

# Vegetation Diversity Quality in Mountainous Forest of Ranu Regulo Lake Area, Bromo Tengger Semeru National Park, East Java

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## ABSTRACT

Aim of this research was to study vegetation diversity quality in mountainous forest of Ranu Regulo Lake area in Bromo Tengger Semeru National Park (TNBTS), East Java. Field observation was carried out by vegetation analysis using sampling plots of 25x25 m<sup>2</sup> for trees, 5x5 m<sup>2</sup> for poles, 1x1 m<sup>2</sup> for ground surface plants. Community structure of each lake side was determined by calculating vegetation's density, basal area, frequency, important value and stratification of species. While vegetations diversity was estimated by taxa richness, Shannon-Wiener diversity index, and rate of endemism. Each lake side forests were compared by Morisita community similarity index. Data were tabulated by Microsoft Excel 2007. The result showed that based on existed vegetation, mountainous forest surrounding Ranu Regulo Lake consisted of four ecosystems, i.e. heterogenic mountainous forest, pine forest, acacia forest and bushes. Bushes Area has two types of population, edelweiss and *Eupatorium odoratum* invaded area. Vegetation diversity quality in heterogenic mountainous forest of Ranu Regulo TNBTS was the highest, indicated by its multi-stratification to B stratum trees of 20-30m high. Heterogenic mountainous forest's formation was *Acer laurinum* and *Acmena accuminatissima* for trees, *Chyatea* for poles. Taxa richness was found 59 species and 30 families, while the others were found below 28 species and 17 families. Diversity Index of heterogenic mountainous forest is the highest among others for trees is 2.31 and 3.24 for poles and second in bushes (H=3.10) after edelweiss ecosystem (H=3.39). Highest rate of endemism reached 100% for trees in heterogenic mountainous forest, 87% for poles in edelweiss area and 89% for bushes also in heterogenic mountainous forest. Trees, poles and herbs most similarity community showed by pine and acacia forest. Based on those five characters, vegetation diversity quality in Ranu Regulo Lake area was medium for heterogenic mountainous forest and edelweiss area comparing to pine and acacia forest which had very low diversity quality. This low diversity was caused by invading species *E. odoratum* in density, distribution and dominance for threatening growth of poles and ground surface plants local species. Invaded ecosystem were pine forest, acacia forest and edelweiss area. It hasn't major invading in heterogenic mountainous forest, but it has reached the edge. Therefore, environmental policy must focus on this matter soon.

**Keywords:** community structure, mountainous forest, quality diversity, Ranu Regulo.

## INTRODUCTION

Mountainous tropical forest was an ecosystem with high biodiversity. Principally, mountainous tropical forest is important habitat for diverse lives, role function in hydrology process and mineral cycle, also as absorbent for atmosphere CO<sub>2</sub> pile up which is cause global warming [1].

Nowadays, a lot of tropical forest fast degraded and caused many species threatened. Two main factors reported as cause of degraded tropical forest were natural and human factor. The last was the dominant factor which is widely damaged tropical forest across the world. Nevertheless many regions determined as

protected forest, doesn't mean it's safe and able to run its function normally to support biosphere life [1].

Bromo Tengger Semeru National Park was dominated by mountainous tropical forest. Human history by way of Bromo Tengger Semeru area occur forest damage. Ranu Pani and Ranu Regulo was one of human activities disturbed area. Wood necessary for building and firewood systemically damaged the forest. Meanwhile, human needs for spatial and farmland caused systematic denudation of forest [1].

Well managed forest would give big benefit, directly or indirectly. It could use as ecotourism program which is yield economy profit significantly. Additional benefits were protected land and village of landslide, flood, and other disasters [1].

Forest damage in Ranu Pani and Ranu Regulo area should be repair soon. Forest ecosystem should be restore as properly as before it was get disturbances. Restoration of these

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ecosystems needs preface study to know vegetation structure as information to determine the next restoration strategy, in handling and prevention of degraded area [1].

The aim of this research was to study vegetation diversity quality in mountainous forest of Ranu Regulo Lake area in Bromo Tengger Semeru National Park (TNBTS), East Java. Database of vegetation diversity are expected as consideration of next related environmental research and policy, especially efforts to overcome global warming such as reforestation, environmental education, wildlife conservation and green accounting.

## METHOD

### Study Site

Ranu Regulo is located in Ranupani Village, south area of Bromo Tengger Semeru National Park, East Java, Indonesia. It's nearby the Mount Semeru which has the highest peak of Java Island (3,676 m asl). Ranu Regulo area itself on  $\pm 2000$  m asl. The ecosystem of this area was included in Mountain Zone, which have especially pioneer species such as *Casuarina junghubniana*. There were also *Albizia* sp. and edelweiss as native species. The ground composited most of volcanoes sand from Semeru [2].

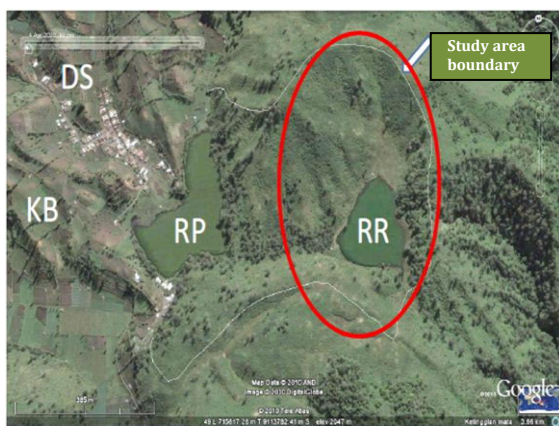


Figure 1. Landscape Area of Ranupani Area, TNBTS, East Java

Abbreviations :

DS : Desa Ranupani (Village)

KB : Kebun/ladang (Farm)

RP : Ranu Pani Lake

RR : Ranu Regulo Lake

Field observation was carried out by vegetation analysis using sampling plots of 25x25 m<sup>2</sup> for trees, 5x5 m<sup>2</sup> for poles, 1x1 m<sup>2</sup> for ground surface plants (for trees with DBH  $\geq$  20 cm). Vegetations diversity was estimated by taxa

richness, Shannon-Wiener diversity index, and rate of endemism. Rate of endemism determined based on comparison of endemic species' density to all species' density. Endemism status determined based on literature of Malesia phytoregion [3].

Community structure of each lake side was determined by calculating vegetation's density, basal area, frequency, important value and stratification of species [3]. Observation on trees' stratification was descriptively analyzed related to its vertical spaces utilization [4]. Each lake side forests were compared by Morisita community similarity index [5]. Data were tabulated by Microsoft Excel 2007.

## RESULT AND DISSCUSION

### Ecosystem Classification

The result showed that based on existed vegetation, mountainous forest surrounding Ranu Regulo Lake consisted of four ecosystems, i.e. heterogenic mountainous forest, pine forest, acacia forest and bushes. Bushes Area has two types of population, edelweiss and *Eupatorium odoratum* invaded area.

*Eupatorium odoratum* L. is a noxious perennial weed in many parts of the world. It possesses most of the characteristics necessary for rapid spread and establishment. Spread widely and has become a dominant weed of wasteland, roadside and other exposed area [6].

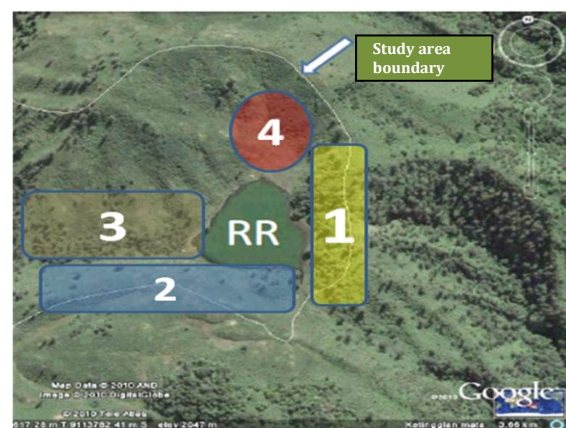


Figure 2. Ecosystem Classification

1. Heterogenic forest
2. Pine forest
3. Acacia forest
4. Edelweiss area

### Community Structure

Vegetation diversity quality in heterogenic mountainous forest of Ranu Regulo TNBTS was the highest, indicated by its multi-stratification to B stratum trees of 20-30m high (Table 1).

Table 1. Stratification of Vegetation in Ranu Regulo Area

| Ecosystem          | Stratification | Height (m) |
|--------------------|----------------|------------|
| Heterogenic Forest | B-E            | 0 – 30     |
| Pine Forest        | B-E            | 0 – 30     |
| Acacia Forest      | C-E            | 0 – 20     |
| Edelweiss Area     | D-E            | 0 – 4      |

Stratification [4]:

1. Stratum A : >30 m
2. Stratum B : 20-30 m
3. Stratum C : 4-20 m
4. Stratum D : 1-4 m
5. Stratum E : 0-1 m

Heterogenic mountainous forest's formation was *Acer laurinum* and *Acmena accuminatissima* for trees, *Chyatea* for poles and Poaceae for herbs. Trees, poles and herbs most similarity community showed by pine and acacia forest i.e. 0,91; 0,99; and 0,92. On the contrary heterogenic mountainous forest was very different community compare to the other three ecosystems with  $C_M \leq 0,4$ .

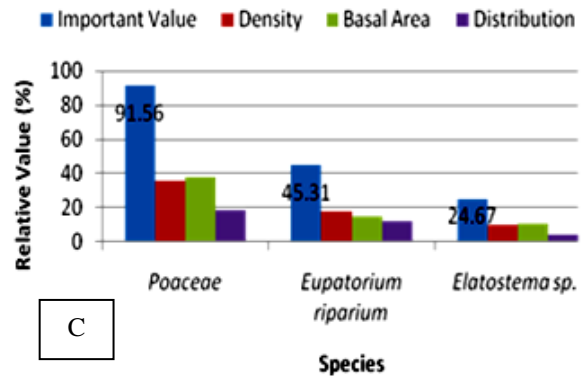
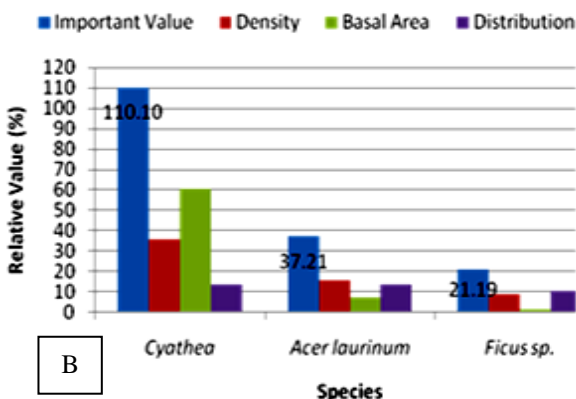
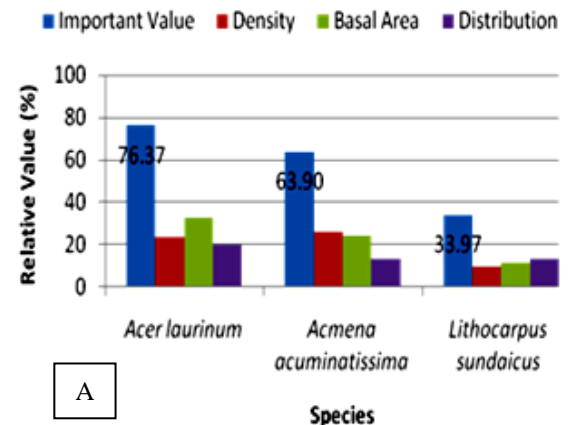


Figure 3. Community Structure in Heterogenic Forest (A: Trees; B: Poles and C: Herbs)

*Acer laurinum* (dadap putih) being the only maple whose range actually extends into the southern hemisphere. It distributed in South East Asia, China and India [7]. *Acmena accuminatissima* (jambos) distributed in southern Myanmar, Thailand and southern China, to the entire Malesian region and the Solomon Islands. The bark has been used in Indonesia to dye cotton [8]. *Cyathea* spp. occurred in mountain monsoon forest, above 1000 m elevation of eastern Java [9].

**Vegetation Diversity**

Heterogenic forest's taxa richness was found 59 species and 30 families, while the others were found below 28 species and 17 families. Diversity Index of heterogenic mountainous forest is the highest among others for trees is 2.31 and 3.24 for poles and second in bushes (H=3.10) after edelweiss ecosystem (H=3.39). Its lower trees diversity compare to Mount Papandayan Mixed forest [10] which has 2.93, otherwise higher in poles and herbs diversity compare Mount Papandayan's (3.0 and 2.32 respectively). Highest rate of endemism reached 100% for trees in heterogenic mountainous forest, 87% for poles in edelweiss area and 89% for bushes also in heterogenic mountainous forest.

**CONCLUSIONS**

Based on those five characters, vegetation diversity quality in Ranu Regulo Lake area was medium for heterogenic mountainous forest and edelweiss area comparing to pine and acacia forest which had very low diversity quality. This low diversity was caused by invading species *E. odoratum* in density, distribution and dominance for threatening growth of poles and ground surface plants local species. Invaded ecosystem were pine forest, acacia forest and edelweiss area.

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