>	0	1	0	0	1
129	<i>Terminalia oblonga</i>	1	0	0	0	1
130	<i>Tetrorchidium rubrivenium</i>	1	0	0	0	1
131	<i>Theobroma subincana</i>	0	0	0	1	1
132	<i>Trigonidium obtusum</i>	0	0	1	0	1
133	<i>Trymatococcus amazonicus</i>	0	0	1	0	1
134	<i>Virola macrocarpa</i>	1	0	0	0	1
135	<i>Virola sebifera</i>	1	0	0	1	2
136	<i>Virola sp. 1</i>	0	0	0	1	1



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	Biome	Helobiome	Lithobiome	Peinobiome	Zonobiome	
137	<i>Vitex orinocensis</i>	1	0	0	0	1
138	<i>Vochysia ferruginea</i>	1	0	0	0	1
139	<i>Xylopia aromatica</i>	1	0	0	0	1
140	<i>Xylopia parviflora</i>	1	0	0	0	1
Total de especies		65	22	36	44	

Beta Diversity

To establish the turnover rate among the four biomes, a cluster analysis was conducted using the Jaccard similarity index (see Figure 1 and Table 6). The analysis indicates that the highest affinity is between the Peinobiome and Zonobiome, with a 19% similarity; followed by the Lithobiome with a 6.4% similarity, and lastly, the Helobiome with a 5.8% similarity. This suggests that these forests have a high species richness and very low affinity, sharing only one species among the four biomes, highlighting a marked difference between them.

The species present in all four biomes was *Qualea paraensis* (Vochysiaceae). The species present in three biomes were *Dacryodes belemensis*, *Protium decandrum* (Burseraceae), *Myrcia neospeciosa* (Myrtaceae), and *Pouteria caimito* (Sapotaceae). There were 16 species found in two biomes and 119 species found in only one biome.

Figure 1. Floristic similarity among biomes

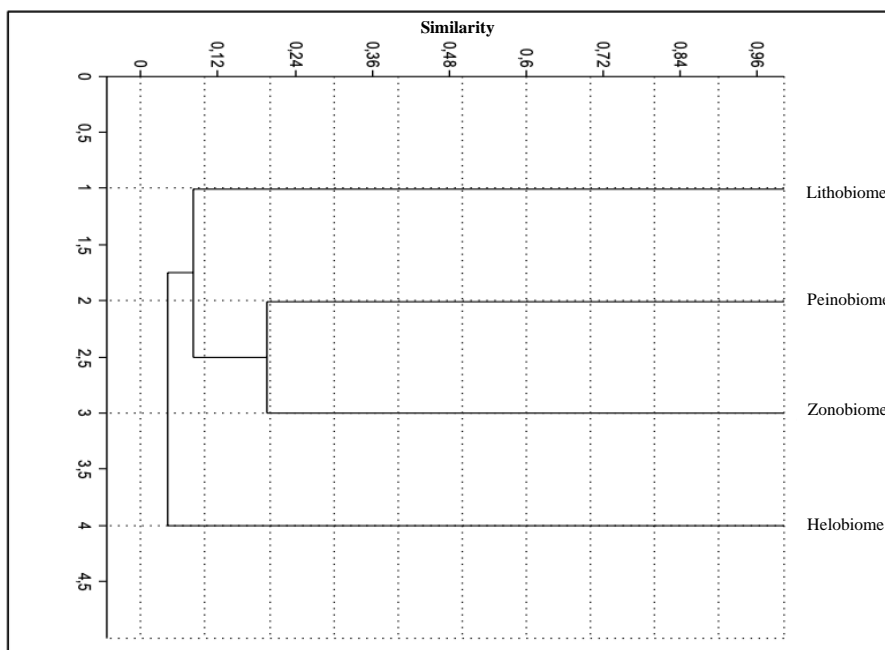


Table 6. Floristic similarity between biomes

	Helobiome	Lithobiome	Peinobiome	Zonobiome
Helobiome	1	0,035714	0,030612	0,058252
Lithobiome	0,035714	1	0,09434	0,064516
Peinobiome	0,030612	0,09434	1	0,19403
Zonobiome	0,058252	0,064516	0,19403	1

Regarding the threat status in Colombia, one species was identified as Critically Endangered (CR): *Humiriastrum procerum* (Little) Cuatrec. On a global scale, two species were recorded as Vulnerable (VU): *Humiriastrum procerum* (Little) Cuatrec. and *Protium aff. pittieri* (Rose) Engl. Additionally, 16 species from the Orchidaceae family and one species from the Cyatheaceae family were listed under CITES.

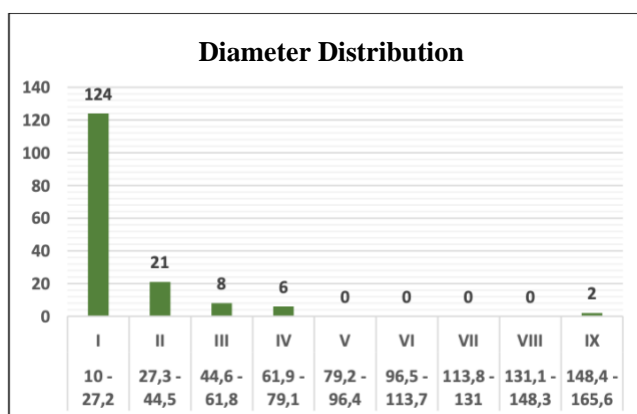
Vertical Structure

The diameter distribution of the species recorded during the inventory (see Table 7) revealed nine diameter classes or categories, with ranges of 17.2 cm. The data are distributed in an inverted J shape (Figure 2). The majority of individuals are found in categories I to IV, with a predominance in the lower categories I and II, having diameters between 10 cm to 44.5 cm. Only two individuals had diameters greater than 148.4 cm.

Table 7. Diameter distribution in diameter categories

Class Ranges (cm)	Category	No. of Individuals
10 - 27,2	I	124
27,3 - 44,5	II	21
44,6 - 61,8	III	8
61,9 - 79,1	IV	6
79,2 - 96,4	V	0
96,5 - 113,7	VI	0
113,8 - 131	VII	0
131,1 - 148,3	VIII	0
148,4 - 165,6	IX	2

Figure 2. Distribution of Species Diameters

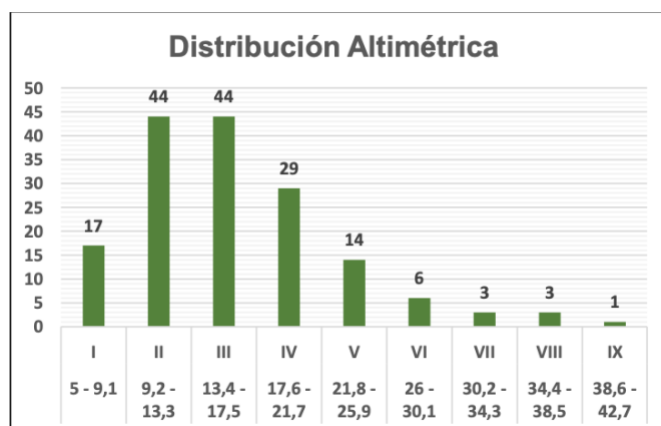


Nine altimetric categories or classes were established, with ranges of 4.1 meters (Table 8). The individuals were distributed across all categories (Figure 3), but the majority were in classes I and II, with 105 individuals having heights between 5 to 17.5 meters and 56 species with heights between 17.6 to 42.7 meters.

Table 8. Height distribution in altimetric categories

Class Ranges (cm)	Category	No. of Individuals
5 - 9,1	I	17
9,2 - 13,3	II	44
13,4 - 17,5	III	44
17,6 - 21,7	IV	29
21,8 - 25,9	V	14
26 - 30,1	VI	6
30,2 - 34,3	VII	3
34,4 - 38,5	VIII	3
38,6 - 42,7	IX	1

Gráfico 3. Distribución altimétrica de las especies inventariadas



Based on the vertical structure results, it can be determined that these forests do not have very thick diameters, ranging from 10 to 79 cm, and their average heights are between 5 to 30 meters. They are defined as low-stature forests, likely due to the characteristics of the soils, which are poor, acidic, and shallow. These same traits were reported in the work of Villareal et al. (2009) on the landscapes of the Matavén Forest.

Recommendations

- The studies conducted in the Matavén Forest by Villareal et al. (2009) and the present work have recognized the high floristic richness of this territory and its general structural characteristics. It is necessary to conduct detailed sampling across the various cover types found in this forest to expand knowledge on diversity, horizontal structure, or Importance Value Indices, to better define the forest types.

- Conduct comprehensive inventories by plots in different cover types (terra firme forests, floodplain forests, morichales, Amazonian savannas, etc.) to establish cover types, richness, diversity, and structure for each one. This will allow for detailed monitoring of the conservation status of the vegetation in this forest.
- Perform inventories not only in forests but also in herbaceous cover types such as savannas, which are equally important in terms of richness, diversity, and structure, and also play a role in carbon sequestration.
- The Matavén Forest is of great biogeographical interest as it lies in the transition zone between the savannas of the Orinoco Basin to the north and the humid forests of the Amazon to the south, and within the subregion of the Escudo Guayanés. Detailed flora studies in inventories should identify elements of Amazonian, Guiana, and Orinoco origin. Due to its geographical location, these forests are crucial for the conservation of the biodiversity present.
- Through flora and fauna inventories, establish the relationship of these cover types as determinant habitats for the fauna present in these forests, which will contribute to reinforcing their unique ecosystem and landscape characteristics.

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