The Application of Curtain Creeper (*Vernonia elaeagnifolia*) as an Eco-Friendly Green Facade Plant for Colombo, Sri Lanka

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Abstract:

The integration of green facades into urban design has become a critical strategy to combat urban heat island effects, improve air quality, and enhance the aesthetic value of built environments. While exotic species are frequently employed in vertical greening systems, the use of environmentally friendly plants remains underutilized in Sri Lanka. This study investigates the application of the Curtain Creeper (*Vernonia elaeagnifolia*), a climbing species, as an ecologically sustainable alternative for green facades in Colombo. Through field experiments, growth performance analysis, and biodiversity impact assessments, this research highlights the potential of *Vernonia elaeagnifolia* to deliver significant environmental benefits without the invasive risks commonly associated with exotic species. The findings support the prioritization of environmentally friendly species in green building strategies to promote urban biodiversity resilience in Colombo.

Keywords: Biodiversity, Green Facade, Sri Lanka, Sustainable Plants, Urban Heat Island Effect

Introduction

Urbanization in Colombo has resulted in significant environmental challenges, including reduced green space, elevated surface temperatures, air pollution, and declining biodiversity. Green infrastructure, particularly green facades, has been increasingly promoted as a solution to mitigate these impacts (Perini & Rosasco, 2013). However, the widespread use of fast-growing exotic species such as *Thunbergia grandiflora* often compromises local ecosystems due to their invasive characteristics.

The selection of native plant species for vertical greening can support both architectural objectives and urban ecological integrity. The Curtain Creeper (*Vernonia elaeagnifolia*), an environmentally friendly, non-invasive climbing plant commonly found in Sri Lanka, presents a promising candidate for sustainable green facade applications. Despite its prevalence in local ecosystems, its potential in urban architectural design remains underexplored.

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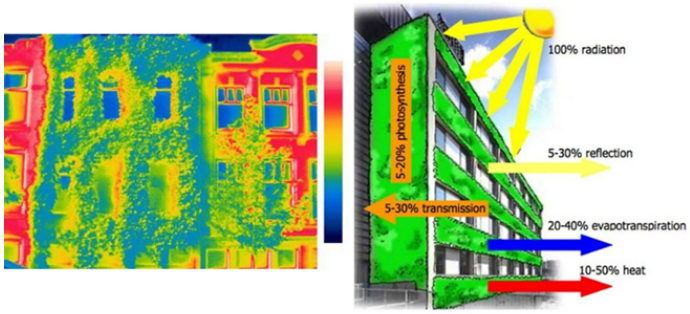
Even the plant is widely growing in green facade systems in Colombo, Sri Lanka previous study has not identified this *Vernonia elaeagnifolia* as sustainable environmentally friendly plant species. This study aims to scientifically evaluate the suitability of the Curtain Creeper as a green building covering plant in Colombo, focusing on growth performance, maintenance needs, ecosystem services, and its role in enhancing local biodiversity.

Literature Review

Existing literature states that applying green facades to buildings can mitigate the urban heat island effect in buildings by blocking the direct solar radiation, which can reduce the heat absorption by building a wall structure (Afolabi et al., 2025). On the other hand, plants can release moisture through evapotranspiration, cooling the surrounding air and resulting in reduced ambient temperature. These green façade systems can act as a thermal insulation layer, decreasing heat transfer into the buildings, which significantly reduces the cooling energy demand of the buildings (De Jesus et al., 2017).

Figure 01

How green facades reduce the urban heat island effect



Source: (Jimenez, 2025)

Not only mitigating the urban heat island effect, researchers highlight that these green façades offer a range of benefits, such as environmental, ecological, and economic benefits (Mohamed Sheweka & Nassar, 2012).

When it comes to the selection of plant species for the green façade systems, existing literature identified key factors that affect the performance of the green facades. Plant species that have high transpiration properties can optimize the thermal performance of green facades. This study proposes a method to select plants for urban greenery systems using integrating several factors such as climatic, eco-physical, and botanical aspects. This study emphasizes the integration of sustainability into challenging urban ecosystems (Burlando & Ferrini, 2025). However, on the other hand, utilizing invasive species to green facades can significantly threaten the local biodiversity by competing with native plant species, and these exotic species can possibly alter the urban ecosystems. These studies highlight the importance of careful plant selection to avoid potential negative impacts from the invasive plants, and therefore, ecological knowledge is crucial for selecting plants for green facades (Salisbury & Broad, 2023).

Curtain creeper (*Vernonia elaeagnifolia*) is a well-adapted and widely available creeping plant in Sri

Lanka. A scientific article mentions that it is used for bioengineering purposes in Sri Lanka (Jayasundara & Wijesekara, 2015). This indicates the local availability of the plant and ecological integration. The plant is commonly described as an easy-to-grow creeper but does not aggressively climb without structural support, reducing the negative impacts on the native ecosystems. Importantly, the *Vernonia elaeagnifolia* plant is not listed among recognized invasive species (Shaker & Mazhar, 2020).

Table 01 (Williams, 2022) (Jayasundara & Wijesekara, 2015.) (Vystrčil & Chybik, 2024)
Details about Vernonia elaeagnifolia growth characteristics, growing conditions, and structural requirements in green facades

General information	
	Family – Asteraceae (Compositae) Scientific name – *Vernonia elaeagnifolia* Common name – Curtain Creeper
Growth behaviour	Quick growing Woody climber Creeper plant Create dense hanging foliage
Stem	Slender pendulous stem
Leaves	Simple alternative with irregular toothed margins
Flowers	Pinkish-purple in colour, small terminal clusters
Growing conditions	
Light	Full sun light Tropical and sub-tropical climates (typically 20^{o} north or south of the equator)
water	Low to moderate watering
Growing Media	Well-drained porous soil Grow n normal (glycophytic) – saline (halophytic) conditions Low root penetration depth
Temperature	Warm to moderate
Structural support for green facades	Supportive structures are needed, such as trellises, wires, and meshes attached to the wall secure anchorage points Allow vertical and horizontal spread to maximize the coverage

Methods

This study uses a mixed-methods approach integrating field surveys and a comprehensive literature review. The study is primarily focused on evaluating the sustainably aspects of *Vernonia elaeagnifolia* as a green façade plant, emphasizing its water usage, adaptability to the local climatic conditions, ecological benefits of the plant species to the urban ecosystems, and reduction of energy demand of the buildings.

Site selection and survey

Initially, based on the accessibility and representing the typical urban setting in Colombo, Sri Lanka, two locations were selected where the *Vernonia elaeagnifolia* was used as a green façade plant. Then, field visits were conducted to gather primary data about the existing irrigation practices, watering frequency, and other maintenance routines. Field visits were conducted throughout a week (Starting from the 10th of May to the 17th of May 2025). The following list represents the questionnaire administered to the facility managers and maintenance staff to gather data.

1. The existing method of irrigation
2. Watering frequency and volume of the water
3. Fertilization method and amount of fertilizer used
4. Pruning schedule
5. Observed growth rate
6. Health of the plants
7. Challenges facing in maintenance of the green façade

In addition to the field survey, observed data on the vigour of the plants, plant coverage density, and symptoms of stress and pest infestation were collected to complement the survey responses.

Assessment of growth rate and climate adaptability

Data from the surveys on growth rate of the creepy plant and other maintenance data were comprehensively analysed to assess the plants performance under the various local climatic conditions such as temperature, and perception patterns typical in the study areas.

Literature Review

To gain a comprehensive understanding of the sustainability potential of *Vernonia elaeagnifolia* within green façade systems, a systematic literature review was conducted. This review examined peer-reviewed journal articles, conference papers, and technical reports to assess the species' performance across several key dimensions: (1) water use efficiency and drought resilience in tropical urban climates, (2) ecological services including biodiversity support and pollutant absorption, and (3) its potential to reduce building energy consumption by functioning as a natural thermal insulation layer. Previous studies on green façades in tropical contexts have highlighted the importance of plant physiological traits in determining façade performance (Perini et al., 2011; Susorova et al., 2014). Additionally, the selection of native or

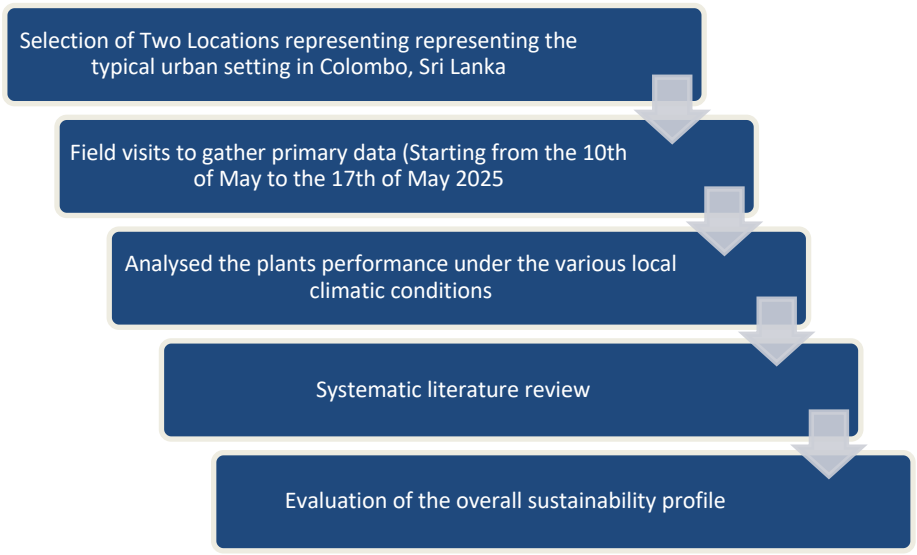
well-adapted species like *V. elaeagnifolia* is considered crucial for optimizing long-term sustainability, particularly in regions with variable rainfall and high solar radiation (Wong et al., 2010; Pérez et al., 2014).

Data integration and analysis

Finally, to evaluate the overall sustainability profile of the *Vernonia elaeagnifolia* as a green façade plant, survey findings and literature review information were triangulated.

Figure 03

Flow diagram of the methodology



Results and Discussion

Analysis of water usage efficiency

Table 02 describes the results of the questionnaire and observed data from the field visits. In location 01, utilize an automated drip irrigation system as the irrigation method and water regularly in small quantities. Also, in location 01 can observe a higher growth rate, lush foliage, dense and uniform growth with minimal challenges. On the other hand, in location 02, utilize manual watering as the rotation method. Watering twice per week in dry seasons and once per week in rainy seasons. In location 02, can observe moderate plant growth with gaps in the plant coverage.

Both locations' irrigation systems are utilizing a small amount of water and less frequent watering, especially in manual watering, proving that curtain creeper require less water. This demonstrates the water efficiency. Furthermore, constant regular watering with a little amount of water vigour the plant growth compared to manual watering.

Table 02 : *Results of the questionnaire and observed data*

	Location 01	**Location 02**
Figure		
Location	Sobadam Piyasa, No. 416/C/1,Robert Gunawardana Mawatha, Battaramulla	144 High Level Rd, Maharagama 10280
The existing method of irrigation	Automated Drip Irrigation	Manual watering by hosepipe
Watering frequency and volume of the water	Automatic irrigation is regularly done in small quantities	Twice per week during the dry season/once per week during the rainy season
Fertilization method	Soluble fertilizer with the irrigation system Balanced NPK fertilizer once per month	Balanced NPK fertilizer
Pruning schedule	Prune Overgrown stems monthly	As needed
Growth rate	Vigorous growth	Moderate growth
Health of the plants	Minimal pest issues	Minimal pest issues
Challenges facing in maintenance of the green façade	Minimal challenges	Growth rate is slow Labour intensive
Observed data		
Plant coverage density	Dense uniform coverage Lush foliage	Moderate Some gaps are visible The *Thanbergia* plant is growing over the curtain creeper plant
Soil moisture level	Constant moisture	Vary
Structural support	Wooden horizontal strips	Metal trellis

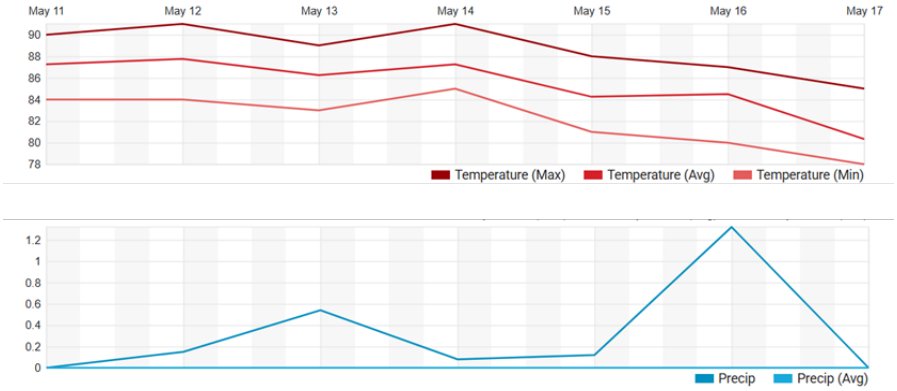
When considering the other maintenance practices, such as fertilizing, pruning, and controlling pest invasions, both locations show that less maintenance is required, rather complex regular monitoring and

maintenance practices. Location 01 shows that the automation of the irrigation and fertilizing system can significantly reduce the labour intensity, and it increases the vigorous growth of the plant.

Assessment of growth rate and climate adaptability

Figure 06

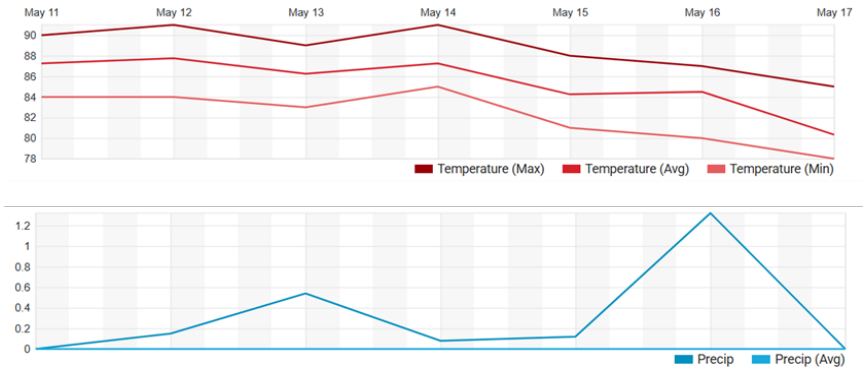
Average temperature and precipitation data of location 01 throughout the experiment period



Source: https://www.wunderground.com/history

Figure 07

Average temperature and precipitation data of location 02 throughout the experiment period



Source: https://www.wunderground.com/history

According to the climate data throughout the period of the experiment, both locations experienced a range of temperatures (maximum – 30.8 °C, minimum – 26.8 ºC) and precipitation (maximum – 1.32 in, minimum – 0.00 in). Throughout the period of the experiment, according to the field surveys and observed data, can observe vigour-medium growth rate, which proves that *Vernonia elaeagnifolia* has a high-medium growth rate in a wide range of temperature and perception conditions. Both locations show that *Vernonia elaeagnifolia* is well adapted to the local climate conditions in Colombo, Sri Lanka.

Assessment of the environmental sustainability through a literature review

Several studies are evaluating the tolerance of *Vernonia elaeagnifolia* to drought and moderate salinity conditions and adaptability to the local climate and its fast-growing rate (Varghese et al., 2015) (Kanimozhi & Arumugam, 2023). With these insights and analyzed results based on the field survey, it's proving the water efficiency, fast-growing rate, and local climate adaptability of the *Vernonia elaeagnifolia.*

One study emphasizes that *Vernonia elaeagnifolia* has the ability to attract pollinators such as bees and butterflies, which can boost the local biodiversity in built environments and enhance urban ecological networks. The creeper is well-known for forming a dense foliage, providing natural screening and privacy to building facades, and improving aesthetic value. Also, its dense foliage provides habitat for urban fauna, improving urban biodiversity further (Kattekola, 2020).

As a green façade plant, *Vernonia elaeagnifolia* has cleansing ability in tropical environments. This study proves that *Vernonia elaeagnifolia* effectively traps PMs and absorbs gaseous pollutants such as SO_x and NO_x gases, contributing to environmental sustainability, reducing air pollution. (A., 2014). Several studies have been conducted to research the *Vernonia elaeagnifolia* plant's medicinal and pharmacological benefits. This plant contains flavonoids (quercetin), tannins (ellagic acid), phenolics, terpenoids, and steroids. Therefore, showing antimicrobial, antioxidant, anti-inflammatory, and anti-infective properties, supporting ethnobotanical knowledge and strong potential for pharmaceutical applications (Mishra, 2023). Varghese et al., (2015) showing that building green façades which are covered with *Vernonia elaeagnifolia* can reduce surface temperature by 1.8 ^{0}C during peak hours.

Conclusion

To reduce the urban heat island effect and other challenging conditions of the highly urbanized areas, such as Colombo, Sri Lanka, incorporating green facade systems into building facades is becoming an emerging trend. However, when choosing plants for the green facade systems, ecological knowledge plays a crucial role in avoiding exotic plant species and therefore mitigating negative impacts on the local urban ecosystems. This study elaborates that *Vernonia elaeagnifolia* is widely available and well-adapted to the local climatic conditions. It has shown the water use efficiency and high growth rate, suggesting a better option for architectural objectives. Furthermore, *Vernonia elaeagnifolia* plant increases local biodiversity, contributes to air cleansing, which is very useful in urbanized areas, and acts as an insulation layer to the building wall; it can reduce the cooling energy demand of the buildings. Matching the objectives of the paper, these findings suggest that *Vernonia elaeagnifolia* is a sustainable, environmentally friendly alternative to exotic plant species, improving urban biodiversity resilience in Colombo, Sri Lanka. Future studies can focus on finding more sustainable native species for urban greenery systems instead of depending on the exotic, fast-growing plant species, which can potentially decrease local biodiversity. And also, considering the policy implications of reducing reliance on invasive species for the green façade systems, can improve the environmental sustainability of green façade systems and help to raise awareness of the negative impacts of invasive species among stakeholders who are involved in green façade systems design to maintenance.

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