Vegetation Structure and Composition in Taman Wisata Alam (TWA) Sicike-cike as Ritual Site for Local Community

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Abstract. Taman Wisata Alam Sicike-cike is a nature conservation area intended for the benefit of natural tourism and recreation. TWA Sicike-cike besides being used as tourist site, is also known for its ritual or traditional ceremonial site performed by the Pakpak-Dairi tribe. Presence of local wisdom on forest management, such as tapping the sap of incense (Styrax \textit{paralleleoneuron}) and floral organ are commonly utilized as a worship material during traditional rituals. The importance of this forest region for local communities is crucial for the sustainability of the local wisdom of the Pakpak-Dairi tribe. This study aims to determine the vegetation structure and composition in ceremonial sites located within TWA Sicike-cike. The study used vegetational analysis to obtain Importance Value Index (IVI) from each structures (seedling, sapling, pole and tree. The results showed that the largest IVI at seedling to tree structure was dominated by \textit{Rhododendron malayanum} with 46.29, 26.41, 55.53, and 28.99 for seedling, sapling, pole and tree, respectively. Shannon’s diversity index ($H'$) in this region falls between medium to high diversity categories. Hence, \textit{Rhododendron malayanum} is considered as primary indicator of typical vegetation in ceremonial site of TWA Sicike-cike which dominate all types of vegetational structure with complete growth rate.

1. Introduction

Natural park or Taman Wisata Alam (TWA) Sicike-cike is one of tropical forest region in North Sumatra, Indonesia. Sicike-cike forest region is inhabited by various plant species, e.g Lejeuneaceae (Bryophyta), Styracaceae, Zingiberaceae, Araliaceae, Lauraceae, Nepenthaceae and Orchidaceae \cite{1-2}. Local communities living around forest region is reported to perform their ritual or religious belief within Sicike-cike forest region. The Batakinese subtribe or \textit{Pakpak} people are believers of Sicike-cike sacred forest which commonly utilize certain site for their religious activities \cite{3}.

The \textit{Pakpak-Dairi} subtribe heavily relied on water resources from TWA Sicike-cike. The locals utilized water flowing out from forest region as drinking water, irrigation and housing. The local wisdom or traditional belief also improve their perceptions to conserve forest region. In general, religious practices or motivation by people living around natural preserved forest can be seen as
positive efforts to restore or monitor any potential damaged forest ecosystem. The local wisdom or traditional belief may become an important element in forest conservation [4].

Little is still known for its forest structure contributing to their existence as preserved forest region in North Sumatra. Here, we reported several plant species in all structures (seedling, sapling, pole and tree) which may be used as biological indicators to future habitat changes in TWA Sicike-cike.

2. Method

2.1. Sampling site
The study was conducted in TWA Sicike-cike with an altitude of 1,330-1,400 m.asl [5]. TWA Sicike-cike is geographically located at 02°35′-02°41′N and 98°20′-98°30′E in Pancur Nauli Hamlet, Lae Hole Village, Parbuluan District, Dairi Regency, North Sumatra [6]. TWA Sicike-cike was designated as conserved forest area based on the Decree of the Minister of Forestry or SK Menteri Kehutanan No.78/Kpts-II/1989 on 7 February 1989 [7].

2.2. Sampling method
Determination of sampling sites was chosen purposively. Observation plots were constructed along pioneer line of 4 km. The line was divided into 27 baselines as survey points within interval of 100–200 m at distance. In each survey point, 5 nested plots were placed along 100 m. The size of plots were arranged based on forest structure: tree (20×20 m), pole (10×10 m), sapling (5×5 m), seedling (2×2 m) (Figure 1). Total of 145 plots covering 5.8 ha were used in this study.

Figure 1. Illustration of sampling plots in TWA Sicike-cike

2.3. Data analysis
Vegetation structure and important plant species in TWA Sicike-cike was analyzed for its Importance Value Index (IVI) which was calculated from Relative density (Rd), Relative frequency (Rf) and Relative dominance (Rdo) [8]. Shannon’s diversity index ($H'$) was obtained from each vegetational structure: tree, pole, sapling and seedling [9]. All graphical images were generated using GraphPad.
Prism ver. 8.0. All specimens collected in this study were stored and authenticated by Herbarium ANDA, Universitas Andalas, Padang, West Sumatra, Indonesia.

3. Results and Discussion
This study found numerous plant species in TWA Sicike-cike in which the IVI from each species in forest structure are determined. The highest IVI obtained in all structures is from *Rhododendron malayanum* with the index of 28.99, 55.53, 26.41 and 46.29 for seedling, sapling, pole and tree, respectively. Here we only present the 10 highest IVI in TWA Sicike-cike.

The IVI is commonly used to denote the ecological importance of a plant species in an ecosystem. The IVI may also be used to show the rarity of plant species in an ecosystem which latter show their priority in conservation efforts [10]. The lower IVI will indicate that the species need to be conserved. The high IVI by *R. malayanum* indicate that the species is dominating in terms of relative frequency, density and dominance compared to other species which may also indicate their distinct presence as key species indicator of TWA Sicike-cike.
Rhododendron malayanum Jack. has been documented in the tropical forest region of Indonesia. A survey has reported Rhododendron species from montane forest of Lore Lindu National Park, Central Sulawesi revealing four species namely *R. malayanum*, *R. quadrasianum* var. *celebicium*, *R. zollingeri* and *R. celebicum* [11]. *Rhododendron* spp. has also been considered as protected species in Indonesia through *ex situ* conservation effort [12]. In contrary, certain members of *Rhododendron*, e.g. *R. maximum* and *R. ponticum*, are considered threats being invasive alien species to native forest species with global distribution range and highly adaptive ecophysiological traits [13]. To date, no information or categorization of *R. malayanum* as invasive plant species list in Indonesia while also support its further investigation in other field of studies.
Diversity of forest structure in this study was calculated using the Shannon’s diversity index \( H' \) (Figure 3). The highest diversity was obtained in the tree plots with 3.26 while the lowest diversity was in seedling plots with 2.86. Biodiversity index is an information formula to show the diversity and abundance of communities in different habitats. The higher the index, the greater the species richness. The higher values of the diversity index are commonly generated from a forest with high tree species and abundance [13]. In this study, the forest is still considered to harbor diverse plant species, indicated by overall \( H' > 2.0 \) to all structures. Biodiversity may be used as an indicator to ecosystem health while woody plant species are key feature of forest ecosystem which construct and govern the overall composition of forest communities [14]. The high diversity of trees in TWA Sicike-cike is then proved to support the nature conservation value managed by the Pakpak subtribe.

4. Conclusion
Religious practice site by Pakpak subtribe in Taman Wisata Alam (TWA) Sicike-cike forest region is dominated by species of Rhododendron malayanum with the highest IVI found in all forest structures, e.g seedling, sapling, pole and tree. The diversity in this area is considered as high which indicated the well-preserved forest condition by the local tribe and minimal interference by foreign anthropogenic activities.

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