



Evaluation of Urban Plant Vegetation on the Effects of Flight Noise Around the Airport Area

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Abstract

In urban and industrial regions, noise pollution is becoming a bigger environmental issue, particularly around airports. Excessive noise can have a number of detrimental effects on people's physical and mental well-being. The World Health Organization (WHO) states that extended exposure to noise can raise blood pressure, cause sleep disruptions, cause hearing loss, and increase the risk of cardiovascular disease. The fast expansion of air travel and heightened airport operations in Indonesia have made the noise issue worse. A lot of study has been done on how to lessen airport noise. More environmentally friendly natural solutions, such as the use of plants as noise barriers, have attracted attention as effective and sustainable alternatives. It is hoped that this research can provide practical and effective solutions that not only reduce noise but also support environmental sustainability. Thus, the results of this research will provide long-term benefits for the community around the airport and educational institutions such as the Indonesian Aviation Academy Banyuwangi. With an average noise reduction percentage of 46.79%, the study's results demonstrate the most notable decrease in noise levels. With a noise reduction of 29.54%, Tunas Merah comes in second. With a noise reduction of 23.94%, the TFan spruce comes in third. Noise is only decreased by 17.77% in the absence of barrier plants.

Keywords: Noise, airports, urban plants, noise barriers, hearing health, environment

1. INTRODUCTION

Airports are one of the most dominant sources of noise in urban areas. Sounds produced by aircraft engines, takeoffs, landings, and ground handling activities all contribute to high noise levels. The environment around the airport, including residential areas, schools and public facilities, is directly affected by this noise. The Banyuwangi Indonesian Aviation Academy, as an educational institution located near the airport, also faces similar challenges. Noise from aviation activities can disrupt the teaching and learning process and damage the quality of life for students and staff. A lot of study has been done on how to lessen airport noise. A number of strategies have been put forth and put into practice, such as flight path management, the installation of sound-blocking walls, and the development of quieter aircraft technology. However, putting these strategies into practice can be costly and time-consuming (Agustin, R. E., & Hamidah 2019). Conversely, as viable and sustainable substitutes, more ecologically friendly natural solutions—like

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using plants as noise barriers—have gained attention. Because of their innate capacity to absorb, disperse, and reflect sound waves, plants can lower noise levels (Bai, J et al., 2023), (Baudin, C et al., 2021) . According to a number of studies, employing plants with particular leaf shapes can help cut down on noise (Chen, K. H et al.,2020) , (Dalby, S.,2021). Sound-proofing qualities are influenced by a number of factors, including plant height, leaf density, stem thickness, and kind (Ekici, F.,2022), (Farooqi, Z. U. R., 2022), (Kalu, C. U., & Attamah, N., 2021). The purpose of this study is to assess how urban leaf plant species like Furing, Pucuk Merah, and Cemara Kipas might lessen noise in the Indonesian Aviation Academy Banyuwangi (Kuzmina, T. I., 2024), (Mudiana, D., 2021),(Ojha, A., & Kumar, V.,2022) . One crucial step in efforts to reduce noise is choosing the appropriate kind of plant. Due to their distinct leaf properties, Furing, Pucuk Merah, and Cemara Kipas were selected for this study (Ovdienko, O.,2021), (Roşca, S.,2019) , (Sarant, J.,2023) . The thick, broad leaves of Furing, the dense, layered leaves of Red Pucuk, and the tight, needle-shaped leaves of Fan Pine are all well-known (Stephens., 2006) It is anticipated that these features will offer a range of noise-attenuating capacities and reveal which plants work best in the vicinity of airports. It is intended that by using the findings of this study, the Indonesian Aviation Academy Banyuwangi will be able to lessen the effects of noise by using eco-friendly and natural solutions. Furthermore, this study could support additional research in this area and add to the body of knowledge about the use of plants as noise barriers. It is envisaged that this research will yield useful and efficient solutions that promote environmental sustainability while also lowering noise. As a result, the community surrounding the airport and educational establishments like the Indonesian Aviation Academy Banyuwangi will profit in the long run from the findings of this study.

2. METHOD

The application of urban leaf plants (Furing, Red Shoots and Fan Cypress) aims to reduce noise around airports by addressing its negative impact on hearing health and human psychic condition. To test the noise level, a 2-inch, 6-meter-long sound tunnel made of 3 mm PVC was utilized to reduce sound reflection. Loudspeakers positioned in front of the tunnel's mouth, where the urban leaf plants are planted, are used to generate the noise. Using sound measuring equipment, noise levels were recorded every meter inside tunnels and in front of urban leaf plants. By evaluating several kinds of urban leaves, this study seeks to ascertain the reduction in noise levels.

A. Research Framework

In addition to potentially harming hearing, the loudness may also have an impact on an individual's emotional state and induce cardiovascular system problems. Effective countermeasures are required to stop and lessen the harm that this noise causes. Utilizing specific plant species in metropolitan settings, which act as a natural noise barrier, is one possible approach. In order to lessen the negative effects of airport noise, it is anticipated that the utilization of urban vegetation surrounding the airport will be able to reduce noise.

B. Research Framework Data Retrieval

Data Retrieval Steps (Figure 1):

1. Loudspeakers are placed at the end of the sound aisle at a distance of 30 cm from the starting point of measurement.
2. Noise level measurements are made at several points shown in the figure, where the SL 1 noise sensor is placed at the end of the aisle to obtain reference data.
3. Several types of leaves that are often found in urban areas have been selected and placed at the end of the voting aisle according to a predetermined leaf arrangement matrix.
4. The noise level given to the barrier media is set at 100 dB, according to the traffic noise level based on previous studies. The type of sound used in this study was continuous sound to ensure consistency of testing.

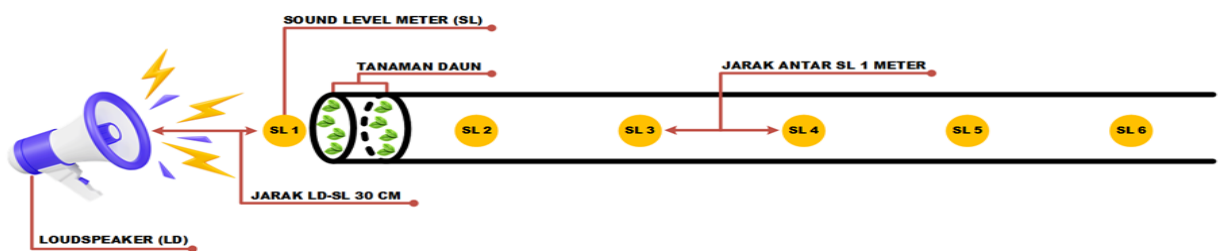


Figure 1. Data Retrieval

3. RESULTS AND DISCUSSION

Table 1 displays the trend of declining noise levels for each houseplant barrier.

Table 1. Data Retrieval Results

Types of plants	Average noise level (dB) inside tunnels measured at a certain distance (meter)						Noise reduction rate (%)
	0	1	2	3	4	5	
No Plants	105,7	103,6	98,5	91,3	89,6	86,9	17,77
Pucuk Merah	105,7	98,1	95,7	83,4	78,5	74,5	29,54
Cemara	105,7	102,3	97,5	87,2	84,2	80,4	23,94
Furing	105,7	90,5	86,3	79,1	69,8	56,2	46,79

The graph in Figure 2 displays the trend of declining noise levels for each barrier from ornamental plants based on the data in Table 1 as follows:

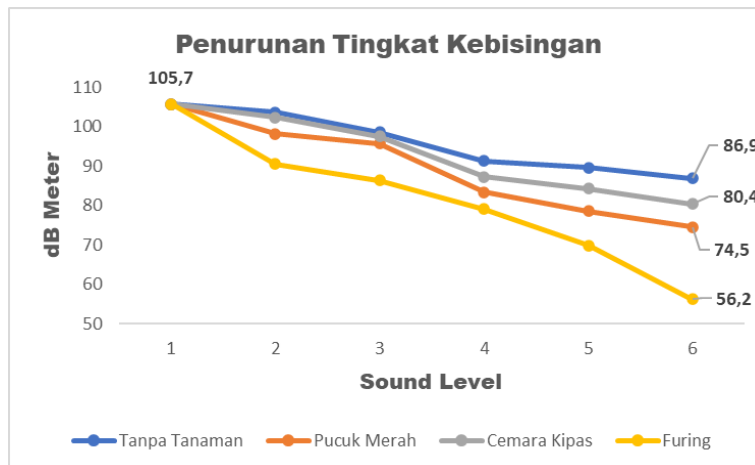


Figure 2. Tendency to decrease noise levels by some types of urban plants

While the percentage of the average noise reduction level by the barrier of some ornamental plants can be seen in Figure 3, as follows:

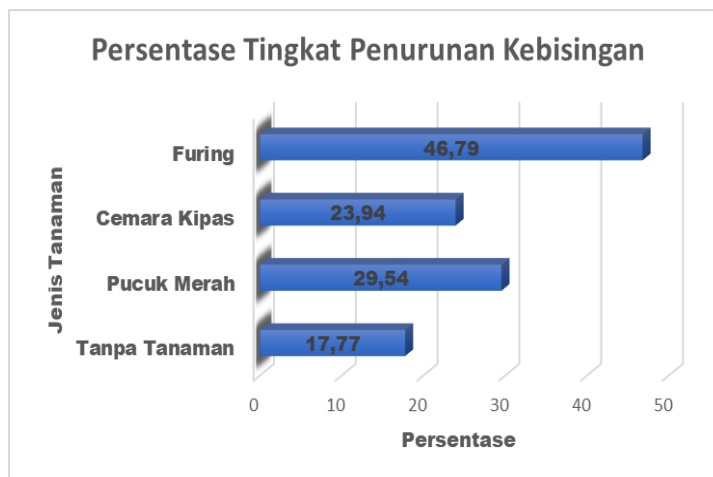


Figure 3. Average noise reduction rate percentage

From Figures 2 and 3 can be obtained information on the types of urban leaf plants that are most effective in reducing noise levels from the highest to the lowest. Furing type urban leaf plants are the most effective in reducing noise levels, followed successively by Red Shoots and Cypress. Each type of urban leaf plant has a different leaf surface area size and leaf characteristics.

4. CONCLUSIONS AND SUGGESTIONS

Out of the three plant species that were evaluated, furing plants proved to be the most efficient noise barrier. Airports can be made quieter and more comfortable by utilizing urban vegetation, like furing, to greatly minimize noise and its detrimental effects.

With an average noise reduction percentage of 46.79%, furning plants demonstrated the most notable reduction in noise levels. Second place went to red shoots, which reduced noise by 29.54%. Third place goes to Cemara TFan, which has a noise reduction of 23.94%. Noise was only reduced by 17.77% in the absence of the plant barrier.

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