Spontaneous Plant Library and Potential Applications in Urban Landscape

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Abstract

Proliferated in urban derelict, vacant land and marginal space, the apparently homogeneous and disorder form of spontaneous plants, conventionally categorized with the term 'weeds', are often associated with negative impression and reckoned as undesirable in the urban environment. Yet, the ecosystem services and resilience of these spontaneous inhabitants, which thrive in the most human-disturbed conditions, are often overlooked and rendered invisible.

This ongoing project aims to re-examine the human-plant symbiosis relationship by investigating the aesthetics, functions and benefits of these unintended plants and scrutinizing our perception of 'weeds' from an ethnographic perspective. There are two major objectives, namely to build up a comprehensive library framework for spontaneous plants in Hong Kong and conduct trials for the potential applications of these plant species also commonly found in major cities in South China. The initial findings have revealed that unlike conventional understanding, many of the 'weed' species considered as invasive are in fact native species with ecological value and often form part of the rural life and vernacular knowledge.

By advocating urban wilderness and incorporating spontaneous plants in landscape design and adaptive horticultural maintenance, this project contends that spontaneous landscape is not only part of the total experience in urban nature intertwined with cultural, economic and social nexus but also crucial to the exploration of co-existence with multispecies in a hyper-dense urban environment and a more sustainable future.

Keywords: Spontaneous plants, unintentional landscape, ruderal ecology, novel ecosystem, urban wilderness

1. Introduction

"At its core, a weed is, quite simply, a plant that people do not like because it is growing where they do not want it to grow. To put it another way, it is the context in which a plant is growing – not the plant itself – that makes a weed."

Peter Del Tredici, Wild Urban Plants of the Northeast, 2010

"If our analytical starting point for marginal spaces is reframed in relation to a closer engagement with spontaneous traces of nature, and their social and cultural significance, this can serve as a basis from which to develop a wider terrain of critical reflection over the concept of landscape itself."

Matthew Gandy, Unintentional Landscape, 2016

Proliferated in urban derelict, vacant land and marginal space, the apparently homogeneous and disorder form of spontaneous plants, conventionally categorized with the term 'weeds', are often associated with a negative impression and reckoned to be undesirable and nuisance in the urban environment. Yet, the ecosystem services and resilience of these spontaneous inhabitants, which thrive in the most human-disturbed conditions, are often overlooked and rendered invisible. Landscape studies typically examine different forms of human development based on rational and utilitarian design and planning intentions. Yet, the dynamic of spontaneous and unintentional landscapes, which are ambiguous, complex and difficult to trace the origins and flows, often remain outside the mainstream discourses.

This ongoing project contends that a closer look at these spontaneous landscape may allow us to envisage an urbanism that do not only form part of the total experience in urban nature but also crucial to the exploration of co-existence with multispecies in a hyper-dense urban environment. It aims to re-examine the human-plant symbiosis relationship by investigating the aesthetics, functions and benefits of these unintended plants and scrutinizing our perception of 'weed' from an ethnographic perspective. To understand spontaneous landscape as a widespread urban phenomenon in cities is crucial and requires a socio-ecological framework as they are indicators of global connections, heterogeneity of urban life, environmental changes and traces of social, economic and political human activities (Stoetzer, 2018). There are two major objectives in this project, namely to build up a comprehensive library framework on spontaneous plants in Hong Kong and explore trials for the potential application of these plant species also commonly found in major cities in South China.

2. Unintentional Landscape and Spontaneous Vegetation

Unintentional landscape is defined as "an aesthetic encounter with nature that has not been purposively created." it is not an "idealised landscape that conforms to some pre-existing conception of the innate relations between nature and culture, and it is not a designed landscape allied to particular social or political goals. It is a landscape "in spite of itself" (Gandy, 2016). The concept is connected to other urbanist terminologies, such as terrain vague, urban void, marginal land, loose space and vacant land, and ecological concepts, such as spontaneous vegetation, novel ecosystem, ruderal ecology and cosmopolitan ecology. In natural environment, all plants are propagated spontaneously without human intervention. The term spontaneous vegetation is anthropocentric in nature. It refers to "all plants that develop without intentional horticultural input" (Kühn, 2006). These cosmopolitan plants can be native inhabitants, species that escaped from or were left over in agricultural sites, or unintentionally introduced exotic species. Hobbs refers these patches and corridors of spontaneous vegetation as novel ecosystem which has the potential to change the functioning of ecosystem as a result of human actions but do not depend on continuous intervention or maintenance (Hobbs, 2006). The presence of spontaneous vegetation, therefore, has inherited conflict with mainstream practice of landscape design and management presuming there is a "scientific" approach to instruct interventions and maintenance based on certain order and complete control of "nature".

3. Perception of Weeds

Our perception of 'weed' is culturally constructed and ethnographic. From an ecological perspective, 'weeds' are equivalent to spontaneous plants that are adaptive to urban disturbance or artificial landscapes. They may not be the cause of environmental degradation but symptoms of it. If resilience in ecology is the ability of an ecosystem to resist, to recover from, or to adapt to adversity and to maintain its functions and services during and after disturbances, then the performance of 'weeds' could outperform many other plants. 'Weeds' are tough and can adapt to environmental stress, scavenge nutrients and water in harsh conditions. They are diverse in

morphology and can interact with other species and provide eco-system services at places no other cultivated plants could survive. Spontaneous landscape can be deemed as a natural process reclaiming urban voids from human activities with both native and non-native species, the resilient urban spontaneous inhabitants which thrive in the most disturbed urban conditions.

4. Study Area and Methodology

The aim of data collection in this project is to systematically establish a framework and compile an initial record of spontaneous plants in Hong Kong. Majority of researches related to 'weeds' aims to eradicate them from the angle of agricultural production and urban landscape management. The spontaneous plant library in this projects, in opposite, aims to establish a systematic archive for spontaneous plants and analyze their functions and benefits. Desktop research is conducted to identify the spontaneous plants commonly categorized as "weeds" with reference to local and international publications (Lee et. al, 2023; Xu, 2019; CABI Digital Library, 2024). These recorded spontaneous plant species are detailed with the botanical attributes, perniciousness, functions and benefits, ecological value and environmental stress tolerance of the plants for further analysis (Figure 1). Further study may potentially include growth rate, size, ease of reproduction, well being, toxicity etc.

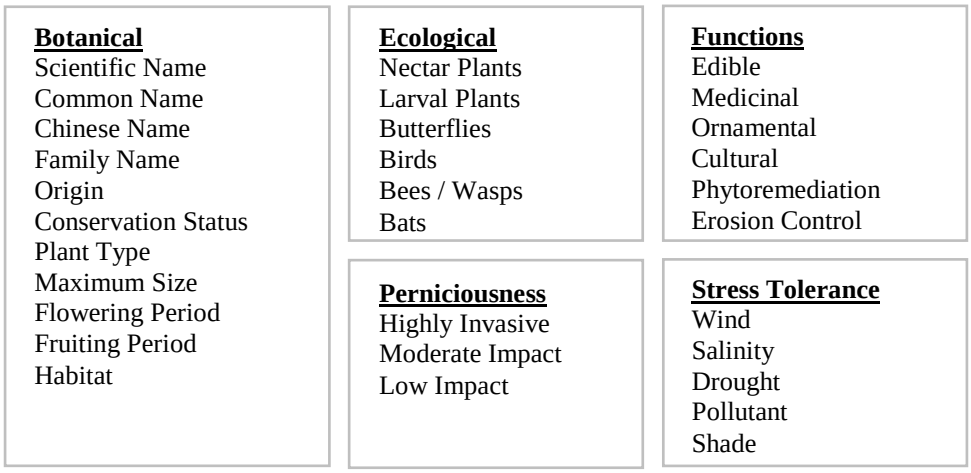

Figure 1. Data attributes in desktop research.

Spontaneous plants commonly found in field which have no signs of human propaganda are recorded. Three plots and two transects were studied to better understand the spontaneous plants in urban settings. The three plots were located at the rooftops of buildings in the Chinese University of Hong Kong, the approximate roof area ranges from 650m^2 to 2,100m^2 (Figure 2). The two transects were surveyed to represent the typical urban development mode in Hong Kong, namely the harbourfront development in Hong Kong Island which extend from the Victoria Harhour to uphill Green Belt marginal to conservation area and new town development centred with transportation hub to rural conservation area (Figure 3).

Figure 2. Survey plots located at the Chinese University of Hong Kong, Hong Kong

Figure 3. Transect surveying routes located in Central and Tin Shui Wai, Hong Kong

5. Results and Discussions

The initial spontaneous plant library has recorded 202 plant species from 62 families of which there are 163 annual / perennial herbs, 16 vines (or climbers), 14 tree species, 4 ferns, 3 shrubs and 2 palm species (in taxonomy, palm can be trees, shrubs or climbers. The curent categorization follows the common categories in landscape / planting design). Out of the 202 recorded plant species, 120 plants species were found in the three plots and two transects surveyed with photographic records. 59 plant specimen records had been collected for further archival processing.

Argument 1: Not all Spontaneous Plants are Exotic and Invasive

The general perception on spontaneous plants is that they are “exotic” and “invasive”. However, data analysis has shown that 126 out of 202 recorded plant species are native species, comprising approximately 62.4% of plant library record (Figure 4). Of the 76 non-native species defined by Hong Kong Herbarium, 26 of them are classified as naturalized. A further study on the 91 species classified by literature as medium to high perniciousness, 53 of them are in fact native species. Unexpectedly, 6 of the recorded plant species are classified as species

of conservation value protected by local ordinance and/or classified as rare or with conservation concern by IUCN.

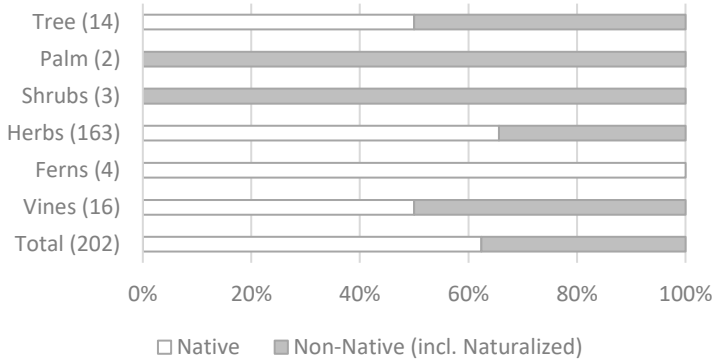

Figure 4. Native verse Non-native species (defined by Hong Kong Herbarium)

Argument 2: Not all Spontaneous Plants are Undesirable and Useless

Based on the initial desktop research, 184 out of 202 plant species have either edible, medicinal, ornamental, cultural, phytoremediation and/or erosion control functions or value. It is worth to mention that around 74% and 40% of plant species have medicinal (150 out of 202 plant species) and phytoremediation functions (81 out of 202 plant species) respectively (Figure 5).

Most people would perceive spontaneous plants as undesirable and without any functions. The traditional human-nature relationship built upon a mutually beneficial basis, forming part of the rural life, has vanished in the urban. Urban dwellers are difficult to establish any connections with plants in their livelihood except for amenity purpose.

Spontaneous vegetation in marginal space and urban voids are started to be recognized as part of the ecological infrastructure of the city extending to roles such as flood control, erosion control, accumulation of organic matter, carbon sequestration, air, water and soil purification, and the mitigation of the urban heat island effect. Not only large green space in urban environment forms habitat, urban derelict, vacant land and marginal space essentially serve their ecological functions and support life (Del Tredici, 2020; Seiter, 2016; Picket et. al, 2008). Yet, there is still a large gap in ecological studies in terms of human-plant symbiosis relationship that worth further researches

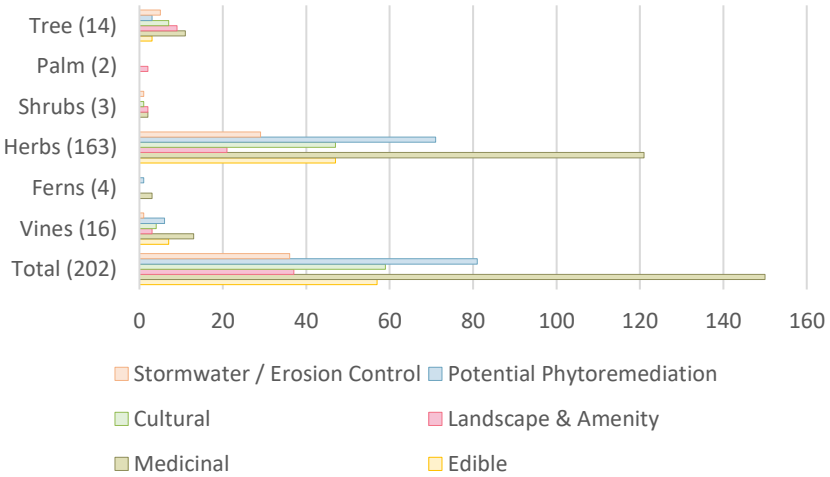

Figure 5. Functions of spontaneous plants

Argument 3: Spontaneous Plants have Ecological Value

There is a presumption and urgent need in landscape design to improve biodiversity amid the environmental challenges. However, there are few local studies on the ecological value of unintentional landscape and spontaneous plants. It is in fact a dilemma that on one hand biodiversity at conservation area without human intervention is celebrated whilst ecological value of spontaneous plants in urban area is ignored. Based on our initial study, 69 out of 202 plant species, i.e. approximately 34% of the recorded spontaneous plants have known connections to fauna, such as butterflies, bees, wasps, bats and birds, as nectar or larval plants or providing food source (Figure 6).

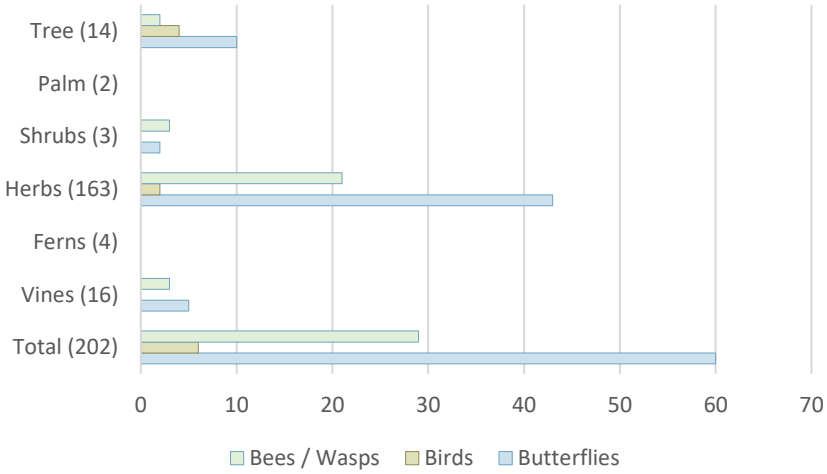

Figure 6. Functions of spontaneous plants

Many of the spontaneous plants, including non-native, interact with native fauna and provide food source. Many of the flowering plants, cultivated, naturalized and exotics are visited by bees and butterflies. For instance, *Melinis repens* attract seed-eating birds, such as the Scaly Breasted Munia, and fruit trees, such as *Morinda citrifolia*, attracts a variety of fauna, from birds to insects. Butterfly host and nectar plants, such as *Lantana camara*, also attract their respective butterfly species to the site (Hwang & Jonathan, 2019). Even the notorious *Leucaena leucocephala*, which is considered as invasive species (despite Hong Kong Herbarium has defined its locality as "cultivated and naturalized"), is found to support a specific psyllid, *Heteropsylla cubana*, and provide major food source for *Phylloscopus inornatus*, as well as other avifauna including Japanese white-eyes, bulbuls and warbles in winter (Corlett, 2005). It is not to give the illusion that all spontaneous plant species have ecological value and are suitable to urban landscape. The aim of the analysis is to reveal the fact that spontaneous plants, whether they are native or non-native do have certain ecological value and should not be overlooked. It is the lack of knowledge and research that make 'weeds' seemingly useless.

Argument 4: Potential of Spontaneous Plants in Resilient Urban Landscape

As one could imagine, spontaneous plants can thrive at the most unexpected locations – disturbed area, wastelands, roadside kerbs, concrete cracks, paving gap, drainage channels and manmade slopes – and tolerate a number of environmental stress. More than 60% of the recorded plants are known to tolerate one or more than one stresses including drought, salinity, pollutant, wind and shade which are common in urban context. 107 species are recorded to be drought tolerant and 80 species are pollutant tolerant. These characteristics are essentially crucial for the design of low maintenance and self-sustaining urban landscape (Figure 7).

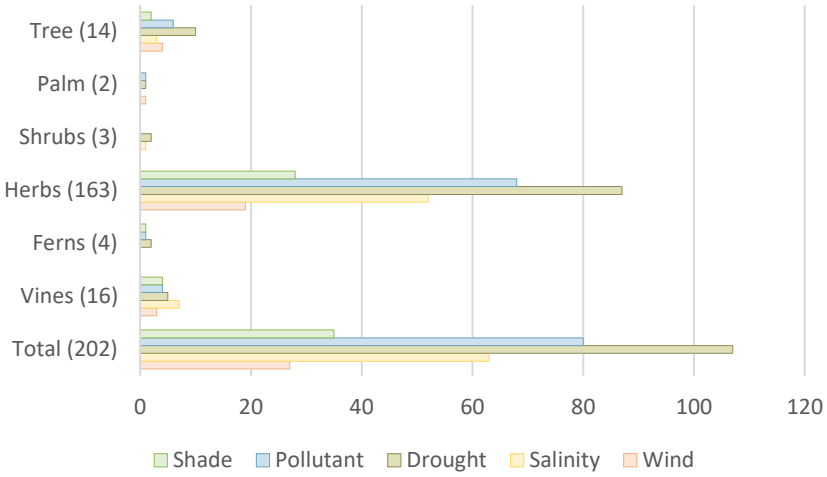

Figure 7. Functions of spontaneous plants

With increasingly rapid urbanization and climate change, hyper-dense urban environment similar to Hong Kong may become more and more common. These "concrete jungles" are habitats unsuitable to most of the ornamental plants in landscape design or woodland species, which require high maintenance input to sustain.

6. Trial Applications of Spontaneous Plants

WEEDsilience is an exhibition installation featured at the 2022 Hong Kong Shenzhen Bi-City Biennale of Urbanism \ Architecture from September 2022 to November 2022. The exhibit was an experiment utilizing spontaneous plants as the main planting palette. The 25m^2 planting area is mixed with 8 species of 'weedy' plants and ornamental Poaceae namely - *Cyperus odoratus, Cyperus surinamensis, Echinochloa crusgalli, Eleusine indica, Panicum maximum, Pennisetum alopecuroides, Muhlenbergia capillaris* and *Setaria viridis*, of which 5 species are exotic and 3 species are native to Hong Kong. Apart from *Pennisetum alopecuroides* and *Muhlenbergia capillaris*, all the plant species are not commonly employed in landscape projects (Figure 8).

Figure 8. Exhibition at Hong Kong Shenzhen Bi-City Biennale of Urbanism \ Architecture

Horticultural Maintenance

The trial has demonstrated that small intervention with minimal maintenance input can change the quality of space significantly, a sharp contrast to the normally maintenance dependent urban green space. It suggests that both native and non-native spontaneous plants can be introduced to the designed landscape without suppressing other landscape ornamental plants if planting design is carefully curated. There was no sign any of the 'weedy' plants are dominating the planting area. Apart from Muhlenbergia capillaris, all the Poaceae were able to establish with minimal maintenance. Except on the first 2 weeks, irrigation was completing absent. No other maintenance was input except grass cutting once for aesthetic purpose only.

Ecological Value

No systematic ecological survey was conducted given the short exhibition period. However, it was observed that the temporary landscaped area had promptly become a hotspot for adjacent butterflies and birds. Parnara guttata was being observed throughout the exhibition period. Apparently, the butterfly species had established its population with larvae food source offered with the Poaceae species. A group of Passer montanus had regularly occupied the space planted with Echinochloa crusgalli for consumption of plant seeds. Other common urban resident birds such as Pycnonotus sinensis and Pycnonotus jocosus. Although these birds and butterflies observed were common species, nonetheless, the spontaneous landscape still served as a temporary refuge for urban wildlife in the otherwise vacant rooftop.

Aesthetic Appreciation

Nearly all the studies on spontaneous landscape focuses on evaluating its ecological value and the economical maintenance aspects. In this discussion, the scope is expanded to aesthetic and spatial experience of human beings which would be crucial to the incorporation of spontaneous plants in landscape design and place making. Apart from exhibition visitors, the trial had attracted uncommon users including couples taking wedding pictures and tango dancing groups to hold event at the space. To explain such unexpected users, it is interpreted that the spontaneous landscape was able to offer certain stimuli which could not be found at conventionally designed landscape. Whilst spontaneity evoked the daily experience of users, its arrangement had certain complexity that induced one to explore and adventure, a sense of appreciation on different kind of aesthetic quality in urban space.

The exhibition is a very small experiment testing the idea. A much more complex processes where spontaneous vegetation passes diverse types of environmental filters and grows freely in urban area are awaiting to be uncovered. That knowledge may give us a new perspective to future landscape.

7. Conclusion

This project has analyzed the spontaneous plant species in Hong Kong and identified potential species for incorporation to landscape design projects. A trial has been carried out to explore the practicability of spontaneous plants. The initial result has demonstrated that incorporating spontaneous plants to landscape design with minimal maintenance requirements is a resilient and adaptive measure for urban landscape. A more comprehensive quantitative experiment with longer time frame, synthesizing interdisciplinary knowledge is under planning to further explore the functions and benefits of spontaneous landscape (Figure 9).

Resilient and adaptive design concepts, such as blue-green infrastructure and nature-based solutions, are celebrated as splendid landscape approaches to tackle climate change. Many of the recent projects claimed to have adapted these initiatives deploy planting with high maintenance input. The essence of these design concepts lie in their abilities to require minimal

human input and let the 'nature' to do its own job. In this regard, spontaneous vegetation deserves further researches to cumulate knowledge systematically regarding their unique characters, functions, ecological niches and interactions with other living organisms.

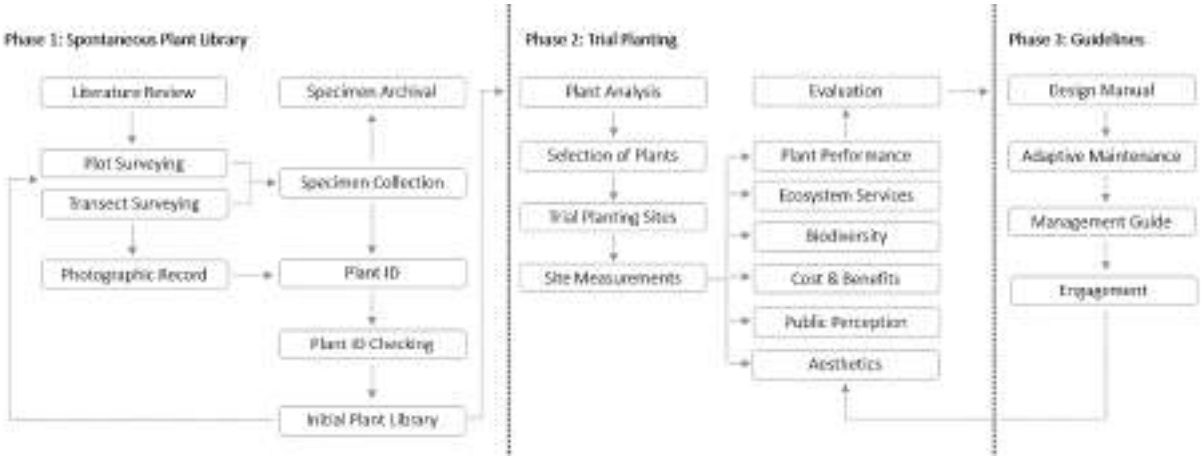

Figure 9. Wayforward for studies of spontaneous plants

Conventional design and planning dissects human-nature and urban-rural relations. The dualities have simplified the complex interactions between human activities and its environment by positioning nature as an outsider. Spontaneous vegetation challenges the perception that nature is something to be managed and utilized by human. It has formed its own system independent to human intention and find the loopholes to claim its existence. This rupture opens up the possibility that "nature" can be an integral part of the city. If the quest of design in this era is to recover an apparatus to pursue co-existence with multispecies in a hyper-dense urban landscape, we have to reframe the understanding of landscape from an epistemological perspective. To recalibrate our perception of plants will allow us to have a boarder imagination in urbanism.

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