

Potential Native Plant Selection for Sustainable Landscape Architecture in Wangchan Forest, Rayong, Thailand

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Abstract

Landscape architecture in Thailand still relies heavily on commercially propagated species. While convenient, this dependence narrows the design palette and promotes inclusion of exotic species or ecologically unsuitable plants, undermining biodiversity, long-term sustainability, and ecological resilience. By contrast, sustainable landscape architecture prioritizes indigenous and locally adapted species that are visually expressive yet ecologically matched to local conditions, thereby reducing maintenance, supporting native biota, and articulating regional identity. This research investigated the Wangchan Forest in Rayong Province to develop a systematic process for identifying and selecting native plants for landscape use. The study objectives were to: (1) develop a framework for selecting native species; (2) compile a list of native plants in Wangchan Forest; and (3) recommend species suitable for sustainable landscape design. The study combined botanical database analysis with ethnobotanical inquiry. Data were drawn from Thai Plant Names by Tem Smitinand for the Southeastern Floristic Region and complemented by semi-structured interviews with herbal doctors, local pioneers, and former loggers with experiential knowledge of the forest. Species were evaluated using criteria emphasizing ecological adaptability, microclimatic and edaphic compatibility, water requirements, and functional roles in landscape design. Of the 13,527 plant species listed in the national database, 1,724 occur in the Southeastern Floristic Region. Cross-referencing with local knowledge confirmed 516 species as native to Wangchan Forest and identified 137 additional species recognized locally but absent from the database, highlighting the value of traditional ecological knowledge. Applying the selection framework yielded 125 native species recommended for landscape application, categorized into drought-tolerant, moderately drought-tolerant, high-humidity, and riparian or aquatic groups. Integrating scientific data with Local Ecological Knowledge thus provides a practical, replicable framework for native plant selection that expands the ecological and cultural richness of sustainable landscape architecture in Thailand.

Keywords

Biodiversity enhancement; Native plants for landscape design; Sustainable landscape; Wangchan Forest; Evidence-based planting design

1. Introduction

Plant selection plays a crucial role in shaping the discipline of landscape architecture and garden design in Thailand. Historically, the selection process has been heavily influenced by commercialized species available in plant markets, with Bangkok and the surrounding metropolitan region acting as the primary hubs for production and distribution. These species often are chosen based on popularity trends that shift over time, which leads to the mass production of certain ornamental plants irrespective of their ecological suitability (Chatakul, 2010). In addition to market trends, cultural beliefs, symbolic meanings, and aesthetic characteristics frequently dictate plant choices. As a result, landscape architects and garden designers may be constrained to select species that align with societal expectations rather than ecological appropriateness, even when these species are not well-adapted to local environmental conditions.

A significant portion of the plants currently used in Thai landscaping projects are exotic species, introduced either through local plant industries or imported from abroad. While their introduction has enriched design palettes, the ecological consequences of relying on such species have become increasingly evident. Three major scenarios commonly are observed: (1) certain newly introduced plants may coexist with native vegetation without notable ecological disruption; (2) some species require substantial resources for establishment and long-term maintenance, placing additional burdens on ecological and financial systems; and (3) in some cases, exotic species display invasive tendencies, outcompeting native flora and transforming local ecosystems in ways that threaten biodiversity and ecosystem stability (Chatakul, 2015). These risks highlight the critical need for careful plant selection and greater emphasis on ecological compatibility in landscape design.

To address these challenges, the implementation of systematic and research-driven methodologies for plant selection has emerged as a central concern in contemporary landscape architectural practice. Such methodologies not only enable the identification of indigenous flora within designated project sites but also provide insights into the specific ecological requirements of these plants. More importantly, they allow for the assessment of the functional potential of native species within landscape designs. The integration of native flora offers numerous ecological benefits, such as the restoration of habitat complexity, the provision of food and breeding grounds for local fauna, the improvement of soil structure and moisture retention, and the mitigation of hydrometeorologic risks, including drought and flood occurrence (Arayanimitsakul, 2015). From a design perspective, the use of native plants also enhances the sense of place, reinforces regional identity, and promotes sustainable approaches to urban and peri-urban development.

This research is designed to provide evidence-based recommendations for plant species selection tailored to the environmental conditions of the Wangchan Forest. The outcomes of the study are intended to contribute to both theoretical and practical aspects of landscape architecture. On a practical level, the findings will offer guidance for selecting plant species that are ecologically suited to a variety of microenvironments, paving the way for their real-world application in future projects. On a theoretical level, distinguishing between native and non-native species will enable researchers and practitioners to evaluate the ecological impacts of non-native introductions and determine whether such species can successfully coexist with established native communities. This dual perspective—balancing applied design concerns with ecological sustainability—underscores the importance of developing a robust framework for plant selection in Thailand.

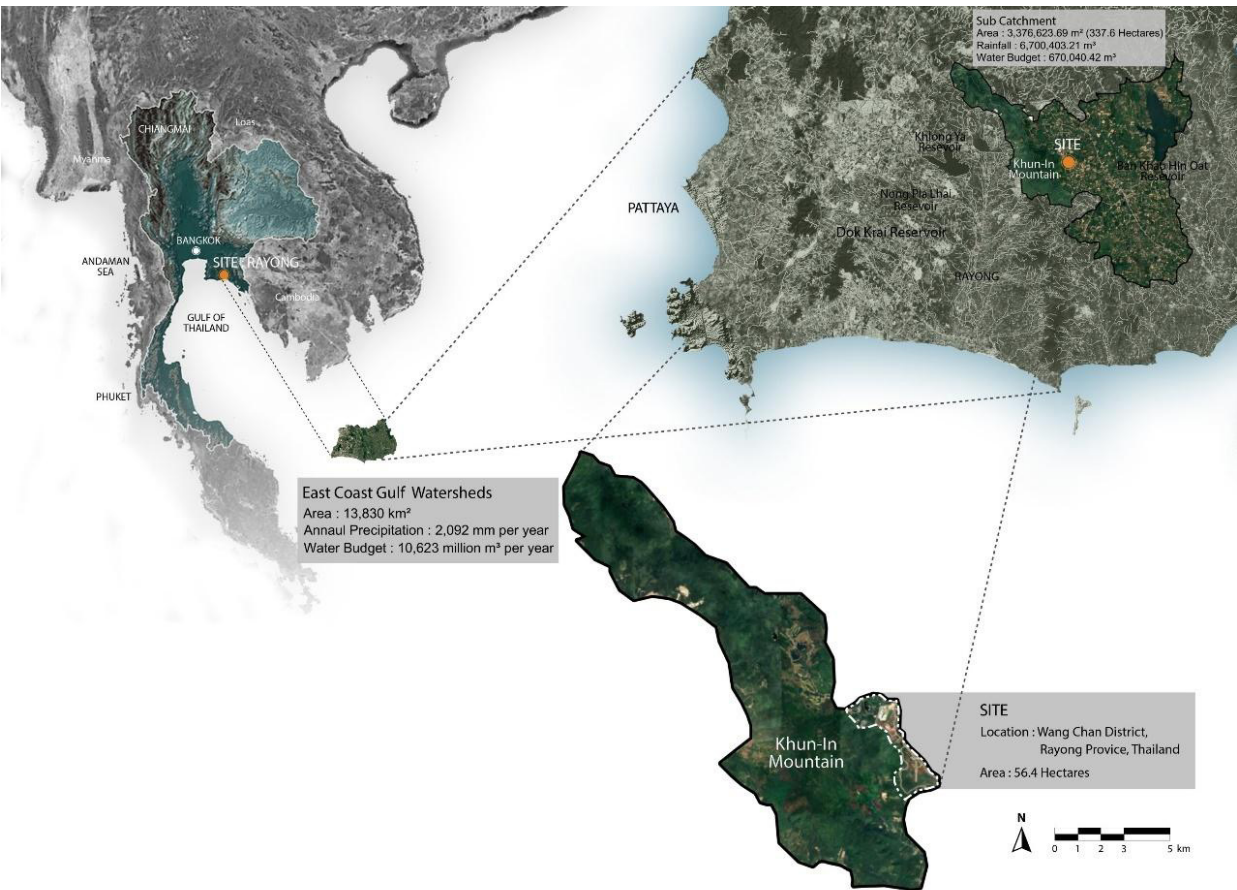
The case study site, the Wangchan Forest Learning Center, provides a unique opportunity to advance this research agenda. Established on January 1, 2013, by the PTT Reforestation and Ecology Institute of PTT Public Company Limited, the site encompasses 56.4 ha of land in Wangchan District, Rayong Province

(Figure 1). Originally used for agricultural purposes, the area has since been transformed into a newly planted forest with high potential for experimental studies on the selection and application of native plants. Beyond its role in forest restoration, the site represents an important model for integrating ecological principles into landscape architecture to accommodate human use while promoting biodiversity. The research conducted here is especially relevant in the context of Thailand's rapid urbanization, where expansion and development are directly linked to the reduction of green space and fragmentation of ecological networks (Likitswat & Sahavacharin, 2023).

Accordingly, the objectives of this study are threefold:

1. To establish a systematic and replicable methodology for the selection of native plants suitable for future application in landscape architecture;
2. To identify specific native plant species present within Wangchan Forest and evaluate their potential for design integration; and
3. To recommend native plant species with demonstrable ecological and design value that can enhance biodiversity, strengthen green networks, and expand connectivity among fragmented green areas, thereby contributing to the development of resilient green infrastructure in Rayong Province (Vanno, 2019).

By addressing these objectives, the study aspires to bridge the gap between ecological research and design practice, ensuring that future landscape architecture projects in Thailand advance both aesthetic and ecological goals.



2. Literature Review

The study of native plant resources in Thailand traditionally has employed methodologies that focus on surveying designated areas, analyzing the properties of plant species found, and subsequently suggesting their potential uses within ecological and design contexts (Sritram & Wongsuksaweang, 2020). While this approach provides a foundational understanding of available plant resources, it is not without limitations. In particular, such methods may fail to account for the presence of non-native species that have colonized sites prior to the survey. These species, often introduced through historical land use practices or unregulated plant dispersal, can establish themselves in ecosystems undergoing natural succession, thereby complicating the distinction between native and non-native vegetation. Consequently, a methodological framework that explicitly addresses the identification and exclusion of non-native species is essential for ensuring the integrity of native plant research in Thailand.

A critical review of the literature reveals several methodological strategies for distinguishing and documenting native plant species. One commonly adopted approach involves historical comparison—analyzing current plant assemblages alongside historical records and propagation data (Ghorbanalizadeh & Akhiani, 2022). The importance of environmental conditions and propagation characteristics in delineating species boundaries and identifying indigenous flora has been emphasized in *Forest Trees of Southern Thailand*, Vol. 1 (Gardner et al., 2015). Beyond botanical and scientific nomenclature, the incorporation of local vernacular names, cultural classifications, and traditional taxonomies provides additional insights into the distribution and recognition of native species, reflecting how local communities historically have understood and interacted with plants (Engel & Phummai, 2002).

Another widely applied method involves field surveys in conjunction with herbarium records. By comparing newly collected specimens with herbarium databases, researchers can determine whether a species is native to the region or represents an introduced element (Chung et al., 2020). The herbarium thus functions as both a scientific archive and a reference system for verifying plant identity. Complementing this botanical data with cultural-historical evidence also has proven effective. For example, the integration of mural paintings, Buddhist traditions, linguistic evidence, and local oral histories provides a broader cultural context for plant identification. Such approaches have been used to distinguish native species referenced in religious texts, scriptures, and ancient monuments, which are then cross-verified against botanical records and herbarium data (Na-nakorn, 2012; Chatakul & Janpathompong, 2022). This interdisciplinary methodology not only broadens the scope of native plant identification but also reinforces the cultural significance of native flora within Thai society.

Following the establishment of the Wangchan Forest as a reforestation and ecological research site, a wide range of studies have been conducted that contribute to the understanding of plant resources in the area. These include investigations into fauna as ecological indicators of forest recovery, the establishment of plant resource databases, the initiation of a pilot carbon forest project, and assessments of the PTT reforestation model. One particularly relevant study is the plant survey conducted on Khun-in Mountain, as part of PTT's environmental and community data research project for sustainable reforestation in the Wangchan District, Rayong Province (Kansuntisukmongkol, 2016). This survey recorded 224 plant species, representing a significant dataset for understanding the current floral composition of the Wangchan Forest. However, as the study itself acknowledged, the species documented reflect vegetation influenced by natural succession processes that followed extensive logging operations. Consequently, the flora identified at present may not accurately represent the original native composition of the forest and some species recorded may be naturalized exotics rather than true natives.

These challenges highlight a central methodological issue: reliance on recent survey data or herbarium records alone is insufficient for accurately identifying native species in historically disturbed landscapes. Instead, triangulation of data sources is required. In the case of Wangchan Forest, additional verification was sought through oral histories and local knowledge. Since logging occurred in the region from the reign of 1900 until 1984 (Love Sriracha Club, 2015), long-term residents and individuals involved in past forest utilization represent invaluable sources of ecological memory. Their knowledge provides an historical perspective on the flora that once characterized the forest before extensive disturbance.

The integration of Local Ecological Knowledge (LEK) into scientific methodologies represents a crucial step in reconstructing the original biodiversity of Wangchan Forest. Interviews with community members who possess generational knowledge of the forest's history allow researchers to identify plant species that may no longer exist in the area but could be candidates for reintroduction in future reforestation efforts. This approach also helps to verify the native status of species currently observed, distinguishing between true natives and introduced species that have become established through natural succession. The incorporation of LEK not only enriches botanical research with historical depth but also fosters a participatory approach to ecological restoration, wherein communities become active contributors to the knowledge base and long-term management of forest ecosystems.

Thailand must extend beyond simple field surveys and herbarium comparisons to include interdisciplinary and multi-source verification methods. Historical documents, cultural records, herbarium archives, and LEK collectively form a comprehensive framework for accurately identifying native plant species in disturbed ecosystems such as Wangchan Forest. This integrated approach ensures that reforestation and landscape architecture projects are grounded in ecological authenticity, thereby supporting biodiversity conservation, cultural continuity, and long-term sustainability.

3. Methodology

The methodology developed for identifying indigenous plant species in the Wangchan Forest integrates ethnobotanical analysis, floristic data, and community-based knowledge systems. By combining archival resources, field-based surveys, and ethnographic interviews, this approach ensures both ecological authenticity and cultural relevance in identifying species suitable for restoration and landscape architectural use. Such methodological triangulation addresses the limitations of relying solely on contemporary surveys, which may include naturalized non-native species and instead emphasizes long-term ecological continuity grounded in both scientific and local knowledge.

The research process was structured into six interconnected stages, as follows:

1: Compilation of Floristic Data from the Thai Plant Names Database

The first stage involved the systematic collection of species records from the Thai Plant Names Database, focusing specifically on the Southeastern Floristic Region (SE), within which Wangchan Forest is geographically located. This floristic region is characterized by high levels of biodiversity influenced by both Indochinese and Malayan elements, making it an essential reference point for determining species pools relevant to the study area. By establishing a baseline dataset of species recorded in the region, the research ensures that subsequent plant selection is rooted in verified botanical records and reflects the broader ecological context of southeastern Thailand.

2: Preparation of Reference Materials and Ethnographic Interviews

Following database compilation, plant lists and photographic reference materials were prepared for use during community-based interviews. The interviews targeted local elders, herbal practitioners, pioneer settlers, and former loggers, groups whose lived experience with the Wangchan Forest predates extensive ecological disturbances such as commercial logging (which persisted until 1984). These participants possess LEK, including insights into plant uses, ecological functions, and species formerly present in the area but absent today due to disturbance. Interviews were semi-structured, allowing flexibility to incorporate narratives, cultural associations, and traditional classifications that might not appear in scientific records. This ethnobotanical perspective is essential for reconstructing the historical composition of the forest. Ethnobotanical and ethnomedical approaches involve the acquisition of Traditional Ecological Knowledge (TEK) related to plants, thereby encouraging the local environment (Jarić et al., 2024).

3: Cross-Referencing Literature, Interviews, and Reforestation Project Reports

The third stage focused on the integration of multiple data sources to identify species most likely to represent the original native flora of Wangchan Forest. Literature reviews, ethnobotanical interviews, and project documentation—including the environmental and community database from PTT's sustainable reforestation project in Wangchan District (Kansuntisukmongkol, 2016)—were cross-analyzed. The Khun-in Mountain survey, which documented 224 plant species, provided an especially important reference point, though it was recognized that some recorded species may reflect naturalized exotics rather than true natives. This triangulated analysis allowed for the filtering of non-native and successional species, strengthening the accuracy of the native plant list.

4: Establishing Criteria for Landscape Architectural Applications

After assembling a verified list of candidate species, a Landscape Architecture Plant Suitability (LAPS) framework was developed to determine their suitability for landscape architectural use. Criteria included: (i) ecological adaptability under site-specific conditions, selecting climate appropriate plants; (ii) functional contributions to ecosystem services (e.g., soil stabilization, hydrological regulation, provision of wildlife habitat); (iii) aesthetic qualities relevant to design practice; and (iv) cultural significance, including symbolic or ritual uses recognized within local communities. This multi-criteria assessment ensures that species selected are not only ecologically appropriate but also aligned with the cultural and aesthetic dimensions of landscape architecture.

5: Environmental Classification of Candidate Species

The refined plant list was further analyzed by classifying species according to their environmental requirements and physical characteristics based on information from the Encyclopedia of Plants in Thailand (Forest and Plant Conservation Research Office, 2016). This included differentiation by habitat type (e.g., upland, riparian, evergreen, or dry dipterocarp), growth form (e.g., tree, shrub, climber, groundcover), and level of tolerance to environmental stressors such as drought, soil salinity, or flooding. Such classifications provide practical guidance for applying native species across diverse microenvironments within the Wangchan Forest and adjacent designed landscapes.

6: Development of Landscape Architecture Applications

Finally, practical design applications were formulated to demonstrate how native species could be integrated into the landscape architecture of the Wangchan Forest. These included model planting schemes, ecological corridor designs, and habitat-enhancing green infrastructure intended to strengthen the connectivity of the regional green network. The knowledge developed over generations of interactions between traditional

people and ecosystems can make a valuable contribution to ecological restoration (Upreti et al, 2012). By illustrating concrete design scenarios, this stage bridges research and practice, showing how indigenous flora can serve both ecological restoration objectives and human-centered landscape design needs.

This multi-layered methodology—linking floristic records, ethnobotanical interviews, and ecological design criteria—provides a rigorous framework for identifying and applying indigenous plant species in the Wangchan Forest. The process not only contributes to biodiversity conservation but also situates native plants as integral components of green infrastructure, thereby advancing ecological resilience, cultural continuity, and sustainable landscape architecture in southeastern Thailand.

4. Data Collection

4.1. Native Plants According to the Floristic Region

Currently, the most widely used official document specifying indigenous plants in Thailand is the Thai Plant Names List (Forest and Plant Conservation Research Office, 2014), which contains the names and distribution patterns of 13,527 indigenous and non-indigenous plant species found in the country. Thailand’s floristic regions (Smitinand, 2001) refer to a geographical area classified based on the distribution, diversity, and composition of plant species. It reflects differences in ecological, climatic, vegetation types, and biogeographical factors that influence the presence of particular plant communities, which are divided into 7 regions (Figure 2).

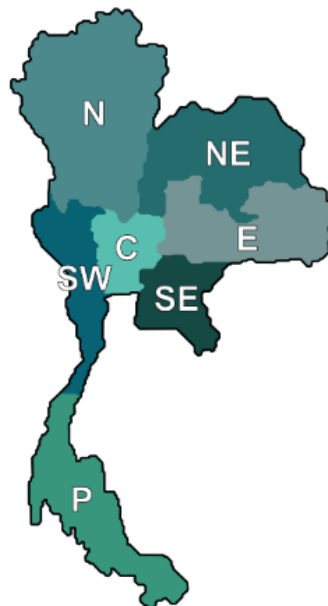


Figure 2. Thai Floristic regions N= Northern, NE= North-Eastern, E= Eastern, SE= South-Eastern, C= Central, SW= South-Western, PEN= Peninsular by Author.

The study area is located in the Southeastern Region (SE). This region is both under the Cochin Chinese and Malayan floristic elements. The Dipterocarps form the predominant species in the tropical rain forests; from the main type of the forests present, savannas are not uncommon in the plains, which during the rainy season are always inundated. Rich mangrove swamps and tidal forests are the common features of the coastline and along the estuaries of the main rivers. (Smitinand, 1958).

From the total data screening, it was found that the SE Region contains 1,724 species. These species are identified based on plants specified as thriving in the Southeastern Floristic Region (SE), in addition to plants specified as being capable of growing in all regions or General within Thailand (G).

Considering the extensive list of plant species in this floristic region in conjunction with diverse forest types and plant communities (Santisuk, 2012), it is evident that plants thrive under varying environmental conditions, including beach plant communities, mangrove forest plants, mountainous plants, etc. Thus, thoroughly identifying indigenous plants in the Wangchan Forest necessitates collecting additional data for comprehensive analysis and selection of indigenous species.

4.2 Interviews with the Local Wisdom Bearers

Following the compilation of the initial database of indigenous plants from the Southeastern Floristic Region, the selected species were utilized as the basis for interviews with local wisdom bearers who possessed experiential familiarity with these plants. The contribution of Traditional Ecological Knowledge in Ecological Restoration and management is increasingly recognized and implementation endeavors in several countries (Uprety et al, 2012). The participants, hereafter referred to as local bearers, were selected according to the following criteria: (1) long-term residence in communities surrounding Wangchan Forest (the Payubnai Subdistrict in Wangchan District, Rayong Province); (2) prior experience of interacting with, or deriving benefits from, Wangchan Forest; and (3) foundational knowledge of local flora sufficient to identify plant species. This group consisted of four individuals: one traditional herbalist, one land pioneer, and two former timber cutters. Each interview was conducted individually, in an unstructured format, and without predetermined time constraints, thereby allowing participants to elaborate freely on their knowledge and experiences. To enhance accuracy and minimize the risk of misidentification arising from regional variations in plant nomenclature, the researchers prepared visual aids in the form of plant image files, which were employed as reference materials throughout the interview process.

4.3 Comparison with the Plant Species Found in the Survey on Khun-in Mountain

The ethnobotanical data from the research report “Environmental and Community Database for PTT’s Sustainable Reforestation Project in Wangchan Forest” (Kansuntisukmongkol, 2016) were used for analysis and comparison with the indigenous plant data from Section 4.1, and the interview results from Section 4.2. The Khun-In Mountain database documented 224 species, some of which are exotic plant species related to Thai Plant Names by Tem Smitinand. 19 species found in the Southeastern and General floristic region. 169 plant species found in other floristic regions.

The selection framework is structured around three principal groups of criteria:

1. Physical criteria: As described by Arayanimitsakul (2015), these include life form, size, periodicity, leaf morphology, overall form, spread, massing, branching patterns, flowering and fruiting characteristics, trunk and root features, growth rate, longevity, resistance to pests and diseases, cultural or symbolic significance, and capacity for transplantation and propagation.

2. Environmental criteria: These encompass native status, growth height and canopy spread, tolerance to soil pH (acid–alkaline range), adaptability to different soil textures and moisture levels, drought tolerance, light requirements and optima, salinity tolerance, capacity to attract wildlife, and other distinctive ecological characteristics (University of Florida Institute of Food and Agricultural Sciences (UF/IFAS), 2022).
3. Utilization criteria: As outlined by Vanno (2011), these include applications in soil bioengineering for slope stabilization, sediment trapping, water conservation, broader environmental functions, and aesthetic contributions to designed landscapes.

5. Research Results

Based on the findings of this study, the official database of Thai flora records a total of 13,527 plant species for the country. Of these, 1,724 species are documented as occurring within the Southeastern Floristic Region. From the ethnobotanical interviews conducted with local knowledge holders, a total of 653 plant species were identified. Comparative analysis between the interview-derived dataset and the Southeastern Floristic Region database revealed that 516 species overlapped with the existing records, whereas 137 species reported by the local sages were not included in the regional database.

The 137 unlisted species can be categorized into three distinct groups:

1. 63 species of non-indigenous plants that are distributed within Thailand.
2. 11 species of non-indigenous plants that are imported and cultivated in Thailand.
3. 63 species of plants that are not listed in the database of Thai flora.

Furthermore, the Khun-in Mountain study identified a total of 224 plant species, of which 36 species were consistent with the interview results, 19 species were found to be distributed within the Southeastern Floristic Region but were not mentioned in the interviews, and 169 species were non-indigenous plants that are distributed within Thailand (Figure 3).

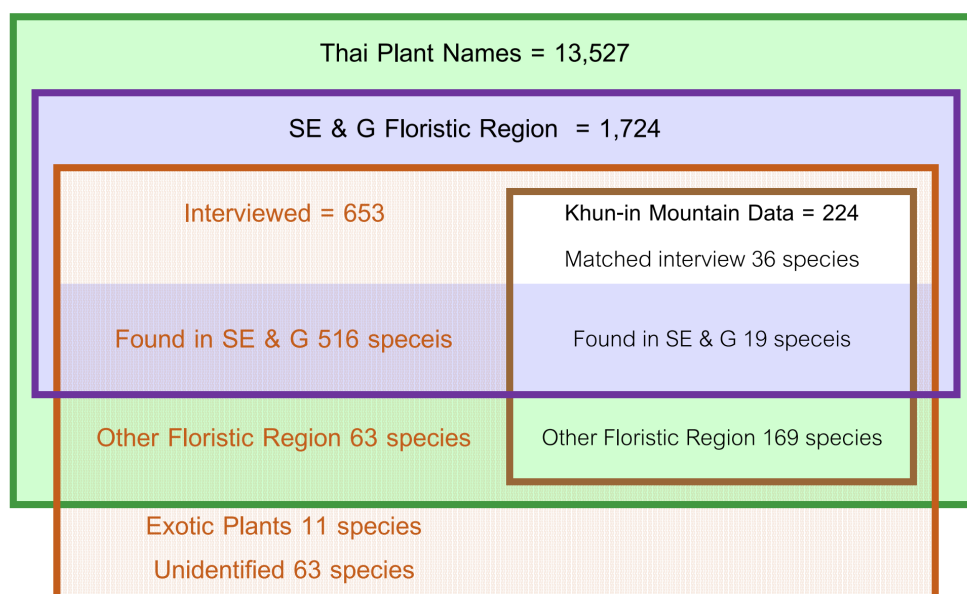


Figure 3. Number of plants found from data and interviews by Author.

6. Discussion

The study indicates that non-native plant species have been diversely distributed within the Southeastern Floristic Region for at least five decades, predating the period of large-scale forest encroachment. Evidence obtained from interviews with local bearers confirmed the coexistence of non-native plant species with native flora in the original forest ecosystems. At present, natural areas in the Khun-in Mountain contain a greater proportion of non-native plant species compared to native species.

Looking ahead, the number of native plant species within the Southeastern Floristic Region is expected to decline due to habitat destruction, leading to environmental changes that are, to some extent, unavoidable. Consequently, the conservation of native plant species has become an urgent necessity. One strategic approach is to cultivate native species in areas beyond their original forest habitats to broaden the scope of conservation. This includes the introduction of native plant species for application within the landscape architecture industry. Such an approach not only contributes to the expansion of genetic diversity but also facilitates the wider cultivation of native species beyond their natural habitats, thereby extending conservation efforts beyond traditional forest restoration practices.

6.1 Selection of Potential Plants for Landscape Architecture

Based on the findings of this study, the selection of native plant species for application in landscape architectural design requires consideration of multiple interrelated factors, including aesthetic qualities, ecological interactions among species within the same environment, sourcing and propagation methods, preparation techniques, and long-term maintenance. Accordingly, it is necessary to systematically evaluate the native plant species documented in the preliminary database in order to identify those most suitable for landscape architectural projects. In addition, species identified through ethnobotanical interviews are given priority in this evaluation process, alongside the established criteria for plant selection in landscape architecture.

Native plant species selected for architectural projects should demonstrate distinctiveness by meeting at least one of the aforementioned criteria. From the evaluation of the 516 species recorded in the comparative database, a total of 125 native plant species were identified as having potential for use in landscape architecture. These species can be further categorized according to their respective growth characteristics, as outlined in the following section.

Tree (T)

Adenanthera pavonina, *Azelia xylocarpa*, *Anisoptera costata*, *Aquilaria crassna*, *Artocarpus lacucha*, *Baccaurea ramiflora*, *Bombax ceiba*, *Calophyllum thorelii*, *Careya arborea*, *Crateva adansonii*, *Chukrasia tabularis*, *Crateva religiosa*, *Dalbergia cochinchinensis*, *Dalbergia oliveri*, *Diospyros decandra*, *Diospyros ehretioides*, *Diospyros mollis*, *Diospyros oblonga*, *Dipterocarpus alatus*, *Dipterocarpus baudii*, *Dipterocarpus dyeri*, *Dipterocarpus hasseltii*, *Duabanga grandiflora*, *Elaeocarpus hygrophilus*, *Endospermum diadenum*, *Ficus callosa*, *Heritiera javanica*, *Irvingia malayana*, *Knema globularia*, *Knema lenta*, *Lagerstroemia calyculata*, *Lagerstroemia floribunda*, *Litchi chinensis*, *Marsypopetalum modestum*, *Millettia brandisiana*, *Mitrephora tomentosa*, *Nephelium hypoleucum*, *Pterocymbium tinctorium*, *Sageraea elliptica*, *Scaphium scaphigerum*, *Shorea farinosa*, *Shorea henryana*, *Shorea hypochra*, *Shorea roxburghii*, *Sindora siamensis*, *Temmodaphne thailandica*, *Vatica philastreana*, and *Xylia xylocarpa*.

Small Tree (ST)

Bridelia ovata, *Ficus fistulosa*, *Ficus heteropleura*, *Guioa pleuropteris*, *Lepisanthes rubiginosa*, *Mallotus philippensis*, *Morinda coreia*, and *Tabernaemontana pauciflora*.

Shrub/Small Tree (S/ST)

Acronychia pedunculata, *Ardisia elliptica*, *Ficus hirta*, *Glycosmis pentaphylla*, *Goniothalamus tenuifolius*, *Mallotus peltatus*, *Melientha suavis*, *Mitragyna diversifolia*, *Orophea enterocarpa*, and *Streblus ilicifolius*.

Shrub (S)

Diospyros undulata, *Clerodendrum schmidtii*, *Croton decalvatus*, *Ficus chartacea*, *Lasianthus cyanocarpus*, *Melastoma malabathricum*, and *Osbeckia chinensis*.

Undershrub (US)

Barleria strigose, *Codonacanthus pauciflorus*, *Desmodium heterocarpon*, and *Donax canniformis*.

Climber (C)

Ancistrocladus tectorius, *Arcangelisia flava*, *Artabotrys siamensis*, *Epipremnum giganteum*, *Uvaria dac*, *Uvaria grandiflora* var. *flava*, *Uvaria hamiltonii*, *Uveria lurida*, and *Jasminum laurifolium*.

Epiphytic Orchid (EO)

Eria biflora, *Grammatophyllum speciosum*, and *Podochilus lucescens*.

Herb (H)

Aglaonema brevispathum, *Aglaonema simplex*, *Amomum ovoideum*, *Amomum testaceum*, *Amomum uliginosum*, *Amomum villosum*, *Argostemma pictum*, *Boesenbergia rotunda*, *Geophila repens*, *Mapania palustris*, *Musa x paradisiaca*, *Sonerila maculata*, *Tacca chantrieri*, *Torenia thailandica*, *Xyris indica*, and *Zingiber officinale*.

Herbaceous Climber (HC)

Cardiospermum halicacabum, *Gloriosa superba*, and *Stemona tuberosa*.

Bamboo (B)

Bambusa bambos and *Bambusa blumeana*.

Palm (P)

Areca laosensis and *Arenga pinnata*.

Fern (F)

Huperzia carinata, *Taenitis blechnoides*, and *Tectaria griffithii*.

Scandent Shrub (ScanS)

Bauhinia pottsii var. *subsessilis*.

Terrestrial Orchid (TerO)

Geodorum densiflorum.

Epiphytic Fern (EF)

Asplenium confusum, *Asplenium nidus*, *Drynaria quercifolia*, *Huperzia hamiltonii*, and *Davallia solida*.

Aquatic Fern (AqF)

Acrostichum speciosum.

Terrestrial Fern (TerF)

Sticherus truncates.

These native plant species can serve as a significant reference resource for the selection of appropriate indigenous plantings that are ecologically well-adapted to prevailing environmental conditions and local ecosystems. Their utilization in landscape architecture not only supports the practical selection of resilient and sustainable plant palettes but also contributes to the long-term conservation of regional plant genetic resources. In this regard, they play a crucial role in safeguarding indigenous plant heritage, ensuring that knowledge and use of native species are maintained and transmitted to future generations.

Beyond their ecological and conservation value, the integration of native plant species into design practices has the potential to reinforce and enhance the cultural and ecological identity of the Southeastern Floristic Region. By incorporating species that are inherently adapted to local soil, climate, and hydrological conditions, designers and planners can establish landscapes that are more sustainable, resilient to disturbances, and less dependent on external inputs such as irrigation or chemical treatments. Moreover, the use of native flora can provide habitat and food sources for local wildlife, thereby supporting biodiversity conservation while simultaneously enriching the aesthetic and functional qualities of designed landscapes.

Importantly, the adoption of native plant species in landscape architecture aligns with strategies to anticipate and adapt to future environmental changes. As global and regional climates continue to shift, the resilience of landscapes will depend heavily on plant species that possess inherent adaptability to fluctuating conditions. Native species, with their evolutionary history within the region, are more likely to thrive under such changing circumstances compared to many exotics or commercially introduced species. Thus, their inclusion in landscape design not only preserves ecological heritage but also represents a forward-looking strategy that integrates conservation with adaptation.

6.2 Categorization of Native Plant Species for Landscape Architectural Applications

Rayong Province is influenced by two dominant monsoon systems—the northeast monsoon (mid-October to mid-February) and the southwest monsoon (mid-May to mid-October)—resulting in a characteristically humid climate. The 30-year mean annual rainfall is 1,383.2 mm over approximately 119 rainy days, and mean temperatures remain relatively stable, averaging 22–32.6 °C throughout the year. These conditions favor evergreen forest formations at the regional scale. At the same time, Wangchan District is characterized as a piedmont plain situated between Khun-In Mountain and the Chamao–Wong Mountain Range. The interplay of lowland plains and hill landforms produces variation in soil depth and water-holding capacity, air temperature, wind exposure, relative humidity, and related microclimatic factors, giving rise to distinct plant communities that respond to site conditions, such as tropical rain forest, dry evergreen forest, and mixed deciduous forest.

Based on the results of this study, which identified 125 native plant species with potential for landscape architectural use, these species can be systematically categorized into four primary groups according to their suitability for different environmental conditions. Such categorization provides an evidence-based framework for species selection, offering practical recommendations for experimental plantings within landscape architectural projects. The four categories are as follows:

1. **Drought-Tolerant Plant Group:** This category includes species that are morphologically and physiologically adapted to withstand prolonged dry conditions. They are particularly well-suited for arid or drought-prone landscapes and can play a critical role in sustainable planting design by reducing irrigation requirements.

2. Moderate Plant Group: Species within this group require a balanced level of soil moisture and are best suited to environments with average water availability. They exhibit tolerance to periodic fluctuations in soil moisture, making them highly versatile for general landscape applications. Their adaptability allows for broad use in urban and peri-urban landscapes where irrigation and environmental conditions may vary seasonally.
3. High-Humidity Plant Group: This group is composed of species that thrive under conditions of consistently high humidity, often occurring in microhabitats adjacent to rivers, streams, or other moisture-rich environments. These plants are characterized by lush foliage, high transpiration rates, and a preference for shaded or semi-shaded environments. Their inclusion in landscape projects not only enhances aesthetic richness but also contributes to microclimate regulation and biodiversity by supporting associated faunal communities.
4. Riparian or Aquatic Plant Group: This category encompasses species capable of growing in riparian zones, including areas subject to periodic flooding or sustained waterlogging. These plants possess adaptation characteristics such as ability to grow in standing water, flexible stems, and tolerance to anaerobic soil conditions, enabling them to survive and reproduce in aquatic or semi-aquatic environments. They are ideal for use in wetlands, ponds, artificial lakes, and water-sensitive urban design systems where flood resilience and ecological restoration are primary goals.

Each of these categories reflects distinct physical, physiological, and ecological characteristics that align with specific environmental contexts. However, some species demonstrate specialized adaptations, enabling them to thrive across multiple conditions. This flexibility is especially valuable in contemporary landscape architecture, where projects often span diverse microclimates and land-use types.

The categorization of native plant species presented in this study therefore provides more than a simple classification, it offers an applied framework for sustainable plant selection and utilization. By aligning plant characteristics with environmental conditions, designers can ensure that the selected species are ecologically appropriate, resilient, and capable of supporting broader conservation and aesthetic objectives. Ultimately, this approach promotes landscape designs that are both environmentally responsive and culturally meaningful, while simultaneously advancing the long-term goals of biodiversity preservation and ecological adaptation (Table 1).

Table 1. Plant classification

Plant habit	Drought- Tolerant	Moderate	High humidity	Riparian / Aquatic
T	<i>Adenanthera pavonina</i> <i>Bombax ceiba</i> <i>Calophyllum thorelii</i> <i>Crateva adansonii</i> <i>Diospyros ehretioides</i> <i>Diospyros mollis</i> <i>Diospyros oblonga</i> <i>Ficus callosa</i> <i>Irvingia malayana</i> <i>Millettia brandisiana</i> <i>Nephelium hypoleucum</i> <i>Pterocymbium tinctorium</i> <i>Shorea hypochra</i> <i>Shorea roxburghii</i> <i>Sindora siamensis</i> <i>Xylia xylocarpa</i>	<i>Azelia xylocarpa</i> <i>Anisoptera costata</i> <i>Aquilaria crassna</i> <i>Artocarpus lacucha</i> <i>Baccaurea ramiflora</i> <i>Calophyllum thorelii</i> <i>Chukrasia tabularis</i> <i>Dalbergia cochinchinensis</i> <i>Dalbergia oliveri</i> <i>Diospyros decandra</i> <i>Dipterocarpus alatus</i> <i>Dipterocarpus baudii</i> <i>Dipterocarpus hasseltii</i> <i>Duabanga grandiflora</i> <i>Heritiera javanica</i> <i>Knema globularia</i> <i>Knema lenta</i> <i>Lagerstroemia calyculata</i> <i>Litchi chinensis</i> <i>Marsypopetalum modestum</i> <i>Mitrephora tomentosa</i> <i>Shorea henryana</i> <i>Shorea hypochra</i> <i>Temmodaphne thailandica</i>		
ST	<i>Bridelia ovata</i> <i>Ficus fistulosa</i> <i>Lepisanthes rubiginosa</i> <i>Mallotus philippensis</i> <i>Morinda coreia</i> <i>Tabernaemontana pauciflora</i>	<i>Bridelia ovata</i> <i>Ficus heteropleura</i> <i>Guioa pleuropteris</i> <i>Lepisanthes rubiginosa</i> <i>Mallotus philippensis</i>	<i>Ficus heteropleura</i> <i>Lepisanthes rubiginosa</i>	-
S/ST	<i>Ficus hirta</i> <i>Melientha suavis</i> <i>Streblus ilicifolius</i>	<i>Acronychia pedunculata</i> <i>Glycosmis pentaphylla</i> <i>Goniothalamus tenuifolius</i> <i>Mallotus peltatus</i> <i>Mitragyna diversifolia</i>	<i>Ardisia elliptica</i> <i>Mitragyna diversifolia</i> <i>Orophea enterocarpa</i>	-
S	<i>Clerodendrum schmidtii</i> <i>Melastoma malabathricum</i> <i>Osbeckia chinensis</i>	<i>Croton decalvatus</i> <i>Lasianthus cyanocarpus</i> <i>Melastoma malabathricum</i>	<i>Ficus chartacea</i> <i>Diospyros undulata</i>	-
US	-	<i>Barleria strigosa</i> <i>Desmodium heterocarpon</i>	<i>Codonacanthus pauciflorus</i> <i>Donax caniniformis</i>	<i>Codonacanthus pauciflorus</i>
C	-	<i>Ancistrocladus tectorius</i> <i>Arcangelisia flava</i> <i>Artabotrys siamensis</i> <i>Epipremnum giganteum</i> <i>Jasminum laurifolium</i>	<i>Uvaria dac</i> <i>Uvaria grandiflora</i> var. <i>flava</i> <i>Uvaria hamiltonii</i> <i>Uveria lurida</i>	
EO	-	<i>Eria biflora</i> <i>Grammatophyllum speciosum</i> <i>Podochilus lucescens</i>	<i>Eria biflora</i> <i>Podochilus lucescens</i>	-
H	-	<i>Aglaonema brevispathum</i> <i>Aglaonema simplex</i> <i>Amomum ovoideum</i> <i>Amomum villosum</i> <i>Argostemma pictum</i> <i>Geophila repens</i> <i>Mapania palustris</i> <i>Musa x paradisiaca</i> <i>Sonerila maculata</i> <i>Tacca chantrieri</i> <i>Torenia thailandica</i>	<i>Amomum testaceum</i> <i>Amomum uliginosum</i> <i>Argostemma pictum</i> <i>Boesenbergia rotunda</i> <i>Mapania palustris</i> <i>Musa x paradisiaca</i> <i>Sonerila maculata</i> <i>Xyris indica</i> <i>Zingiber officinale</i>	-

Table 1. Plant classification (Continued)

Plant habit	Drought- Tolerant	Moderate	High humidity	Riparian / Aquatic
HC	<i>Cardiospermum halicacabum</i> <i>Gloriosa superba</i> <i>Stemona tuberosa</i>	-	-	-
B	<i>Bambusa bambos</i>	<i>Bambusa bambos</i>	<i>Bambusa bambos</i> <i>Bambusa blumeana</i>	-
P	-	<i>Areca laosensis</i> <i>Arenga pinnata</i>	<i>Arenga pinnata</i>	-
F	-	-	<i>Huperzia carinata</i> <i>Taenitis blechnoides</i> <i>Tectaria griffithii</i>	-
Scans	-	-	<i>Bauhinia pottsii</i> var. <i>subsessilis</i>	-
TerO	-	<i>Geodorum densiflorum</i>	-	-
EF	-	<i>Asplenium nidus</i> <i>Drynaria quercifolia</i>	<i>Asplenium confusum</i> <i>Asplenium nidus</i> <i>Davallia solida</i> <i>Drynaria quercifolia</i> <i>Huperzia hamiltonii</i>	-
AqF	-	-	-	<i>Acrostichum speciosum</i>
TerF	-	<i>Sticherus truncatus</i>	<i>Sticherus truncatus</i>	-

Below are examples of plant species native to the region that can be recommended for planting together in architectural projects, forming a plant community. These plant communities can be applied in various architectural designs, such as drought-tolerant plant groups (Figure 4), moderate humidity plant groups (Figure 5), and high-humidity and aquatic plant groups (Figure 6).

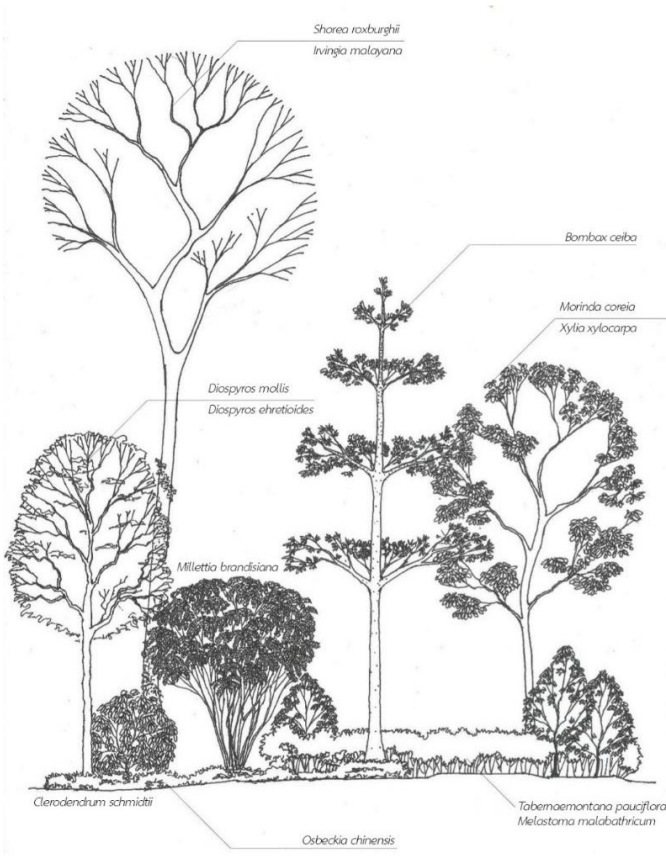


Figure 4. Suggested drought-tolerant plant community in Wangchan Forest by Paron Chatakul.

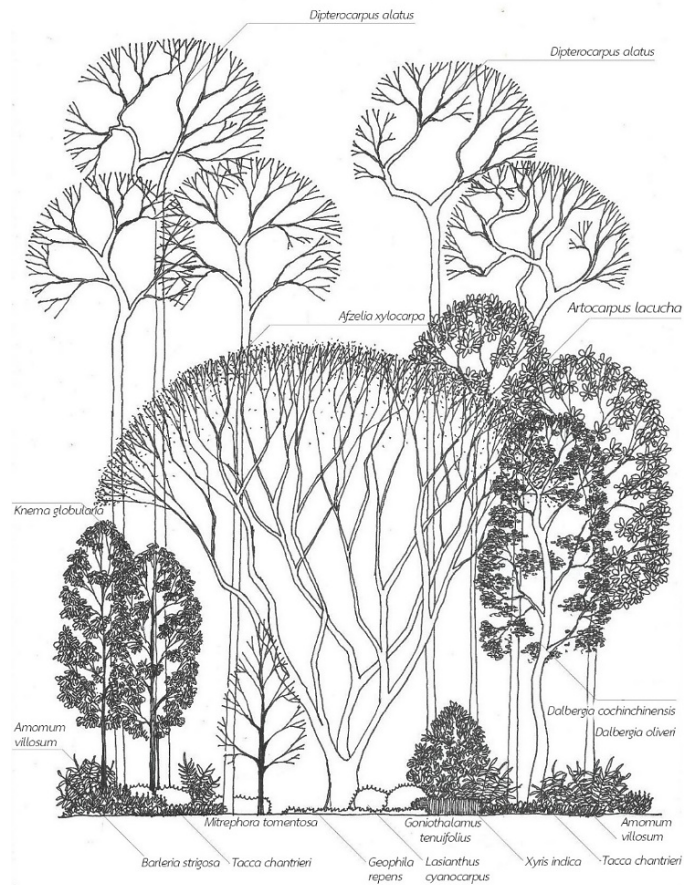


Figure 5. Suggested moderate humidity plant community in Wangchan Forest by Paron Chatakul.

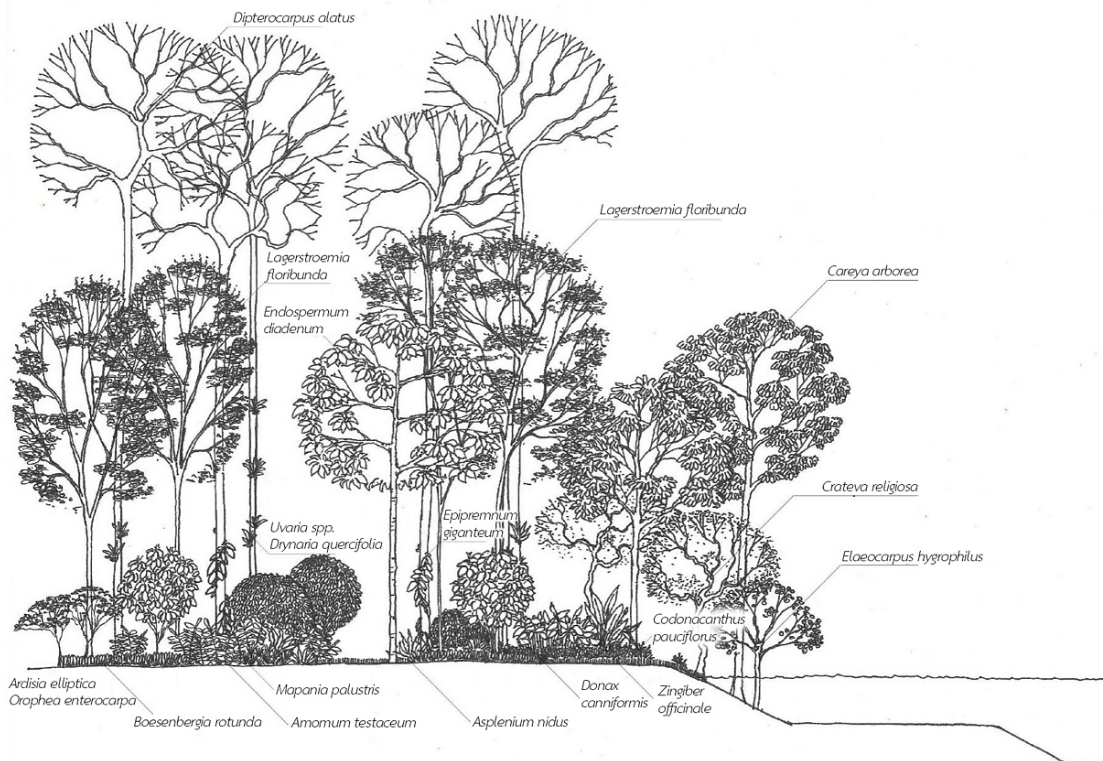


Figure 6. Suggested high humidity and aquatic plant community in Wangchan Forest by Paron Chatakul.

This research demonstrates a transferable methodological framework that can be applied to other areas, serving as a practical tool for landscape architects in the identification of native plant species that are environmentally appropriate and capable of reinforcing the ecological and cultural identity of design project sustainably (Figure 7).

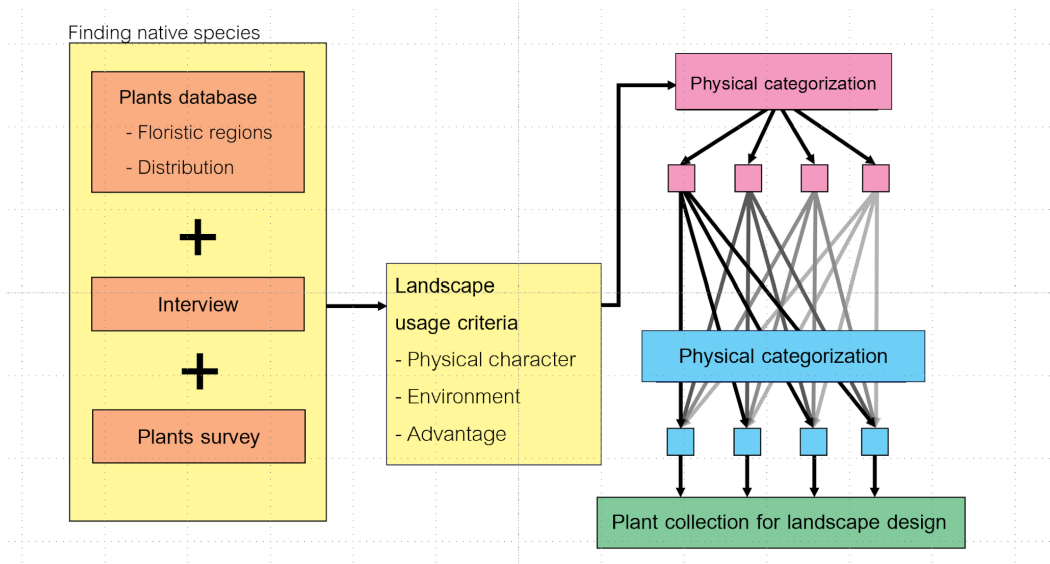


Figure 7. General model of finding native species for landscape design methodology by Author.

7. Conclusion

The search for native plant species for landscape architectural projects in the Wangchan Forest, Rayong Province, represents a systematic research endeavor aimed at identifying locally adapted species with potential applications in landscape design. Beyond species identification, the study provides practical guidelines for their cultivation within the Wangchan Forest Project, while also outlining strategies for future propagation. In doing so, it establishes an essential foundation for advancing the role of native plants in landscape architecture by promoting their integration into restoration practices, ecosystem conservation, biodiversity enhancement, and the development of regional identities. Importantly, this approach is consistent with the principles of Nature-based Solutions (NbS), emphasizing ecological resilience and cultural relevance rather than reliance solely on commercially available plant species.

Despite these advancements, the study acknowledges that the full spectrum of native species with landscape architecture design potential remains underexplored and insufficiently recommended for practical implementation. Addressing this limitation requires targeted efforts in systematic propagation research, controlled experimental cultivation, and the preservation of genetic diversity through ex situ and in situ conservation measures. These actions are essential not only to strengthen ecosystem functions and safeguard ecological processes but also to ensure the long-term stability and adaptability of the Wangchan Forest as a biologically rich and dynamic environment. By bridging scientific research, conservation practice, and landscape design innovation, this work underscores the critical role of native flora in achieving sustainable, ecologically grounded, and culturally meaningful landscapes.

8. Research limitation

This study has several limitations. First, the list of 125 recommended native species represents only a preliminary subset of the flora with design potential in the Southeastern Floristic Region; many additional species suitable for landscape use may remain undocumented or untested. Second, the research stops at species identification and categorization without experimental field trials to evaluate survival, growth, maintenance needs, or aesthetic performance under actual landscape conditions, so the recommendations remain provisional. Third, the work is based on a single case-study site -- Wangchan Forest -- within a specific floristic and context, which constrains the direct generalizability of the species list; in practice, only the methodological framework can be robustly transferred to other regions of Thailand.

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Human Subjects

The manuscript presents information from the interviewees' knowledge, based on their personal expertise and experiences, about the Wangchan Forest native plant community. No personal information or personal data were collected from the participants in this research dataset. Research strictly follows the Declaration of Helsinki, the Belmont report, CIOMS guidelines, and the International Conference on Harmonization – Good Clinical Practice (ICH_GCP)

Data Availability Statement

This research was funded by PTT Reforestation Institute under the Project for Monitoring and Analyzing Physical Environmental Data of the Wangchan Forest Project and the Pa Nai Krung Project, 2017. The original data have restricted availability, but inquiries can be directed to the PTT Reforestation Institution.

Use of Generative Artificial Intelligence (AI) and AI-Assisted Technologies

No AI technologies were used for this manuscript.

Author Contributions

Sirintra Vanno: Writing – original draft, visualization, validation, resources, project administration, methodology, investigation, funding, acquisition, formal analysis, data curation, conceptualization. **Paron Chatakul:** Writing – review & editing, validation, supervision, project administration, methodology, funding acquisition, formal analysis, data curation. Conceptualization.

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