JPPIPA 9(10) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Urban Forest Management Policy Analysis (Case of Serang City)

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Received: August 26, 2023
Revised: September 12, 2023
Accepted: October 25, 2023
Published: October 31, 2023

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DOI: 10.29303/jppipa.v9i10.5108

Abstract: Urban forests are an instrument of urban ecosystems, their existence is very important in the midst of declining environmental quality in urban areas, besides that urban forests also have various environmental service functions such as being able to absorb CO_2 content, as an oxygen supply, then urban forests also have economic value. The policy on urban forest management is important so that its sustainability is maintained. Therefore, this study aims to analyze urban forest policies in forest management. This research was conducted in Serang City. This research approach uses the ANP (Analysis Network Process) approach, involving respondents from the Government (Regional Government Development Agency and Environmental services), forestry academics, forest researchers, KLHK employees in the forestry sector, practitioners engaged in forestry and environmental non-governmental organizations. The results of this study that from the three levels analyzed are factors, actors, and alternatives. The results from the level factor (policy support, quality improvement, evaluation and monitoring) show that policy support is the most priority thing. Meanwhile, from the level of actors (Government, Community, Private, government and private, NGOs) shows that the most influential actor in urban forest management is a combination of government and private sector. Then at the alternative level (evaluation of regulations, selection of tree species, expansion of urban forests, incentives, and sanctions) shows that the expansion of urban forests is the most important thing to implement.

Keywords: Environment; Management; Policy; Urban forest

Introduction

Serang City has a position as the administrative center of the Banten province, as well as an alternative and hinterland area for the State Capital, because Jakarta is only about 70 km away (BPS Kota Serang, 2014). Besides, Serang city is a transit route that connects cities and regencies in Banten Province. Its strategic location gives rise to many activities carried out in Serang City, so that it has an impact on increasing the volume of vehicles from various regions and has the potential to produce high air pollution in the form of carbon dioxide or CO_2, noise, and it is also possible to increase the air temperature in Serang City (BPLH Jawa Barat, 2011; Aguado & James, 2017; Asmarindah et al., 2017; Agroho et al., 2021).

Serang City has an area of 266.74 ha with a population of 576,961 people (Regional Government Development Agency, 2015) and in 2015 the population of Serang city increased to 631,101 people. The average population growth rate of Serang City is 6.51% (Regional Government Development Agency, 2017), with a population density of about 2,320 people/km^2 where most of the population lives in urban areas which are the center of the economy (BPS Kota Serang, 2014). Population growth also systems, residential areas which will continue to increase every year. This growth rate will have a direct or indirect impact on environmental conditions in Serang City if environmental quality protection is not immediately carried out (Watt, 1973).

Initiating the development of Serang City development starting from the aspect of land use and

How to Cite:
Masyruroh, A., & Pangesti, F. S. (2023). Urban Forest Management Policy Analysis (Case of Serang City). *Jurnal Penelitian Pendidikan IPA*, *9*(10), 8745–8750. https://doi.org/10.29303/jppipa.v9i10.5108

transportation (Soemarmo, 2013). The ideal need for green open space in 2020 in Serang City is 11,474.54 ha to get absorb the potential CO_2 content produced. Meanwhile, the current Green Open Space is not yet ideal to be able to restore its function in absorbing the potential CO_2 produced in Serang City (Smith et al., 2011; The World Bank Data, 2014; Masyruroh et al., 2018). Urban forests are one of the urban ecosystems that can support environmental protection, especially in urban areas, according to their functions, such as increasing the absorption of carbon dioxide, urban forests can also contribute to increasing oxygen production.

Method

Analyse of the Policy

To analyse the policy, we use ANP software. The software could models the score of the variable in analysing the policy. The following step is needed to run the software:

a) Compile a problem structure and develop a linkage model to determine the desired goals or objectives, determine criteria referring to control criteria and determine alternative choices. If there are elements that have equal quality then they are grouped into the same component.
b) Assumes that the decision maker must make a comparison of the interests of all elements for each level in the form of pairs. The comparison is transformed into the form of the matrix A. The a_{jj} value represents the value of the relative importance of the elements in row i to elements in column j, for example $a_{jj} = \frac{wi}{wj}$. If there are n elements being compared then the comparison matrix A is defined as:

$$A = \begin{bmatrix} \frac{w1}{w1} & \frac{w1}{w2} & \cdots & \frac{w1}{wn} \\ \frac{w2}{w1} & \frac{w2}{w2} & & \frac{w2}{wn} \\ \vdots & & \cdots & \vdots \\ \frac{wn}{w1} & \frac{wn}{w2} & \cdots & \frac{wn}{wn} \end{bmatrix} = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ a_{21} & 1 & \cdots & a_{2n} \\ a_{n1} & a_{n2} & \cdots & 1 \end{bmatrix} \quad (1)$$

Calculating Element Weights

When the pairwise comparison is complete, the priority vector w, called the eigenvector is calculated by the formula:

$$A.w = \lambda_{max} . W \quad (2)$$

Where A is a pairwise comparison matrix and is the largest eigenvalue of A. The eigenvector is the priority weight of a matrix which is then used in the preparation of the supermatrix.

Calculating Consistency Ratio

The consistency ratio must be 10 percent or less. If the value is greater than 10 percent, the assessment of the decision data must be corrected. In practice, such consistency is impossible to obtain. In the consistency matrix, practically max = n, while in the matrix not every variation of wij will bring a change to the value of max. Deviation max of n is a parameter Consistency Index (CI) as follows:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (3)$$

CI = Consistency Index
λ_{max} = largest eigenvalue
N = number of elements compared

The CI value will be meaningless if there is a standard that states whether the CI shows a consistent matrix. By comparing CI and RI, a benchmark is obtained to determine the level of consistency of a matrix, called the Consistency Ratio (CR), with the formula:

$$CR = \frac{CI}{RI} \quad (4)$$

Where:
CR = Consistency Ratio
CI = Consistency Index
RI = Random Index
The RI value is a random index value issued by the Oarkridge Laboratory.

Creating a Supermatrix

Supermatrix is the priority vector result from pairwise comparisons between clusters, criteria, and alternatives. The supermatrix consists of three stages, namely the unweighted supermatrix, the weighted supermatrix, and the limiting supermatrix.

Result and Discussion

Respondent Characteristics

The Analytic Hierarchy Process (ANP) is used to formulate policies that can be recommended for the development of urban forests in Serang City. ANP results were collected by distributing questionnaires to 15 people to those who understand about urban forests, consisting of: the head of the Serang City Regional Government Development Agency and the Serang City forestry service, forestry academics, forest researchers,

Ministry of Environment and Forestrystaff in the forestry sector, practitioners who engaged in forestry and environmental non-governmental organizations. ANP is one of the tools (process) in decision making (Saaty, 2008). The use of ANP is not only for government or private institutions but can also be applied for individual purposes, especially for research related to policies or the formulation of priority strategies. The use of ANP a priority is composed of various options which can be in the form of criteria that have been previously decomposed (structured) first, so that priority setting is based on a structured (hierarchical) process and makes sense. So in essence ANP helps solve complex problems by compiling a hierarchy of criteria, assessed subjectively by interested parties and then draws various considerations in order to develop weights or priorities (conclusions).

Formulating Policies

There are three basic principles in ANP, namely: the preparation of a hierarchical scheme, namely describing and describing the problem hierarchically by breaking the problem into separate elements; setting priorities, namely determining the ranking of elements according to their importance; and logical consistency, namely ensuring that all elements are grouped logically and ranked. The most important step in the ANP is the assessment using pairwise comparison techniques on elements at a level of the hierarchy (level). Assessment is done by giving numerical weights and comparing one element to another. The next stage is to synthesize the results of the assessment to determine which elements have the highest and lowest priorities (Ascarya, 2012; Ali et al., 2020; Ali & Kassim, 2021).

The characteristics of problem solving using ANP are the use of a hierarchy to decompose complex systems into simple elements, namely: the hierarchy must be able to describe the system as a whole, the hierarchy must be able to take into account decisions, the hierarchy must be able to identify factors related to decisions, and the hierarchy must be able to identify alternatives related to decisions. The advantages of using a hierarchy in problem solving are: the hierarchy represents a system that can explain how priorities at higher levels can be affected by priorities at lower levels, the hierarchy provides detailed information about the structure and function of the system at a higher level. low level and provides an overview at a higher level, the system will be more efficient if it is arranged in a hierarchical form than in another form, and is stable and flexible, namely the addition of elements to the structure that has been arranged will not interfere with other elements (Peniwati & Setiono, 2006).

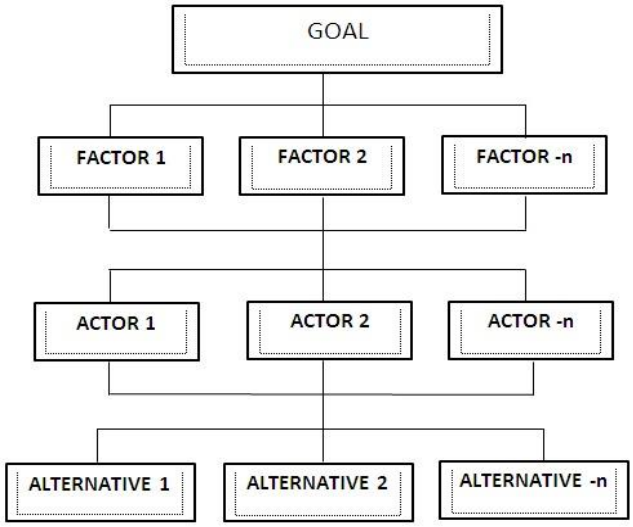

Figure 1. Policy hierarchy

Based on the results of interviews with elements who understand urban forests, there is a hierarchical arrangement of urban forest management in cities, consisting of factors, actors, and alternatives (Santosa & Sari, 2020; Kusumawati & Sari, 2021). Factors are defined as the dominant factors supporting the sustainability of the existence of urban forests, among others; Regulatory Support; Improving the Quality of Urban Forests; and Evaluation and Monitoring. The next hierarchy is actors. This actor is defined as the element that is responsible for the sustainability of the urban forest which is itself from; Government, Community, Private, combination of Government and private, and Non-Governmental Organizations (NGOs). Then the last hierarchy is Alternative. This alternative is defined as actions taken to maintain the sustainability of urban forests. Part of this alternative consists of; evaluation of regulations, expansion of urban forests, selection of tree species, financial support, incentives, and sanctions.

Factor Level Results

Based on the results of the ANP, the value of the weight scale on the level of factors, actors and alternatives is obtained in the context of making decisions on urban forest development. Highest weight value for level the factor is in the support of government regulations of 0.448, followed by evaluation and control of 0.379 and increasing the quality of urban forests by 0.173. As shown in the Figure 2.

Government support is a priority at the factor level because the quality and suitability of urban forests is not yet optimal with existing policies (Suweda, 2011; KLHK, 2016; Juita et al., 2016; Putri et al., 2018). This can be seen from the implementation of PP No. 63 of 2002 concerning Urban Forests that has not been implemented optimally, such as less than optimal

management programs, financial and institutional support, and maintenance so that the existing urban forest functions cannot function optimally (Page & Seyfried, 1970; Nazaaruddin, 1996; Sari & Santosa, 2020; Santosa & Sari, 2021).

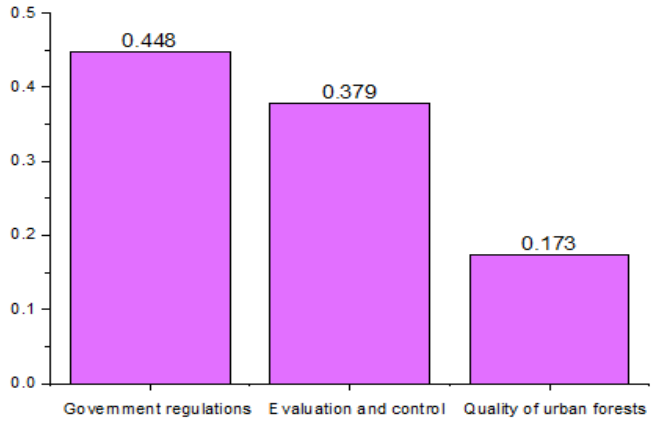

Figure 2. Level factor

Actor Level

The actor level, the highest weight is in the combination of the government and the private sector at 0.314. This decision is a priority because the government is considered the most important party in the development of the urban forest of Serang City. This is in accordance with Article 10 paragraph 3 of PP No. 63 of 2002 concerning urban forests, that the development of urban forests is carried out by the City Government.

The combination of Public and Private becomes the highest priority in the analysis results at the actor level. This shows that the role of the Government and the private sector in managing urban forests is important, because in this joint collaboration the Government can share roles with the private sector. So that the shortcomings contained in the Government can be completed by the private sector, for example in terms of funding and other roles (Cozens, 2002; United Nations, 2018).

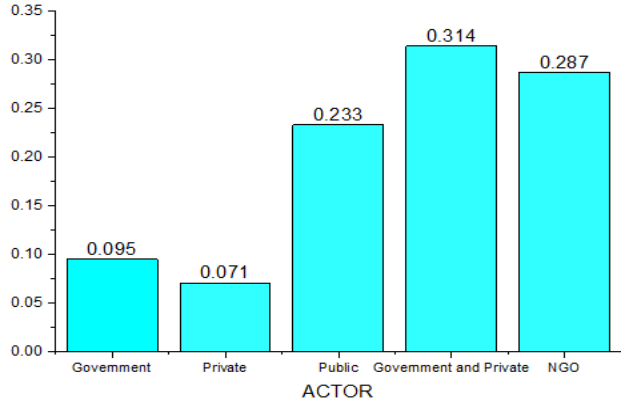

Figure 3. Level actors

At the alternative level, the results of the analysis show that the expansion of urban forests is a priority for its existence, considering PP no. 63 of 2002 ordered that the urban forest area be 10% of the total area, supported by the Serang City Spatial Plan (RTRW) which has reserved 13.94 percent of its area to be used as green open space as stated in the Serang City RTRW 2000–2020. In fact, until now the Serang Bau City Government has an urban forest of 4,000 m² (BAPPEDA, 2019).

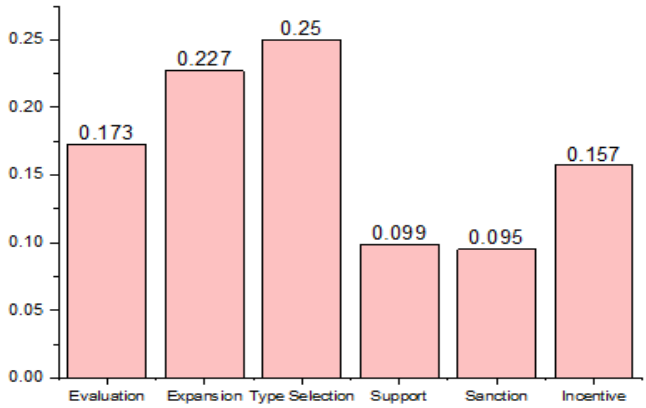

Figure 4. Level alternative

Conclusion

The results of the ANP analysis on the direction of urban forest development policies in Serang City, from the three levels analyzed by factors, actors, and alternatives, show that for the level of the main factors that determine urban forest management are government support factors, at the actor level it shows that the most important actor for urban forest management is a combination of government and private sector, and at the alternative level in urban forest management is to increase the area of urban forest.

Acknowledgments

This journal article was written by Anis Masyruroh, Banten Jaya University's Environmental Engineering. This research was approved by the Chancellor of the University of Banten Jaya and supported by the City Government of Serang and funded by the Ministry of Education and Culture of the Republic of Indonesia based on research results (research title) funded by the Faculty of Social Sciences and Science in 2018.

Author Contributions

Anis Masyruroh conceptualized the research idea, designed of methodology, management and coordination responsibility, analyzed data, conducted a research and investigation process; Fhebrika Sripuji Pangesti conducted literature review and provided critical feedback on the manuscript.

Funding

This research is funded by the Ministry of Education and Culture of the Republic of Indonesia based on research results

(research title) funded by the Faculty of Social Sciences and Science, Banten Jaya University's Environmental Engineering in 2018.

Conflicts of Interest

The author states that this research has no interest from any party that exists only for the benefit of scientific development.

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