Proposal for a Butterfly Habitat Roof Garden

Year 10 Futures Studio Project

Woodleigh School Senior Campus, Langwarrin South

Sam Cox Landscape

Introduction

The Year 10 Futures Studio Project – an extension to the Woodleigh School Senior Campus – is currently under construction and planned for completion by term 1, 2025. The building employs a novel green roof system, where planting substrate (up to 200mm in depth) is held above a rainwater detention reservoir by interlocking plastic domes, conventionally employed in concrete slabs for weight reduction. The resulting green roof resembles an extensive wicking bed, in which detained rainwater is made available for plant-use via capillary action, with the option to actively manage the water-level via top-up/overflow valves. This document, then, outlines an experimental butterfly habitat planting on the novel green roof system. It puts forth fundamental motivations, reasoning in plant selection, planting design, as well as potential maintenance/monitoring strategies to be employed. In doing so, it is intended as an initial proposal, seeking feedback from project stakeholders, teachers, and students alike.

Figure 1: rainwater reservoir formed under Cupolex domes to be employed on the green roof

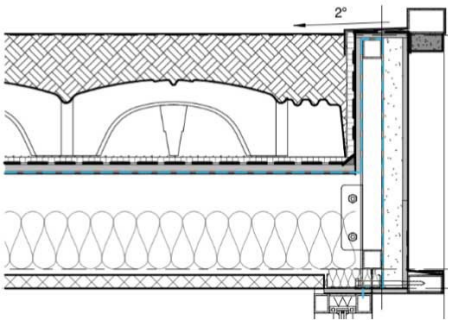


Figure 2: Detail section of the wicking bed system

Motivations

Biodiversity Value

Butterflies are key biodiversity actors in urban and semi-urban landscapes, promoting genetic diversity and flow in otherwise disconnected landscape patches and maintaining their health. In Australia, conservation concern for butterflies is informed by declining abundance and diversity, caused by a combination of habitat loss, fragmentation, degradation (caused by invasive weeds and rabbits), and specifically in urban environments the over-intensive management of green spaces. In this light, the development and adoption of urban habitat typologies for butterflies is an important task.

Contextual Affordance

The Mornington Peninsula plays host to some 46 species of native butterflies, with two immediate areas to the Woodleigh school – the Frankston Nature Conservation Reserve and the Langwarrin Flora and Fauna Reserve – being very active for butterfly observations. A butterfly habitat at the school can extend this often-overlooked dimension of faunal biodiversity into the campus, in turn offering educational opportunities relating to butterfly biology, ecology, and conservation.

Figure 1: butterfly observations sourced from iNaturalist (around the Woodleigh School Senior Campus

Green Roof Affordances

Usually, extreme heat and drought conditions on building roofs place stringent criteria on plant selection to specific plant tolerances and traits (e.g. CAM photosynthesis). This in turn strongly limits the species diversity of roof gardens and restricts their provision of biodiversity services. The green roof system employed at the Year 10 Futures Studio, however, differs as water is made readily available to plants via its wicking-bed design. This broadens plant selection criteria, allowing the inclusion of critical host plants for butterfly habitat such as the Weeping Grass (*Microlaena stipoides*) and White Clover (*Trifolium repens*).

Establishment of a habitat on the roof also prevents herbivorous predation of habitat plants by rabbits, otherwise a significant contributor to butterfly habitat degradation and population decline.

Finally, butterfly habitats require little maintenance, as desiccated leaf litter and grass stalks often form environmental niches where caterpillars pupate/overwinter. This low requirement for maintenance is suitable for a roof garden, where conducting work is often inconvenient and expensive.

Plant Selection

Host and Nectar Plants

Butterflies have a holometabolous lifecycle, going from egg to larva (caterpillar), pupa (chrysalis), and finally the adult butterfly. Between different species of butterflies, egg-laying and caterpillar feeding is often specific to plant species/families (host plants), while adult butterflies can feed from a broad

range flowering plants for nectar (nectar plants). The provision of both host and nectar plants is therefore necessary for the establishment of butterfly habitat.

Habitat Template

The key reference for the butterfly habitat planting consists in plant communities of the native volcanic grasslands, which originally covered much of Western and Central Victoria, but presently only exist as fragmented remnant patches. Generally, communities feature a variety of grass species, interspersed with drifts of low flowering herbs, some annual and some perennial. Species opted for here are perennial, shallow rooted, with good heat and drought tolerance, and most have been proven to grow well on green roofs. The list is also supplemented with species more commonly observed in grassy woodland and heathland communities, in line with the peninsula's natural environment, and making use of expanded plant selection parameters given the wicking bed system in place.

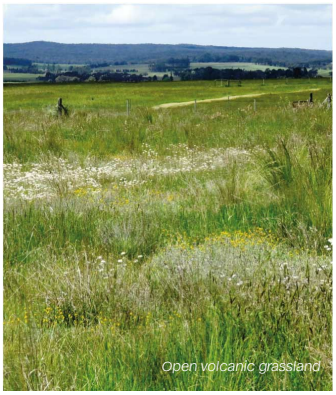


Figure 4: types of vegetation communities referenced in the butterfly habitat planting

Planting species can be divided into 1**) host grasses**, which are often caterpillar food and/or egg laying plants for the Skippers and Brown families of butterflies. 2) **host herbs**, often food and egg laying plants for the Blue family of butterflies, and 3) flowering **nectar plants**, providing nectar for all butterflies. Some species, such as *Scaevola albida* (Pale Fan Flower) may serve both as specialist host plant, as well as generalist nectar plant.

Host Grasses

Grasses are to be planted in a combination of tubestock and seed. Species include each of:

- *Microlaena stipoides* (seed) (Weeping Grass or Rice Grass)
  - Caterpillar food plant for Barred Skipper, White Banded Grass Dart, Ringed Xenica, Common Brown.
  - Egg-laying habitat for Ringed Xenica, Common Brown.
- *Rytidosperma* genticulatum (seed) (Wallaby Grass)
  - Caterpillar food plant for White-banded Grass Dart, Marbled Xenica, Shouldered Brown.
- *Poa morrisii* (tubestock) (Soft Tussock Grass)
  - Caterpillar food plant and egg-laying habitat for Marbled Xenica, Common Brown.
- *Themeda triandra (tubestock)* (Kangaroo Grass),
  - Caterpillar food plant and egg-laying habitat for r Common Brown, Ringed Xenica, Marbled Xenica, Green Grass Dart, Shouldered Brown.

Host Herbs

Herbaceous herbs also to be planted in a combination of seed and tubestock. Species include each of the following:

- *Trifolium repens* (seed) (White Clover)
  - Caterpillar food plant and egg laying habitat for Common Grass Blues.
- *Bossiaea prostrata* (tubestock) (Creeping Bossiaea)
  - Caterpillar food plant and egg laying habitat for Fringed Heath Blues and Common Grass Blues.
- *Einadia nutans* (tubestock) (Nodding Saltbush)
  - Caterpillar food plant and egg laying habitat for Saltbush Blue butterflies.
- *Glycine clandestina* (tubestock) (Variable Glycine)
  - Caterpillar food plant and egg laying habitat for Grass Blue Butterflies.

Nectar Plants (Attractant for All Species)

The following plants serve as an attractant and food source for all adult butterflies. The combined selection aims to provide butterflies with consistent flower availability through the course of the year. All species to be planted as tubestock:

- *Scaevola albida* (Pale Fan Flower)
  - Caterpillar food plant and egg laying habitat for Meadow argus.
- *Xerochrysum bracteatum* (Golden Everlasting)
  - Caterpillar food plant and egg laying habitat for the Australian Painted Lady.
- *Pimelea humilis* (Dwarf Rice Flower)
- *Kennedia prostrata* (Running Postman)
- *Chrysocephalum apiculatum* (Yellow Buttons)
- *Brachyscome multifida* (Cut-leaf daisies)

Supported Butterfly Species

Together, the habitat provides host plants to the following butterfly species of the Skipper, Brown, and Blue families:

- *Ocybadistes walkeri (Green Grass Dart)*
- *Dispar compacta (Barred Skipper)*
- *Taractrocera papyria (White Banded Grass-Dart)*
- *Geitoneura acantha (Ringed Xenica)*
- *Geitoneura klugii (Marbled Xenica)*
- *Heteronympha penelope (Shouldered Brown)*
- *Heteronympha merope (Common Brown)*
- *Vanessa kershawi (Australian Painted Lady)*
- *Junonia villida (Meadow Argus)*
- *Theclinesthes serpentata (Saltbush Blue)*
- *Zizina otis (Common Grass Blue)*
- *Erina hyacinthina (Varied Dusky Blue)*

Table 1: butterfly habitat roof garden planning list

Species	Habitat	Expected Size (H x W)	Br&S Species Supported	B Species Supported	Nectar Plants	Drought and Heat tolerance	Green roof precedence	Proposed Form of planting
Microlaena stipoides	Grassy Creeklines, Grassy Woodlands	0.2m x spreading; stems to 1m	6	0	N	Y	N	Seed
Rytidosperma geniculatum	Grasslands, Grassy Woodlands	0.2 x 0.15m; stems to 0.8m	3	0	N	Y	Y	Seed
Trifolium repens	Broadly occuring	Ground cover x spreading	0	2	L	S	N	Seed
Themeda triandra	Grasslands, Grassy Woodlands	0.75 x 0.5m; stems to 1m	5	0	N	Y	Y	Tubestock
Poa Morrisii	Grassy Woodlands	0.25 x 0.5m; stems to 0.8m	2	0	N	Y	Y	Tubestock
Bossiaea prostrata	Coastal Heath, Grasslands, Grassy Woodlands	Prostrate to 0.6m	0	2	L	Y	Y	Tubestock
Einadia nutans	Heathlands, Grassy Woodlands	0.25 x 0.7m	0	2	L	Y	Y	Tubestock
Glycine clandestina	Grasslands, Grassy Woodlands	Prostrate to 1.2m	0	2	L	Y	Y	Tubestock
Scaevola albida	Heathlands, Grasslands, Grassy Woodlands	Prostrate to 0.7m	1	0	Y	Y	Y	Tubestock
Pimelea humilis	Heathlands, Grasslands, Grassy Woodlands	0.2 x 0.4m	0	1	Y	Y	Y	Tubestock
Kennedia prostrata	Grasslands, Grassy Woodlands	Prostrate to 1m	0	0	Y	Y	Y	Tubestock
Chrysocephalum apiculatum	Heathlands, Grasslands, Grassy Woodlands	0.4 x 0.6m	0	0	Y	Y	Y	Tubestock
Brachyscome multifida	Grasslands, Grassy Woodlands	0.2 x 0.3m	0	0	Y	Y	Y	Tubestock
Xerochrysum bracteatum	Grassy Woodlands	0.5 x 0.5m	1	0	Y	Y	Y	Tubestock

Table 2: butterfly habitat roof garden planting densities

Species	m2 per Plant (Host)	m2 per Plant (Nectar)	Host Total	Nectar Total	Overall Total
Microlaena stipoides	4g/m2	4g/m2	1.38kg	1.55kg	3kg
Rytidosperma geniculatum	2g/m2	2g/m2	0.69kg	0.78kg	1.5kg
Trifolium repens	2g/m2	2g/m2	0.69kg	0.78kg	1.5kg
Themeda triandra	1	0	346	0	319
Poa Morrisii	1	2	346	194	540
Bossiaea prostrata	3	0	115	0	115
Einadia nutans	3	0	115	0	115
Glycine clandestinva	3	0	115	0	115
Scaevola albida	0	3	0	129	129
Pimelea humilis	0	2	0	194	194
Kennedia prostrata	0	3	0	129	129
Chrysocephalum apiculatum	0	2	0	194	194
Brachyscome multifida	0	2	0	194	194
Xerochrysum bracteatum	0	2	0	194	194
				Total Plants:	2239

Host Plant Palette Species

Nectar Plant Palette Species

Figure 5: Butterfly habitat roof garden plant species

Browns and Nymphs

Skippers

Blues

+ Nectar resource for other species found in area

Figure 6: Habitat roof garden hosted butterfly species

Planting Design

Host Plant and Nectar Palettes

The roof garden is to be planted with two distinct planting palettes. One comprised of specialist host grasses and herbs, largely muted in colour, and the other dominated by generalist nectar plants, with colourful floral displays. The nectar plant plantings are intended to feature mainly at the outer peripheries of the green roof; on the one hand, this serves to attract butterflies from surrounding habitats via visual stimulus, and on the other hand, disturbance to host plants is minimised as coppicing and pruning are more likely to be required against the roof edge. Consistent in either palette for soil coverage are *M. stipoides*, *R. genticulatum*, and *T. repens*, while *P. morrisii* is utilized in the nectar plant palette to enhance structural heterogeneity.

Initial Establishment

Windblown soil erosion in the initial stages of green roof establishment will be counteracted by the laying of a fine jute mesh, commonly used in revegetation. The mesh will overlay seeded soil and have apertures large enough to facilitate planting by tubestock, and will naturally biodegrade over roughly one year, in which time plantings and ground cover will have become established.

Figure 7: Jute mesh to be ued for soil retention on the butterfly habitat roof garden

Maintenance and Monitoring (TBC)

Maintenance requirements of the proposed butterfly habitat roof garden are non-intensive. Sam Cox Landscape will oversee the initial 6 months of establishment, weeding and in-fill planting as required. Long term maintenance will be undertaken by the Woodleigh maintenance crew, likely on an annual basis. Tasks will involve light pruning (late spring), weeding, and in-fill planting.

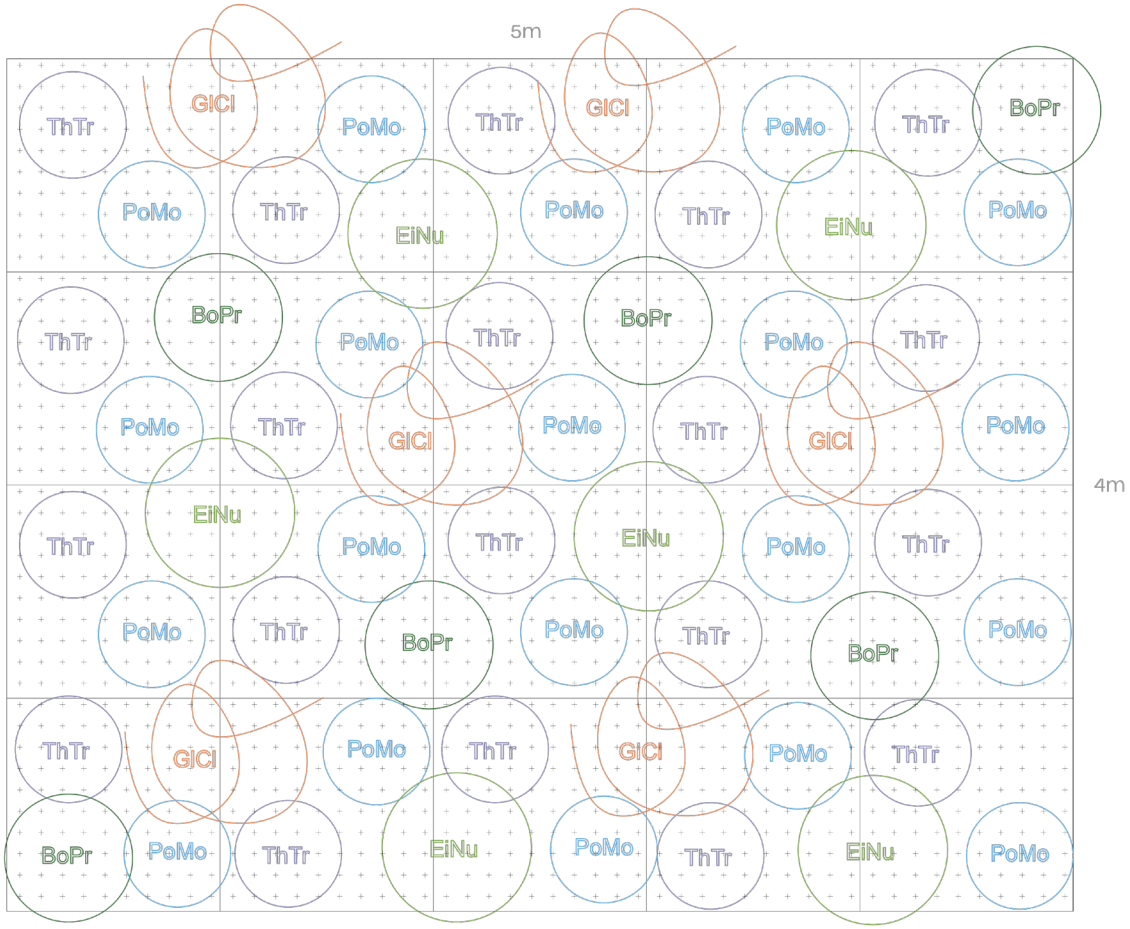
Cut grass stalks and desiccated leaf litter should be largely left in place on the green roof, as they form egg-laying and pupating habitats. Pruning should also be conducted with restraint, unless encountering overrunning individuals, as butterfly eggs are often too small to the naked eye and rest on lower leaves/stalks. Further research is required to detail maintenance techniques and timings - a Maintenance Guide, specific to each species, will be prepared as a separate document for Woodleigh School maintenance crew.

Maintenance tasks can also be undertaken by Woodleigh students during Bush Week events or as part of course learnings (Working from Height certificates required). In doing so, students can couple maintenance tasks with monitoring. The success of the habitat can be quantified by surveying butterfly abundance and diversity, with results uploaded to citizen science databases such as iNaturalist and Atlas of Living Australia.

Significant replanting of the roof garden, especially of host herbs and nectar plants, could be expected at intervals of between 5 – 10 years, in accordance with indicative lifespans. The specific scale and extent of replanting is hard to predict – for example, certain species such as *P. Humilis* (Dwarf Rice Flower) can persist for over 30 years, while grasses and clover can be expected to be self-sustaining. Other species, such as *S. albida* are short lived and will require replanting every two years. Further information relating to ongoing planting renewal will also be included in the Maintenance Guide.

Table 3: Butterfly habitat roof garden flowering times

Species	Jan	Feb	Mar	Apr	May	Jun.	Jul	Aug	Sep	Oct	Nov	Dec
Trifolium repens												
Bossiaea prostrata												
Glycine clandestina												
Scaevola albida												
Pimelea humilis												
Kennedia prostrata												
Chrysocephalum apiculatum												
Brachyscome multifida												
Xerochrysum bracteatum												



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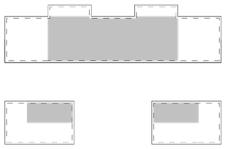
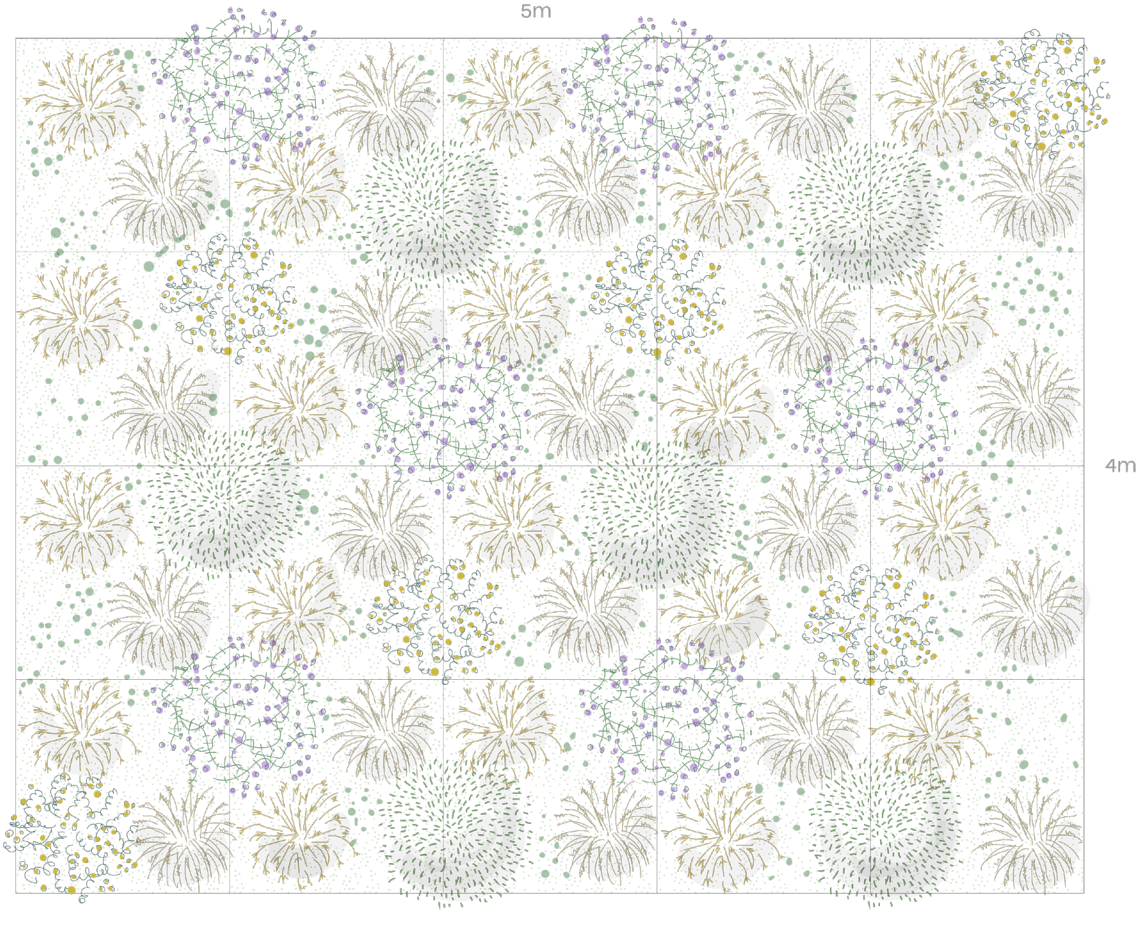


Total: 346sqm

Legend

- *Themeda triandra*
- *Poa morrisii*
- *Einadia nutans*
- *Bossiaea prostrata*
- *Glycine clandestina*
- *M. stipoides*, *R. geniculatum*, and *T. repens* seed mix



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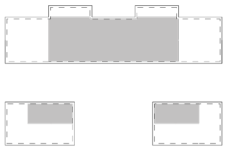

Total: 346sqm

Inclusions

Themeda triandra

Poa morrisii

Einadia nutans

Bossiaea prostrata

Microlaena stipoides

Glycine clandestina

Rytidosperma geniculatum

Trifolium repens

Figure 7: Butterfly habitat roof gardens host plant palette

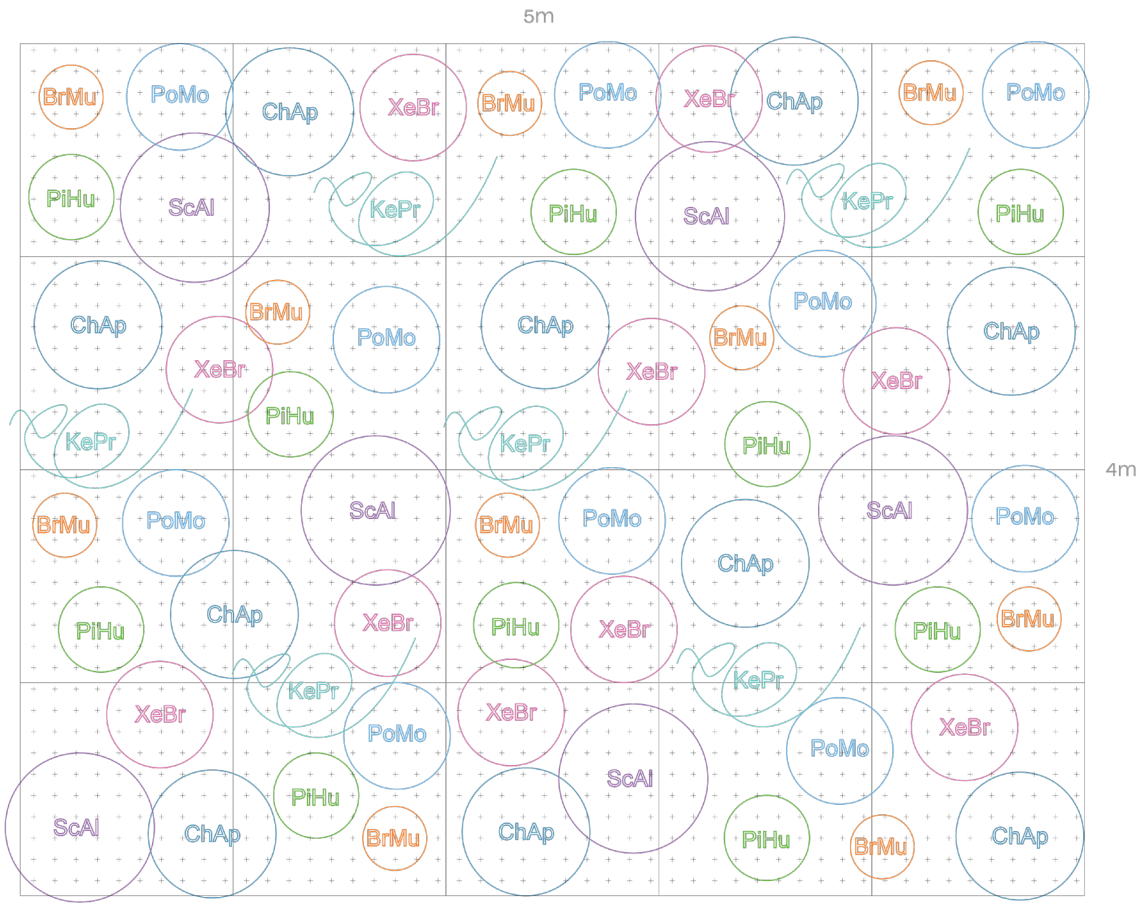

Figure 8: Butterfly habitat roof gardens nectar plant palette

General References and Further Reading

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