Vegetation analysis the waterfalls Curug Sewu in village Curug Sewu subdistrict Patean Kendal regency

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Abstract. Vegetation of plants is part of a biotic component that occupies a particular habitat. The structure and composition of vegetation in an area is influenced by other components of interconnected ecosystems, so that vegetation that grows naturally in a particular area is the result of interaction of various factors that influence. Plants around Curug Waterfall Area Sewu Village Curug Sewu Patean Kendal District is one of the natural resources that support the development of ecotourism in the region. The potential of landscapes and the diversity of plants and the beauty of waterfalls is very potential for the development of nature-based tourism. The Key Values (INP) index of a kind is a value that describes the role of the existence of a species within the community. Based on the data obtained from the research results got the value of INP at station I in obtaining the important value index for the highest tree level on Acacia (Acacia denticulata) the value of its INP 124.5%. The highest value of INP poles on Randu (Caiba pentadra) with a value of 51.95%. The highest value of INP value is Salak (Salacca .Sp) with 81.79%, while at semi level on Grass Puzzle (Cyperus rotundus) with value of 76.35%. At station II obtained Indek Value important for the highest value of tree value in Mangir (Ganophyllum falcatum) which value 59.83%. For the highest pole level on Lamtoro (Nephiphia maculate) with value 57.19%. While the highest value of INP value in Aren (Aarena pinnata) with INP 156.85%, then for highest spring INP level on Grass Teki (Cyperus rotundus) with value 54.29%. A high Important Index score on a plant as mentioned above illustrates that the plant has an important role in forming a plant vegetation and microclimate within the area around Curug Sewu Waterfall in Patean.

1. Introduction
Curug Waterfall Sewu is one of the natural attractions of Kendal Regency located in District Patean Waterfall name Sewu it is taken from the name of the village where the waterfall is, the village of Curug sewu, which is 40 km from the town of Kendal. Curug Waterfall Sewu has its own privileges and uniqueness that has three waterfall, each of which has a height of 45 meters, 15 meters, and 20 meters with a total height of 80 meters. The air of this region is very cool with air temperature ranging from 250C - 270C, with beautiful natural scenery in the form of forest with the diversity of flora. The beauty of this waterfall can be seen from the substation of view or can be seen directly to the location. Not only its natural beauty, the coolness of clean air becomes the destination of visitors. Besides, local culture is also often displayed in this area such as art performances of people from various regions of Kendal Regency such as horse kepang and tambourine in the art festival Kendal every year. Inventory of biological natural resources and culture of a region is necessary if an area will be used as an ecotourism area. Observation of environmental factors such as biological, physical,
chemical, and social conditions of the area is also a very important factor to be managed so that the quality of the environment will be maintained during ecotourism activities.

2. Materials and methods

2.1 Place and time of research

The research was conducted on the location of Curug Waterfall Sewu Village Curugsewu Patean District Kendal District. The study was conducted in October 2014. The location of the study can be seen in figure 1.

Figure 1. The research location at Curug Waterfall Sewu Village Curugsewu Patean District Kendal District

2.2 Measurement and measurement technique of vegetation

The data collection of vegetation plants is done by pangamatan type of plants around the waterfall. The method used in the analysis of vegetation is the method of line in print. The determination of the transect and the starting point for making transect line is determined purposively based on the representation of vegetation, ie from long flat topography. Each transect was made as much as 3 pieces of measuring plot measuring 20 m x 20 m, with a distance of each plot measuring at least 50 m or in sesuaiakan with the area. Subsequently plot is divided into 4 sections, ie 20 m x 20 m for tree level vegetation, 10m x 10m for observation of pile level vegetation, 5m x 5m for observation of pile vegetation level and 1m x 1m for seedlings. The boundaries of tree, pile, stake and seedling levels are based on tree diameter and height. Tree level if the stem is more than 20 cm in diameter. Pile level with trunk diameter between 10-20 cm. Stature / regeneration level with height more than 1.5 m is a young tree with diameter less 10 cm and seedling level / regeneration level of sprouts with height less than 1.5 m.

The data obtained from the measurement activity in the field is then processed using a square plot formulation method to calculate the density, frequency and dominance as well as the important value index (INP) of each type, as for the calculations to be performed according to Ruthena (2010).

Kerapatan (K)

\[ K = \frac{Jumlah\ individu\ suatu\ jenis}{Luas\ petakukur} \]

Kerapatan relative (KR%)

\[ KR\% = \frac{Kerapatan\ suatu\ jenis}{Kerapatan\ seluruh\ jenis} \times 100 \]

Frekuensi (F)
\[ F = \frac{\sum \text{sub petak ditemukannya suatu jenis}}{\sum \text{seluruh sub petak pengamatan}} \]

Frekuensi relatif (FR\%)
\[ FR\% = \frac{\text{Frekuensi suatu jenis}}{\text{Frekuensi seluruh jenis}} \times 100 \]

Dominansi (D)
\[ D = \frac{\text{Luas penutup}}{\text{Luas areal sampel}} \]

Dominansi relative (DR\%)
\[ DR\% = \frac{\text{Dominansi suatu jenis}}{\text{Dominansi seluruh jenis}} \times 100 \]

Indek Nilai penting (INP)
\[ INP = KR + FR + DR \]

### 3. Results and Discussion

#### Table 1. INP Vegetation Waterfall Area

| ST | Local name | Scientific name          | Value     | Value | Value |
|----|------------|--------------------------|-----------|-------|-------|
|    |            |                          | KR (%)    | FR (%)| DR (%)| INP(%) |
| I  | Akasia     | Acacia denticulata       | 44,41     | 36,80 | 43,29 | 124,5  |
|    | Jati       | Tectona grandis          | 3,72      | 2,30  | 10,30 | 16,32  |
|    | Melinjo    | Genetum gnemon          | 22,24     | 25,00 | 11,20 | 59,02  |
|    | Mahoni     | Swietenia mahagoni      | 18,52     | 19,52 | 15,50 | 53,54  |
|    | Nangka     | Arthocarpus integra     | 3,72      | 3,80  | 8,10  | 15,62  |
|    | Sengon     | Paraserianthesfalcataria| 7,41      | 11,79 | 11,61 | 30,82  |
| II | Beringin   | Ficus benyaminca        | 4,00      | 5,88  | 5,60  | 15,48  |
|    | Gempol     | Nauclea orientalis      | 8,00      | 11,76 | 13,30 | 33,03  |
|    | Jati       | Tectona grandis         | 4,00      | 5,88  | 5,60  | 15,48  |
|    | Kepuh      | Sterculia lanceolata    | 8,00      | 5,88  | 8,40  | 22,27  |
|    | Klampok    | Syzygium aquentum       | 4,00      | 5,88  | 5,60  | 15,48  |
|    | Mangir     | Ganophyllum falcataria  | 24,00     | 17,65 | 18,18 | 59,83  |
|    | Mahoni     | Swietenia mahagoni      | 4,00      | 5,88  | 6,30  | 16,18  |
|    | Pule       | Alstonia scholaris      | 20,00     | 17,65 | 11,19 | 48,84  |
|    | Sapen      | Aplaia palembanica     | 4,00      | 5,88  | 8,39  | 18,27  |
|    | Suren      | Toona sureni           | 8,00      | 5,88  | 8,39  | 22,27  |
|    | Sonokeling | Dalbergia latifolia    | 4,00      | 5,88  | 5,59  | 15,47  |
|    | Wuni       | Antidesma bunius       | 8,00      | 5,88  | 3,49  | 17,37  |
| I  | Jati       | Tectona grandis         | 18,50     | 11,09 | 8,36  | 37,95  |
|    | Jarak      | Ricinus comunis         | 3,72      | 5,54  | 11,10 | 20,36  |
|    | Mangga     | Mangifra indica        | 3,70      | 16,85 | 6,25  | 26,80  |
| Plant Name     | Scientific Name               | Height | Diameter | Total Volume | Elevation |
|---------------|-------------------------------|--------|----------|--------------|-----------|
| Melinjo       | *Gnetum gnemon*               | 5.10   | 5.54     | 5.90         | 31.54     |
| Pace          | *Morinda Sp*                  | 7.12   | 11.09    | 6.13         | 24.34     |
| Randu         | *Caiba pentandra*             | 21.46  | 11.09    | 19.40        | 51.95     |
| Sengon        | *Paraserianthesfalcatoria*    | 3.71   | 5.54     | 5.15         | 11.37     |
| Sonokeling    | *Dalbergia latifolia*         | 7.42   | 11.09    | 19.50        | 38.10     |
| Salam         | *Syzygium poyantum*           | 3.74   | 5.54     | 3.35         | 12.63     |
| Wuni          | *Antidesma bunius*            | 7.10   | 11.09    | 12.61        | 30.80     |
| **II**        |                               |        |          |              |           |
| Gmilina       | *Gmilina arbarea*             | 7.41   | 11.73    | 19.50        | 38.64     |
| Kepuh         | *Sterculia lanceolata*        | 18.51  | 17.73    | 20.48        | 56.72     |
| Klampok       | *Syzygium aquentum*           | 3.71   | 5.85     | 11.90        | 21.43     |
| Lamtoro       | *Nephila maculata*            | 33.33  | 17.73    | 6.13         | 57.19     |
| Mahoni        | *Swietenia mahagoni*          | 7.41   | 11.73    | 10.80        | 29.94     |
| Pule          | *Alstonia scholaris*          | 3.71   | 5.85     | 12.42        | 21.98     |
| Suren         | *Toona sureni*                | 3.71   | 5.85     | 4.30         | 13.83     |
| Asem          | *Tamarandus indicus*          | 14.81  | 17.73    | 10.52        | 43.06     |
| Waru          | *Hisbiscus tiliaceus*         | 7.41   | 5.85     | 3.95         | 17.21     |
| **INP Pancang**|                              |        |          |              |           |
| **I**         |                               |        |          |              |           |
| Cengkeh       | *Syzygium aromaticum*         | 11.77  | 21.51    | 24.71        | 57.99     |
| Jatì          | *Tectona grandis*             | 5.88   | 7.09     | 1.17         | 14.14     |
| Kopi          | *Coffeea robusta*             | 23.52  | 21.51    | 29.41        | 74.44     |
| Salak         | *Salacca Sp*                  | 38.23  | 7.09     | 36.47        | 81.79     |
| Salam         | *Syzygium poyantum*           | 5.88   | 7.09     | 1.17         | 14.14     |
| Secang        | *Caesalpinia sappan*          | 2.94   | 7.09     | 2.36         | 12.41     |
| Sengon        | *Paraserianthesfalcatoria*    | 2.94   | 7.09     | 1.17         | 11.20     |
| Randu         | *Ceiba pentandra*             | 8.84   | 21.51    | 3.54         | 33.38     |
| **II**        |                               |        |          |              |           |
| Aren          | *Areana pinnata*              | 56.53  | 30.12    | 70.20        | 156.85    |
| Bento         | *Artocarpus elastica*         | 8.70   | 9.94     | 8.11         | 26.74     |
| Coklat        | *Theobroma caccio*            | 17.39  | 9.94     | 10.83        | 38.18     |
| Jatì          | *Tectona grandis*             | 4.34   | 30.12    | 2.72         | 37.18     |
| Jengkol       | *Archidendron pauciflour*     | 4.34   | 9.94     | 2.72         | 17.01     |
| Lamtoro       | *Nephila maculata*            | 8.70   | 9.94     | 5.42         | 24.05     |
| **INP Semai** |                              |        |          |              |           |
| **I**         |                               |        |          |              |           |
| Alang - alang | *Imperata cylindrica*         | 17.67  | 15.85    | 0            | 33.51     |
| Jarong        | *Stachytarphyta Sp.*          | 3.38   | 10.47    | 12.59        | 26.43     |
| Kangkungan    | *Ipomoea abicara*             | 1.69   | 5.22     | 16.09        | 23.00     |
| Terong        | *Solanum ternum*              | 9.28   | 15.85    | 11.89        | 37.01     |
| terongan      | *Centella asiatica*           | 1.69   | 5.22     | 0            | 6.90      |
| Pegagan       | *Mimosa podica*               | 2.54   | 15.85    | 17.49        | 35.86     |
| Putri malu    | *Cyperus rotundus*            | 60.52  | 15.85    | 0            | 76.35     |
| Rumput teki   | *Elephantopus scaber*         | 1.69   | 5.88     | 20.97        | 27.87     |
| Tapak liman   | *Ageratum conyzoides*         | 1.69   | 10.47    | 20.97        | 33.12     |
| Wedusan       | *Urena lobata*                | 1.82   | 15.02    | 21.83        | 38.67     |
| **II**        |                               |        |          |              |           |
| Alang alang   | *Imperata cylindrica*         | 16.43  | 15.02    | 0            | 31.45     |
| Kembang       | *Clitoria ternatea*           | 0.92   | 15.02    | 26.01        | 41.95     |
| telang        |                               |        |          |              |           |
| Pulutan       |                               | 1.82   | 15.02    | 21.83        | 38.67     |
Important Value Index (INP) is obtained from the value of Relative Density which is added with Relative Frequency value and Relative Dominant value of a plant species. The Key Values (INP) index of a kind is a value that describes the role of the existence of a species within the community. The greater the value of an important value index (INP) of a type, the greater the role of the species in the community. Important Value Indexes with scattered values are evenly distributed across many species better than the value of the Important Value Index that is stacked or prominent in a few types as it shows the creation of more and more uniformly distributed niches, specific and varied. Equivalent Score Index The equitable significance of many species is also an indicator of the higher biodiversity in a good ecosystem to achieve stability (Kainde et al, 2011).

Based on data obtained from two observation stations of waterfall area, there are various Importance Value Index (INP) of vegetation. This is because this forest plant species is a mixed jungle.

Observations and measurements at station I are vegetation in the area before the waterfall is obtained. Key Value Index (Table 1) the highest value of Acacia denticulata with significance value of 124.5%. For the highest level of highest value index of Randu (Caiba pentadra), 51.95%, while for the highest value of the highest value of Salak (Salacca. Sp) palu plant is 81.78%. The highest Important Value Index of the seedling seedling (Cyperus rotundus) with Important Value Index is 76.35%.

Observation and measurement at station II that is vegetation growing in the area after waterfall was obtained Key Value Index (Table 1) for the highest value of Gangophyllum falcatum with the value of 59.83%. High value Important index for plant pole level in plant lamtoro (Nephila maculate) that is 57.19% and kepuh (Sterculia lanceolata) that is 56.72%. Important Value Index on the highest plant level in palm trees (Arena pinnata) is 156.85%. Medium for plant seedlings level that has the highest Important Value Index is on the grass teki (Cyperus rotundus) with value of 54.29%. A plant species that has a high Importance Value Index value illustrates that the plant has an important role in forming a vegetation plant in the area around Curug Waterfall Area Sewu. The existence of a tree that has a value of the Importance Value Index is very useful to maintain the balance of ecosystems, especially in maintaining the water source and to maintain the soil where topographically Curug Waterfall Sewu area is on a steep slope.

4. Conclusion
The result of the research showed that the value of INP at station I in obtaining the important value index for the highest tree level on Acacia (Acacia denticulata) of INP value was 124.5%. The highest value of INP poles on Randu (Caiba pentadra) with a value of 51.95%. The highest value of INP value is Salak (Salacca. Sp) with 81.79%, while at semi level on Grass Puzzle (Cyperus rotundus) with value of 76.35%. At station II obtained Indek Value important for the highest value of tree value in Mangir (Ganophyllum falcatum) which value 59.83%. For the highest pole level on Lamtoro (Nephila maculata) with value 57.19%. While the highest value of INP value in Aren (Arena pinnata) with INP 156.85%, then for highest spring INP level on Grass Teki (Cyperus rotundus) with value 54.29%. A high Important Index score on a plant as mentioned above illustrates that the plant has an important role in forming a plant vegetation and microclimate within the area around Curug Waterfall Area Sewu Patean.

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