

Analysis of the Potential Level of Threat of Invasive Alien Species Regenerating Tree Poles in Laweyan Village

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ABSTRACT

Plants play an important role in producing organic substances and oxygen needed by other living things, but plants can potentially threaten and disrupt the diversity of other plants, causing the quality of biodiversity to decline. Plants that develop in Indonesia can come from various parts of the world, and then these foreign plants can become invasive and have a negative impact on the ecosystem. The aim of this research is to determine the potential level of threat from invasive alien species to tree regeneration in Laweyan Village and the impact of invasive alien species on the environment. The method used is sampling using satellite imagery to determine observation points and methods purposive sampling by making a 10×10 m plot. The results obtained were four plant species that were classified as invasive foreign plants in Laweyan Village, namely *Leucaena leucocephala*, *Cnidioscolus aconitifolius*, *Sandoricum koetjape*, *Bougainvillea glabra* with different levels of risk. The highest risk category is *Leucaena leucocephala* with a risk index of 115.2, and the second highest is *Bougainvillea glabra* with a risk index of 112.8. The risk level is medium, namely *Cnidioscolus aconitifolius* with a risk index of 100.8 and *Sandoricum koetjape* with a risk index of 56.28.

KEYWORDS

Invasive Alien Species
Satellite Image
Biodiversity
Ecosystem

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1. Introduction

Indonesia is a country with a high level of biodiversity. The diversity of flora that develops in the world can be influenced by several factors, thus forming distribution patterns, one of which is in Indonesia. Plants play an important role in producing organic substances and oxygen needed by other living creatures (Siboro 2019). Plants are autotrophic organisms that are the main support for life (Puspita and Prasetyo 2020). Biodiversity, such as plants, can have threats or disturbances that can reduce the quality of biodiversity. Plants that develop in Indonesia can come from various parts of the world, and then these foreign plants can become invasive and have a negative impact on the ecosystem. Invasive alien species are plant organisms outside their native distribution area that can cause negative impacts on new habitats if they dominate the ecosystem. Apart from having a negative impact on the ecosystem, invasive plants also have a negative impact on the breeding of agricultural plants (Pambudi and Purwaka 2019). The important values that exist in plants require that biodiversity be maintained by avoiding factors that cause biodiversity loss, which include invasive alien species (Supriyatna, Aulia, and Cahyanto 2022). Alien plants threaten the presence of native vegetation because they have the ability to adapt well to soil that lacks nutrients and water, so wise management is needed (Blegur and Binsasi 2022). Invasive species have high adaptability and can change even in damaged ecosystem conditions (Mukaromah and Imron 2020). Research Priyono,

Ismanto, and Susilo (2021) states that invasive plants are found in all plant categories, starting from the seedling, sapling, pole, and tree levels.

Invasive alien species have the potential to affect native ecosystems, which can change the hydrological cycle and nutrient cycle. Several invasive alien plants have been recognized as weeds in agricultural and plantation production systems. This weed can inhibit surrounding plants and can reduce the production of various existing commodities. Invasive alien species that pose a threat to the ecology of a place are species that have no opponents, reproduce well generatively and vegetatively, can spread easily, and quickly create shade. Thus, invasive alien species become obstacles to conservation efforts that can have impacts (Susilo et al. 2020). The spread of invasive alien species is caused by several factors, namely the spread of seeds by wind, water, or birds, as well as deliberate introduction factors by humans such as the planting process. Apart from being a threat to biodiversity, invasive foreign species also impose huge costs on the agriculture, fisheries, and forestry sectors, as well as on human health. In some cases, plants and animals that are deliberately moved for the development of the agricultural, fisheries, livestock, forestry, garden diversification, pet trade and other purposes are not a problem. However, in several other cases, plants and animals that develop rapidly, spread, and become invasive can be a concern because they cause damage to the environment, economy or human health (Master et al. 2021).

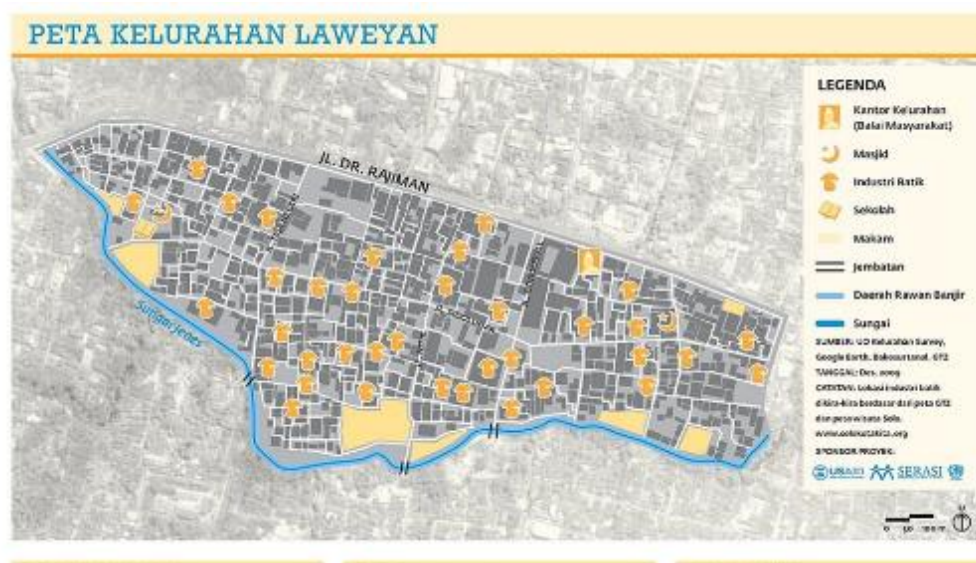
Laweyan Village is part of the Laweyan District, which is to the west of Surakarta City. Laweyan Village can be said to be the heart of Laweyan District because this village is in the center of Laweyan District, Surakarta. Laweyan Village has been popular from the past until now because most of its residents are batik producers, and has a distinctive icon, namely Laweyan Batik Village. Laweyan Batik Village is used as one of the tourist attractions in Surakarta City and has the potential to give rise to foreign plants from seeds carried by visitors, vehicles or food waste (Nurlaila et al. 2019). It was in Laweyan Village that the first trade association was founded by indigenous batik producers and traders in 1992. In this research, plants have been found that have the potential to become invasive alien plants in Laweyan Village, namely *Leucaena leucocephala*, *Cnidioscolus aconitifolius*, *Sandoricum koetjape*, and *Bougainvillea glabra*.

Based on this background, the presence of invasive foreign plants has become a threat, so this needs to be a concern. This research aims to determine the potential level of threat from invasive alien species to tree regeneration in Laweyan Village and the impact of invasive alien species on the environment.

2. Method

2.1 Time and Location of Research

This research was conducted in Laweyan Village, Laweyan District, Surakarta City on Thursday, 7th September, 2023. Laweyan Village is one of the areas to the west of Surakarta City, which has an area of 24.8 Ha. Laweyan Village includes 11 villages, namely Sriwedari, Penumping, Purwosari, Kerten, Jajar, Karangasem, Pajang, Sondakan, Laweyan, Panularan, and Bumi. Geographically, Laweyan Village is located at 7^o34'13" LS and 110^o48'11" BT.

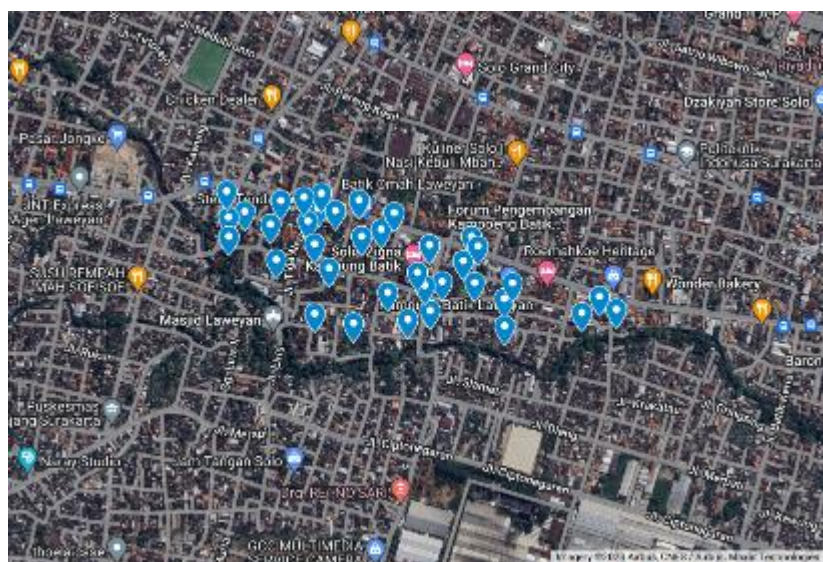


Source: Wikipedia 2022

Fig. 1. Map of Research Locations in Laweyan Village, Laweyan, Surakarta

2.2 Data Retrieval

Data collection is carried out by making direct observations at the research location, and the results will then become primary data. Before the observation is carried out, the location of the observation point is determined from the image by looking at the point where the vegetation is dense and looks green. This determination method uses the Google Earth remote sensing image interpretation method (Santoso, Sudargono, and Rahmawati 2021). Next, data collection is carried out using plotted lines that are determined randomly through purposive sampling at the research location that was selected during sampling with images.



Source: Google Earth

Fig. 2. Research Location Points from Sampling Results with Imagery

There are a total of 38 points obtained from sampling results with images. Purposive sampling is a technique for determining samples from the total population according to the objectives to be achieved in the research (Ramadhan et al. 2020). At these 38 points, a 10x10 m plot was then made. The use of this plot is more often called an area plot, which is the oldest method that is still

widely used today (Setiawan et al. 2022). Types of invasive alien plants in the pole-tree category found in the plots were recorded, and the names of the plants were identified using applications such as Google Lens, iNaturalist, and a plant identification website viz www.gbif.org then counted in the plot. Determination of invasive foreign species is carried out by categorizing plants using reference to Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia No. 94 Tahun 2016 concerning guidelines for invasive alien species in Indonesia and Pedoman Analisis Risiko Tumbuhan Asing (Post Border). Apart from that, it is also equipped with secondary data originating from literature studies in various existing journals.

2.3 Research Flow

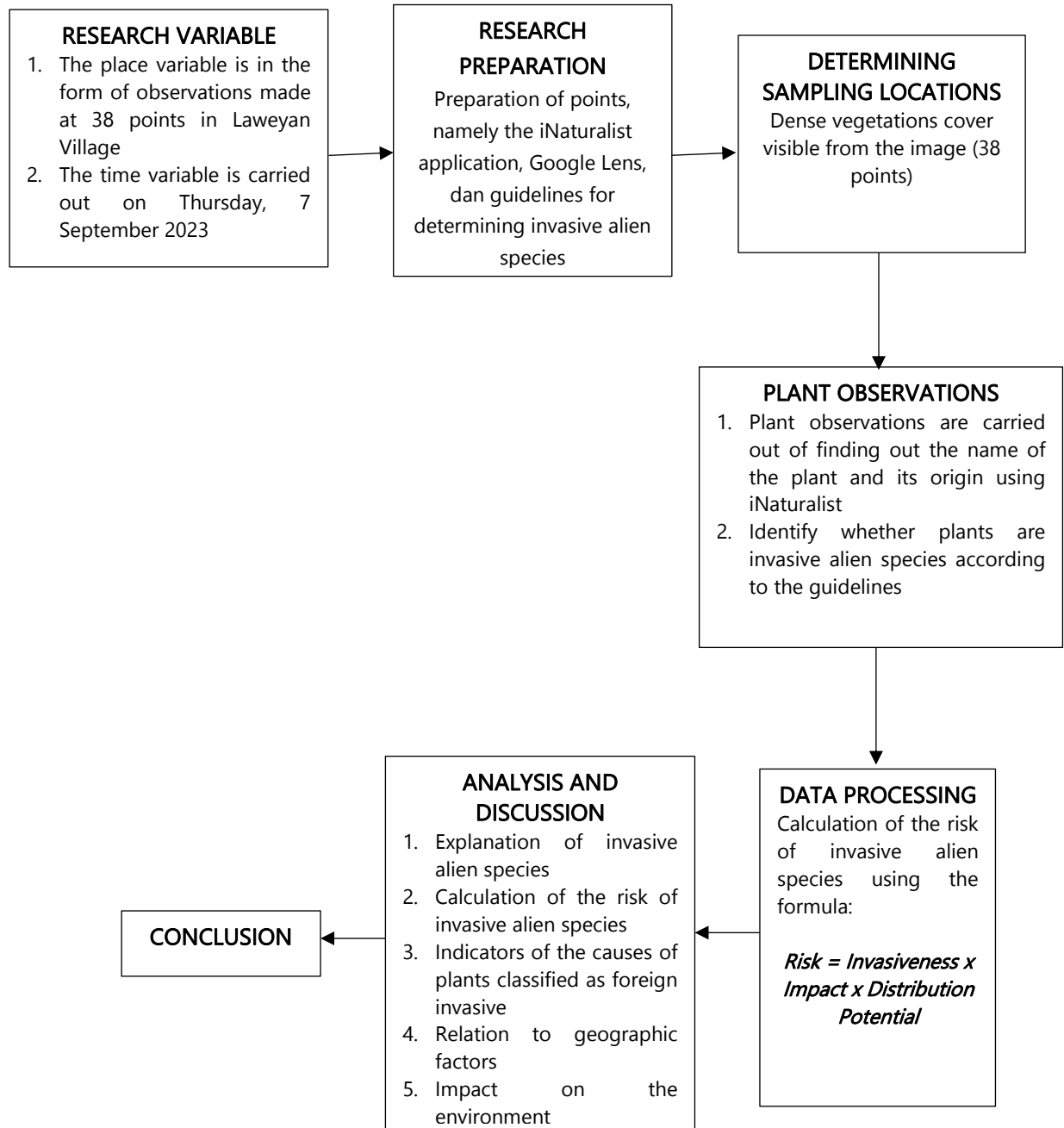


Fig. 3. Research Flow Diagram

2.4 Data Analysis

The foreign plant species data that has been obtained is then analyzed for the plant's risk value. The risk value of invasive plants is determined based on the following formula:

$$\text{Risk} = \text{Invasiveness} \times \text{Impact} \times \text{Distribution}$$

Invasiveness is seen in the rate of expansion of invasive plants, where plants that are classified as invasive will spread quickly and have high priority. Impact is the economic, environmental, and social influence caused by the presence of invasive plants. Invasive plants have distribution patterns that have a negative impact on the evenness of plant species, composition, and diversity in the invaded area (Muis et al. 2020). Distribution potential indicates the total area an invasive plant is likely to spread.

3. Results and Discussion

3.1. Invasive Alien Species

Invasive alien species are plants originating from outside their natural habitat that enter other ecosystems intentionally or unintentionally and are able to compete, establish themselves with native species, and take over their new environment, so that they can potentially disrupt the balance of the ecosystem and cause a decline in the quality of diversity. There are several causes for the introduction of invasive alien species, such as trading activities, meeting food needs, and ecosystem manipulation (Rasyid et al. 2020). Invasive plants cause native plants in an area to be unable to grow and develop, which over a long period of time will affect the existence of trees in the area, so it is important to know the types of invasive plants in an ecosystem (Abduh, Purwanto, and Priyandono 2021). Invasive alien species with effective means of reproduction, both vegetatively and through seeds, make them capable of producing offspring, even in small areas of land. Apart from that, in this way they can compete and be able to maintain their population and position. Invasive alien plant species can have a significant effect on native plants in the invaded area, namely species that have developed in a particular area without human involvement and thrive naturally (Rai and Singh 2020).

It is important to explore the abundant genetic resources of invasive foreign plants, knowing how to utilize them optimally without destroying the biodiversity of these species and other plants (Supriyatna, Aulia, and Cahyanto 2022). Over a long period of time, handling efforts can be carried out with the Invasive Plant Risk Assessment (Invasive Plant Risk Assessment or IPSRA). This assessment method is an instrument to help relevant parties take steps to control invasive foreign plants. The IPSRA assessment system can also be carried out alongside short-term activities to encourage a control process based on good planning and assessment (Sitepu 2020).

3.2. Calculation Result of Risk and Feasibility Values of Invasive Alien Species

Table 1. Invasive Alien Species in Laweyan Village

Local Name	Scientific Name	Plant Origin	Number of Individuals
<i>Bunga Kertas</i>	<i>Bougainvillea glabra</i>	Amerika Selatan	3
<i>Chaya (Tree Spinach)</i>	<i>Cnidocolus aconitifolius</i>	Meksiko and Amerika Tengah	2
<i>Lamtoro</i>	<i>Leucaena leucocephala</i>	Meksiko and Amerika Tengah	8
<i>Kecapi</i>	<i>Sandoricum koetjape</i>	Indocina and Semenanjung Malaya	1

Source: Analysis Result, 2023

Table 2. Results of Analysis of Invasive Foreign Plants in Laweyan Village

Species	Risk Value			Risk Index	Risk Category
	Invasiveness	Impact	Distribution Potential		
<i>Bougainvillea glabra</i>	4.0	4.7	6.0	112.8	High
<i>Cnidocolus aconitifolius</i>	6.0	4.2	4.0	100.8	Currently
<i>Leucaena leucocephala</i>	6.0	3.2	6.0	115.2	High
<i>Sandoricum koetjape</i>	6.7	4.2	2.0	56.28	Currently

Source: Analysis Result, 2023

Table 3. Invasive Plant Risk Categories

Risk Value	Risk
> 192	Very High
101-192	High
39-100	Currently
13-38	Low
<13	Ignored

Source: Guidelines for Risk Analysis of Invasive Alien Plants (*Post Border*)

Based on (Table 1) above, it is known that there are 4 plant species that are classified as invasive alien species in Laweyan Village. These four plant species fall into the tree-pole plant group. From this table, the most dominant species is *Leucaena leucocephala* with a total of 8 individuals spread across Laweyan Village. *Leucaena leucocephala* is a species native to Mexico and Central America that can spread quickly. This species has the highest risk category among the others, namely having a risk value of 115.2. This species also has the greatest distribution potential, namely 6.0. The next species that dominates is *Bougainvillea glabra*, with a total of 3 individuals. *Bougainvillea glabra* originating from the United States, is one of the species included in the high-risk category with a risk value of 112.8. *Bougainvillea glabra* This has the greatest impact and distribution potential among other invasive alien species in Laweyan Village. Assess the impact of *Bougainvillea glabra*, namely 4.7 and the potential distribution value of 6.0 is the same as *Leucaena leucocephala*. Species *Cnidocolus aconitifolius* is an invasive alien species with a risk value of 100.8 in the medium risk category. This species originates from Mexico and Central America and has the ability to grow in various conditions. The number of these species in Laweyan Village is relatively small, namely there are only 2 plants. Species that have the lowest risk value, namely *Sandoricum koetjape* who came from Indochina and the Malay Peninsula with 1 individual and had a risk index of 56.28, which was included in the moderate risk category. *Sandoricum koetjape* This has the highest invasiveness value compared to the other three species, namely 6.7.

3.3. Indicators of the Causes of Plants Classified as Invasive Alien Species

Invasive plants are all types of plants that have spread into a biome and disturb other plants (Nopiyanti and Riastuti 2019). Invasive plants are able to adapt well to new habitats, therefore these plants can maintain their populations well and make it possible to cause ecosystem damage. Invasive alien species can also be defined as flora species that can live and develop outside their natural

habitat, but not all foreign plants can be said to be invasive alien species. Plants can be said to be invasive if they have indicators of being an invasive alien species as stated in the regulations of Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia No. 94 Tahun 2016 concerning guidelines for invasive alien species in Indonesia and Pedoman Analisis Risiko Tumbuhan Asing (Post Border). Laweyan District is one of the areas in Surakarta that is part of the urban area, so there is a possibility that this area has foreign plants that come from outside the area.

In general, plants can be classified as invasive alien species due to several indicators. The indicator that causes a plant to be classified as an invasive alien species is its rapid development. The rapid development of this plant will outcompete native plants in its growth and spread. Then it has the ability to spread quickly, even to various areas that are not its natural habitat. The next indicator is tolerance to various environmental conditions, such as soil type and climate. These invasive plants also often have efficient reproductive abilities, such as producing many seeds or spores, which will make it easier for the plants to replace native plants. These invasive plants often have no predators or diseases that can control their populations in new environments. The absence of natural enemies in this new environment allows these invasive alien species to develop without hindrance. Apart from that, invasive plants also disrupt natural ecosystems by suppressing the growth rate of native plants, reducing water resources, and disrupting animal interactions with the environment. If not controlled, this invasive plant can significantly change the structure of the native ecosystem. Some invasive plants are often spread by humans, intentionally or unintentionally for agricultural or ornamental purposes. This causes the ecosystem to be disturbed by the presence of foreign plants.

Based on (Table 2), it is known that there are 4 species that are invasive alien species and have high and medium risk categories. There are several indicator species that are known to have this risk category. Species *Bougainvillea glabra*, often known as the paper flower is a species in the high-risk category. This is due to the fact that *Bougainvillea glabra* has a high level of tolerance for invasive plant control practices such as the use of herbicides, cultivation, pruning followed by burning, and grazing. Apart from that, this species is also resistant to hot and dry conditions such as those that often occur in Laweyan Village during the dry season. This is because paper flower plants usually grow well in tropical or subtropical climates that are warm all year. However, paper flower plants can also grow in cold climates, but their ability to spread is limited. Easy distribution using vegetative production in the form of stem cuttings allows this species to spread quickly. Apart from using stem cuttings to propagate paper flowers, there is also another method of propagation, namely using seeds. However, spreading paper flowers using vegetative reproduction is more optimal because paper flowers will produce new plants that have exactly the same characteristics as the parent plant, plus this species is also an ornamental plant, so many people cultivate them. Another spread of paper flowers is through birds and wind, but this spread is rare. *Bougainvillea glabra*, as an ornamental plant, can actually be detrimental because this species grows abundantly and quickly, making it possible for this plant to spread and take up space previously occupied by other plants. This can damage the local ecosystem because paper flower plants grow uncontrolled. This can also be caused by the ability of paper flower plants to compete for nutrients and water. This ability can reduce the availability of water resources for local plants. Behind the beauty of this plant, paper flowers can also be dangerous plants. The stems contain sap and thorns can cause contact dermatitis and itchy or uncomfortable skin rashes. Apart from that, the thorns of this plant can also harm small animals if they get stuck, causing a risk of injury. These indicators are what make the species *Bougainvillea glabra* become an invasive foreign plant because it can damage the local ecosystem, disturb other species in the surrounding area, and cause negative impacts on animals and humans even though it is not too dangerous.

The next invasive foreign plant is the chaya or spinach tree. Chaya is an invasive alien plant with a medium-risk category. The species *Cnidoscolus aconitifolius* is classified as an invasive alien species because it has a good ability to adapt to the environment in Laweyan Village and can grow quickly. Chaya is a plant that has a fast fruiting period of around 1 year if climatic conditions, soil type and management are appropriate. This plant also produces quite a lot of seeds when it is mature and growing well. This chaya has the ability to reproduce vegetatively quickly through cuttings and cutting existing plant parts. The spread of this species is mostly intentional by humans for agricultural, horticultural, or personal consumption purposes, but it does not rule out the possibility

of this plant spreading through animals such as birds and also by water and wind. This chaya can be consumed by humans if it is processed first. Therefore, humans distribute it deliberately with the aim of personal consumption. Chaya planting is also often grown as a commercial crop in agriculture because it can bring economic benefits, but consumption of this plant also needs to be considered because if consumed raw, it can cause nausea and narrowing of the respiratory tract because chaya leaves contain cyanogenic glycoside compounds. This plant can also cause contamination of agricultural produce. This can happen if this plant is planted intentionally and fertilized with pesticides. Excessive fertilization will cause soil pollution, which will result in damage to the ecosystem and disruption of agricultural products in the surrounding area. This plant also has the ability to take excessive nutrients and water from the soil so that it can disturb other plants around it. In fact, this chaya has many benefits for humans, but if its growth is not controlled, it will damage the local ecosystem so that local plants can be replaced with this species.

The lamtoro plant, often known as petai cina is an invasive foreign plant in Laweyan Village. Lamtoro is an invasive plant that has quite high resistance to management practices generally used in land use systems. This is the reason why the species *Leucaena leucocephala* is considered an invasive plant that can spread quickly and compete with local plants in Laweyan Village. The factor that causes lamtoro to thrive is its ability to adapt and reproduce in all environmental conditions. Apart from that, the rapid spread of lamtoro is also supported by the help of animals such as birds and the wind which is able to spread lamtoro seeds to several places so that this plant can grow anywhere. The rapid spread of lamtoro is also supported by the deliberate spread by humans. Deliberate distribution by humans is intended for the purposes of animal feed, agricultural use, reforestation and erosion control, but it should be noted that this lamtoro contains toxic compounds such as mimosine and diaminoproponic acid which are toxic to animals that consume lamtoro leaves or shoots. The presence of this toxin should be limited to the use of lamtoro as animal feed. In addition, lamtoro plants can provide shelter for certain pests or diseases that can damage surrounding plants. Lamtoro (*Leucaena leucocephala*) has the ability to increase nutrients in the soil, especially nitrogen. This is related to the ability of lamtoro to form a mutualistic relationship with the rhizobium bacteria that live in lamtoro roots, thereby increasing soil fertility. Lamtoro is an invasive foreign plant with a high risk category. Even though it has many benefits, uncontrolled development and the fact that it can be used as a shelter for pests can cause disruption to surrounding plants and damage the ecosystem.

Wild mangosteen, an invasive alien species in Laweyan Village has a medium risk category. Wild mangosteen (*Sandoricum koetjape*) is a plant that can spread through monkeys and small mammals such as mice. Apart from that, the spread of wild mangosteen can also be done deliberately by humans using cuttings or planting kecap seeds. The spread of various wild mangosteens can cause wild mangosteens to displace local plants in Laweyan, Surakarta. This wild mangosteen can live in various locations, but in less fertile environments the growth of the wild mangosteen may not necessarily be successful. Wild mangosteen plants generally produce lots of seeds. This wild mangosteen is a dioecious plant, which means it has separate female and male trees, making it easier for this plant to reproduce. The seeds of this wild mangosteen are very small, so they can spread through many intermediaries, namely through wind, water, other animals, and not just through humans. This harp plant is often planted for food, ornamental plants and agricultural purposes. The many goals of the community can make the wild mangosteen plant dominate and cause local plants to decline in existence. The spread of wild mangosteen also has the potential to contaminate agricultural produce and affect local plants and the local ecosystem. This happens because wild mangosteens that grow well can compete with local plants in terms of absorbing water, nutrients, and sunlight. Wild mangosteens that grow abundantly will reduce the productivity of local plants because the nutrients needed are taken up by the wild mangosteen plants. This wild mangosteen can also change the structure and function of the ecosystem it inhabits. In addition, wild mangosteens that grow well can cross-breed with local plants. This will produce offspring with mixed characteristics and can disrupt the genetic integrity of local plants. This strong growing wild mangosteen plant can also hinder the growth of the roots of plants around it. Therefore, this wild mangosteen plant can reduce the ability of other plants to absorb water and nutrients from the soil. Apart from that, the

roots of the wild mangosteen plant can also disrupt road infrastructure and waterways if not controlled. This wild mangosteen plant needs to be controlled to limit its growth by regularly pruning and clearing the land so as not to damage the ecosystem. However, the wild mangosteen plant remains difficult to control because it has the ability to grow quickly after taking over a certain area. These indicators make the wild mangosteen plant an invasive foreign plant that can disrupt the native ecosystem.

3.4. Relationship between Geographic Factors and Invasive Alien Species

Invasiveness is a form of plant expansion or geographic expansion. Environmental conditions in an area can influence the development of invasive alien species in that area (Sundari, Patriono, and Indriani 2022). Yang et al. (2021) stated that recently, the level of flower homogenization due to plant introductions has increased in line with the same climate, especially between geographically distant regions. The distribution of plants in general can be influenced by several factors, both biotic and abiotic, such as climate, the earth's relief, soil, and humans. According to Rifai, Nugroho, and Wijayanti (2021), soil is an important part of supporting survival, especially for plants. Invasive alien species can adapt to soil conditions that lack nutrients and water (Blegur and Binsasi 2022).

Laweyan Village is an area at an altitude of 92 m. Lamtoro plant (*Leucaena leucocephala*) can grow well in areas with a height of 0-500 m; heights above 1,000 m can inhibit the growth of lamtoro, so this plant is suitable for growing in this area. Lamtoro can grow in warm tropical climates with daily temperatures of 25-30°C, with optimal growth in the range of 15-25°C north or south of the equator. Lamtoro is quite strong against drought and can even grow well in nitrogen-poor soil. Lamtoro prefers soil with good drainage and is tolerant of various types of soil, such as limestone, wet and dry soil, as well as soil of volcanic origin.

The chaya plant (*Cnidoscolus aconitifolius*) can grow quickly and adapt to various soil conditions that have good drainage. Chaya can grow in soil conditions that have low fertility, is tolerant of drought, but is not tolerant of salt. Chaya can grow in lowlands with tropical climates up to an altitude of 1,300 m. It grows well in areas with temperatures of 20-32°C, but can also survive temperatures of 12-38°C.

The wild mangosteen plant (*Sandoricum koetjape*) is a hot and wet tropical lowland plant. This plant likes fertile soil and good drainage. Wild mangosteen can grow at a height of 0-1,000 meter; in Java this plant cannot grow above 1,000 meters. This plant likes fertile clay soil, limestone soil, volcanic soil, and podzolic soil and is tolerant of drought. A good temperature in summer is around 32-35°C, in winter 18-22°C and not less than 16°C.

The paper flower plant (*Bougainvillea glabra*) is a tropical plant that grows quickly and can grow at an altitude of up to 1,500 meters, but it can also grow in areas with warm to subtropical climates. Paper flowers grow best in moist and fertile soil conditions. Paper flowers have better adaptability to areas that do not have a dry season and are constantly in humid conditions. Paper flowers can grow at annual daytime temperatures of 18-25°C and can survive at 10-38°C. Paper Flowers have popularity in tropical regions it is much higher than in other regions.

3.5. Impact of Invasive Alien Species on the Environment

Invasive alien species are known to have a general impact, especially in ecological and economic fields, namely changing the character of an ecosystem, causing endemic plant species to become extinct, as well as putting pressure on production costs in agriculture and forest areas (Junaedi et al. 2021). Apart from that, according to (Solfiyeni et al. 2022), the presence of invasive alien species affects other types of individuals, as evidenced by negative impacts on species diversity, decreasing the number of species, habitat movement, or colonization where resources and space for other species to grow and develop are limited, as well as high dominance. Dominance proves that this species has influence in its community (Paiman 2020). Furthermore, according to Putra (2022) invasive alien species can cause environmental damage, namely they can damage the preservation of biodiversity, disrupt plants with potential food and habitat for animals, cause succession or changes in habitat, and disrupt animal associations with plants in national parks. Therefore, invasive species may affect functional ecosystems indirectly by changing plant diversity, plant biomass or both, leading to loss of plant diversity, biomass production, and other functions during the invasion (Linders et al. 2019).

Invasive alien species are also known to impact surface water and groundwater capacity (Shackleton, Shackleton, and Kull 2019). If invasive plants are not managed and left to grow as they are, the diversity of plant species will decrease over time, so that the ecosystem will experience changes in the structure and form of vegetation, energy cycles, and communities of organisms, which can reduce the function and quality of environmental services provided (Sehati and Solfiyeni 2023).

4. Conclusion

Based on the results of the analysis that has been carried out, there are 4 plant species that are classified as invasive foreign plants in Laweyan Village, namely *Leucaena leucocephala*, *Cnidocolus aconitifolius*, *Sandoricum koetjape*, and *Bougainvillea glabra*. The highest-risk category is *Leucaena leucocephala* with a risk value of 115.2 and second height viz *Bougainvillea glabra* with a risk value of 112.8. The medium risk category is *Cnidocolus aconitifolius*, with a risk value of 100.8 and *Sandoricum koetjape* risk value 56.28. As invasive alien species, these four plants are able to survive and adapt to soil conditions that lack nutrients and water. Invasive alien species that are not controlled will have a negative impact on the native ecosystem of Laweyan Village. These invasive alien plants will reduce the diversity of local plant species, causing the ecosystem to experience changes in vegetation structure and form, energy cycles, and the function and quality of available environmental services.

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