

FYNBOS CORRIDOR COLLABORATION FYNBOS STEPPING-STONE CORRIDOR STRATEGY

A community-focused strategy to increase socio-ecological connectivity in Cape Town

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Published in 2021.

This strategy is dedicated to the people, plants and animals of the Mother City.

Table of Contents

Table of Contents	3
Acknowledgements	5
Definitions	6
1. Introducing the Fynbos Corridor Strategy	10
1.1. Vision and Mission	11
1.2. Purpose	12
1.3. Geographic Scope	13
1.4. Approach	14
1.5. Actors	18
1.6. Chapter Outline	19
2. Fynbos Wonder: Our Invaluable Biodiversity	21
2.1. Introducing Urban Biodiversity	22
2.2. Threats to Urban Biodiversity	34
2.3. Ecosystem Services of Urban Biodiversity	38
2.4. A Way Forward	39
3. Fynbos Stepping-Stones: A Rehabilitation Method	40
3.1. The Stepping-Stone Gardens Approach	40
3.2. Fynbos Rehabilitation Goals	41
3.3. Guiding Principles of Fynbos Stepping-Stone Rehabilitation	41
3.4. Possible Negative Consequences of Fynbos Rehabilitation Gardens	54
4. Collective Fynbos Stepping-Stone Corridor Building	56
4.1. Where to Create Connectivity?	56
4.2. Fynbos Stepping-Stone Opportunities	58
4.3. Ideal Urban Fynbos Stepping-Stones	59
4.4. Creating Connectivity among Stepping-Stones	62
4.5. Identifying key focus areas	66
5. Making a Fynbos Stepping-Stone Garden	71
5.1. Stage 1: Select a Site	72
5.2. Stage 2: Assess and Imagine	75
5.3. Stage 3: Choose Plants	84

5.4. Stage 4: Design your Garde	n 89
5.5. Stage 5: Make a Work Plan	90
5.6. Stage 6: Monitor	98
Conclusion	101
Useful Resources	
References	104

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Definitions

Biodiversity	Biodiversity (biological diversity) is the total variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur. It is the 'natural wealth' of the earth, which supplies all our food and much of our shelter and raw materials ¹ .
Climax Species	Late succession Fynbos plant species that require more suitable and stable environmental conditions. These are more specialist, endangered and endemic plants that can only thrive once the pioneer species are established creating more suitable soil conditions for climax species.
Critically Endangered (CR)	An IUCN Red List status that refers to a species facing <i>extremely high</i> risk of extinction in the wild.
Ecological Corridors	An ecological corridor is a link of natural habitat, containing indigenous vegetation, which joins two or more larger areas of similar habitat. Corridors are for the maintenance of ecological processes including allowing the movement of animals and continuation of viable populations ² .
Eco-sourcing	The term is used in ecological restoration projects and refers to sourcing the most appropriate seeds or plants to be introduced at a specific location. Plant material should be responsibly sourced from the nearest naturally occurring vegetation to help maintain healthy plant gene pools.
Ecosystem	An assemblage of living organisms, the interactions among them and with their physical environment ³ .
Ecosystem Goods and Services	Ecosystem goods and services (EG&S) are the environmental benefits resulting from physical, chemical and biological functions of healthy ecosystems and include tangible goods produced from

¹ City of Cape Town Nature Conservation. 2019: 3.

² City of Cape Town Nature Conservation. 2019: 3.
³ City of Cape Town, 2018: 102.

	ecosystems (e.g. food, materials), and the material and non-material benefits provided by ecosystem processes (e.g. clean air and water) ⁴ .
Endangered (EN)	An IUCN Red List status that refers to a species facing <i>very high</i> risk of extinction in the wild.
Endemic Species	A species that is restricted to a particular geographic region, owing to factors such as isolation or in response to specialized soil or climatic conditions ⁵ .
Fynbos	We distinguish between "Fynbos" and "fynbos". Thus "fynbos" is a colloquial term for various communities in the Western Cape, often including Fynbos, Renosterveld and Strandveld. However, "Fynbos" is restricted to those communities that have a greater than 5% cover of Cape Reeds (or Retinoid). Typically it also has bulbs, heaths, proteas and elements of the endemic Fynbos plant families ⁶ .
Habitat	The area or environment occupied by a species, or groups of species, due to the particular set of environmental conditions that prevails there ⁷ .
Habitat Rehabilitation	In general, ecosystem restoration or rehabilitation refers to restorative activities that aim to reinstate a level of ecosystem functioning and do not necessarily aim for the complete recovery of indigenous ecosystems. In this document, however, habitat restoration refers to restorative activities in urban spaces which seek to rehabilitate locally indigenous Fynbos to the highest level of recovery possible.
Indigenous Species	A species that occurs naturally in an area, and therefore one that has not been introduced by humans either accidentally or

⁴ City of Cape Town. 2017: 2.

⁵ City of Cape Town Nature Conservation. 2019: 3.

⁶ Rebelo & Holmes: 4.

⁷ City of Cape Town, 2018: 102.

	intentionally ⁸ . In this document the term refers to plants that come from any part of South Africa.
Invasive Alien Species	Invasive species refers to any species whose establishment and spread threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and may result in economic or environmental harm or harm to human health ⁹ .
Locally Indigenous	A species that occurs naturally in a locally specific area. In this document the term refers to plants that are historically or currently part of the original vegetation type of that area. i.e. down to the subspecies and population genetics of that original population. In restoration activities that means genetic material from plants from the closest natural area to the proposed stepping stone.
Multi-functional Spaces	Spaces that aim to meet both social and ecological needs of people and biodiversity.
Natural Heritage	The sum total of the elements of biodiversity, including flora and fauna and ecosystem types, natural systems and processes, together with associated geological structures and formations ¹⁰ .
Natural Remnant	A natural area that has not been significantly degraded and contains indigenous flora and fauna.
Place-making	The process of planning, designing and managing shared or public spaces in such a way that it fosters pride and sense of belonging and place, and promotes health and well-being ¹¹ .
Pollinator	An animal that transfers pollen between flowers and thus assists plants with breeding. Animals are attracted by rewards of nectar, pollen, oil, scent and breeding sites ¹² .

⁸ City of Cape Town Nature Conservation. 2019: 4.

⁹ City of Cape Town Nature Conservation. 2019: 4.

¹⁰ City of Cape Town. 2017: 3.

 ¹¹ Project for Public Spaces. 2007.
 ¹² Rebelo & Holmes: 7.

Protected Areas	These are areas of high biodiversity which are formally proclaimed (protected) under the Protected Areas Act 56 of 2003. They are also referred to as Nature Reserves ¹³ .
Reference Ecosystem	An ecosystem that acts as a model for the desired outcome for habitat rehabilitation. It includes local indigenous plants and animals and ecosystem characteristics. It is usually the nearest natural remnant.
Rehabilitation Garden	Gardens that are geared towards supporting the biodiversity of Cape Town and the recovery of locally indigenous vegetation types.
Resilience	The ability of an environmental, economic, or social system to respond to disturbance by resisting damage and recovering to a functional state ¹⁴ .
Stepping-stone Corridor	Small patches of indigenous Fynbos that are close enough to one another to support keystone pollinator species. When strategically placed in areas in need of connectivity, and in close enough proximity, these 'gardens' form a stepping-stone corridor for species to move between natural habitats.
Successional Planting	Planting in successive phases (pioneer, middle succession and late succession) that aims to mimic the natural and gradual replacement of plant communities over time through active planting.
Urban Greening	The general term that describes adding plants to urban spaces to increase the presence of nature in built-up areas.
Vegetation Type	A set of plant communities that occur in a landscape. Another popular term is 'veld type' ¹⁵ .
Vulnerable (VU)	An IUCN Red List status that refers to a species facing <i>high</i> risk of extinction in the wild.

¹³ City of Cape Town Nature Conservation. 2019: 5.
¹⁴ City of Cape Town. 2017: 4.
¹⁵ Rebelo & Holmes: 9.

1. Introducing the Fynbos Corridor Strategy

At the southern tip of Africa, the vibrant city of Cape Town rests in the centre of one of our planet's smallest and most remarkable ecosystems. The Cape Floristic Region is world famous for its vast and varied landscapes and its incredible diversity of habitats and species. As one of only six recognised floral kingdoms in the world with 9,600 recorded plant species – 70% of which are endemic (found nowhere else on the planet) – the region has been identified as a biodiversity hotspot.

Much of the diversity of the Cape Floristic Region is associated with the fynbos biome, a Mediterranean-type, fire-prone shrubland. In addition to its intrinsic biological value, the fynbos biome also provides significant economic, cultural and recreational value to the region through ecotourism as well as the provision of ecosystem services and harvestable products.

However, in spite of its immense ecological and economic value, the fynbos biome is also one of the world's most threatened ecosystems. While some areas have been successfully conserved within nature reserves, which play an invaluable role in protecting urban nature, the natural vegetation of Cape Town's Lowlands (often referred to as the Cape Flats) has increasingly been removed to make way for agriculture, development and urban expansion. Ecosystems have also been damaged by pollution, over-extraction of water, alien invasive plant species and increasingly frequent fires. Much of the remaining off-reserve fynbos wilderness now exists as fragmented segments amongst farmlands and urban areas, where populations of plant and animal species are becoming too small to remain viable. To date, the city of Cape Town has lost 14 species of plants to extinction.

In addition to the ecological pressures facing the city, Cape Town also continues to battle numerous social challenges. Due to the legacy of Apartheid, it remains one of the most spatially segregated cities in the world. This can quite starkly be seen in terms of access to green space with differences in the quantity and quality of nature freely accessible to residents largely running along lines of race and socio-economic status. This has led to a situation in which many people rarely (if ever) have the opportunity to enjoy and benefit from safe and abundant green space or appreciate first-hand the wonder of the fynbos biome.

In response to these ecological and social challenges, the need for community-led fynbos rehabilitation in Cape Town is gaining traction. In most residential areas there are members of the public involved in greening private gardens and public spaces. In addition, various organisations in Cape Town have established off-reserve fynbos conservation and rehabilitation programs targeting fynbos habitats in community spaces such as parks, school yards and places of worship and along riverbanks, roads and train lines.

However, while well-intentioned, these numerous fynbos rehabilitation projects tend to be isolated and uncoordinated and, as a result, are limited in their impact. Each project has its own focus and goals, utilises a different strategy, employs a different rationale for plant selection and sourcing, and carries out different methods of monitoring, evaluation and reporting (if any at all).

As a response to this situation, a group of Cape Town-based urban greening NGOs (the Greenpop Foundation, Communitree and Ingcungcu Sunbird Restoration), funded by the Table Mountain Fund, established the Fynbos Corridor Collaboration in 2018. Over three years, these organisations, in consultation with numerous stakeholders, developed a set of guidelines for coordinated fynbos rehabilitation in Cape Town. This Fynbos Stepping-Stone Corridor Strategy, along with its accompanying <u>website and mapping platform</u>, details those guidelines.

1.1. Vision and Mission

1.1.1. Our Vision

We envisage a restored relationship between plants, insects, birds and people, through a collaborative Fynbos stepping-stone corridor, that enhances and connects urban spaces so that communities and nature can thrive together.

1.1.2 Our Mission

- To assist in the creation of a Fynbos stepping-stone garden network that reconnects people with their place, purpose and pride in our natural heritage.
- To facilitate the movement of animals and insects across Cape Town's environmentally and socially fragmented landscape by supporting the establishment of resilient,

locally indigenous Fynbos gardens which contribute to increased ecological function and biological diversity.

- To facilitate collaboration and cohesion between the various organisations undertaking off-reserve urban greening activities in Cape Town.
- To empower people from all walks of life to become environmental stewards and participate in restoring, preserving and connecting Cape Town's precious biodiversity.

1.2. Purpose

The Fynbos Stepping-Stone Corridor Strategy presents an integrated and proactive approach to addressing the need for social and ecological connectivity in Cape Town and suggests a framework for off-reserve conservation of Fynbos that can be applied to various urban contexts. This strategy aims to help coordinate action against the rapid extinction of biodiversity, weakening ecosystems, divided and hostile public spaces and the diminishing yet vital relationship between Cape Town's urban population and the natural environment¹⁶.

By collating our practical experience and knowledge into publicly-available guidelines, the Fynbos Corridor Collaboration members aim to elevate indigenous gardening and greening within Cape Town and encourage functional, coordinated urban socio-ecological rehabilitation. It is our hope that this strategy will be used by enthusiastic indigenous gardeners and greening organisations to create their own Fynbos stepping-stone gardens to provide forage and habitat for the unique but vulnerable local urban wildlife of Cape Town.

While bolstering biodiversity is, in and of itself, a worthy goal, we recognize that most spaces in urban areas do not have the luxury of existing solely for the purpose of ecological function. Instead, green spaces need to simultaneously serve human needs. As such, we also intend for this strategy to inform off-reserve gardening and greening as an act of <u>place-making</u> in which gardening is a response to unfulfilled human needs. Further insight into place-making can be found outside of this document,¹⁷ but it is highly recommended that it accompanies the ecological activities described here, particularly within public greening projects.

It is important to note that Fynbos stepping-stone gardens are different from most existing gardens because they are created with a sensitivity to *both* the positive outcomes and potential threats that come with planting plants and creating corridors. To reduce the risk of

¹⁶ Standish et al. 2012.

 $^{^{\}rm 17}$ The Integration Syndicate, Africa Centre for Cities, University of Cape Town.

the potential negative outcomes, such as introducing alien invasives, a Fynbos stepping-stone should be built by following restoration principles that are outlined in this document.

This document is not intended as an exhaustive scientific reference work on the practice of Fynbos restoration in Cape Town, nor will it teach formal coursework or scientific knowledge on ecological restoration. Rather, it aims to guide non-professional greening efforts by introducing a best practice method for off-reserve Fynbos rehabilitation. By bringing in the use of key terms, concepts and practices the aim is that they would be used consistently across various indigenous gardening and greening initiatives to help coordinate efforts towards a maximal cumulative effect, regardless of background and experience level of actors.

Building a network of Fynbos habitat is an opportunity for coming together, for creating spaces that link people and people, nature and nature, and people and nature. Through indigenous Fynbos stepping-stone corridor building, this strategy aims to meaningfully bring together individual, school and community greening action to create indigenous Fynbos habitat pockets that support local social function, while simultaneously supporting the movement of key species within Cape Town.

1.3. Geographic Scope

The scope of this strategy is restricted to the boundaries of the city of Cape Town and current Fynbos rehabilitation knowledge included in the strategy thus far has focussed primarily on threatened vegetation types found on the Cape Lowlands such as Cape Flats Sand Fynbos (critically endangered) and Cape Flats Dune Strandveld (endangered).

The strategy suggests prioritising Fynbos corridor building efforts within highly transformed urban areas which are in need of restorative action and where traditional conservation theories and methods are inappropriate due to the social purposes of the space. This rehabilitation approach is therefore distinct in that it is from the outset and by design meeting multiple social needs while fostering ecological recovery.

While this strategy and its accompanying <u>website and mapping tool</u> can be used to inform off-reserve Fynbos rehabilitation anywhere in Cape Town, it is beyond the scope of the current strategy draft to map all potential stepping-stones across the city. It is our hope that this strategy will be continuously improved and expanded as new Fynbos Stepping Stones are created and knowledge is inevitably gained.

1.4. Approach

The Fynbos Stepping-Stone Corridor approach is built around 6 key principles. These will now be further discussed.

1. Support On-Reserve Conservation Efforts First

It is critical to recognise that Fynbos stepping-stones should <u>strengthen and not detract from</u> existing efforts within Cape Town's Protected Area Network.

Cape Town's Protected Area Network includes provincial nature reserves managed by CapeNature, Table Mountain National Park managed by SANParks, 16 contractual conservation areas managed by the City of Cape Town Department of Recreation and Parks, and private nature reserves and conservation areas that have contractual agreements with CapeNature. These other protected areas and conservation areas are integral to Cape Town's Biodiversity Network (BioNet) and protected area network.

It is important to recognise all protected and conserved areas, as these are managed to stricter ecological standards than other public open space and private gardens. In most cases, rehabilitation planting outlined in this strategy is <u>not appropriate</u> or in line with the Management Plans for these sites. Instead, these sites each have their own management plans and are managed by professional ecologists with many years of experience and in-depth knowledge. This document does not intend to speak to these sites already within BioNet, but does the important work of increasing ecological connectivity *between* these sites.

To ensure a Fynbos stepping-stone supports rather than threatens the existing BioNet, it is important to closely follow the protocols outlined in Chapter 5 of this strategy. In short, first a) check that a site is not already under management by someone else and then b) get written permission from the landowner, potentially the City Recreation and Parks or Roads and Stormwater Departments, to carry out your proposed activities. Following this, pay careful attention to c) species selection for each site, d) keeping a record of where plants were originally sourced in the wild by the nursery, e) checking that alien invasives are controlled and removed from each site, and f) acquiring required permits for the plants you are working with. Any locally indigenous plant material collection and introduction (sowing/planting) must be compliant with all relevant legislation and those involved must be in possession of

relevant, valid permits. Please refer to the Western Cape Nature Conservation Ordinance (10 of 1974 as amended) Chapter VI Protection of Flora and consult CapeNature for next steps.

If created with care and caution, Fynbos stepping-stones present a way for community members to responsibly participate in building off-reserve conservation sites for Fynbos which are appropriate to their local urban context. These stepping-stones, when in close proximity, enable vital biological exchanges to take place between one another, and later with caution, between protected areas as well. This ultimately serves to enhance the resilience of Cape Town's biodiversity by increasing the area of land covered by locally indigenous plants, the degree of connection between fragments, and the number of refugia for urban wildlife in the event of disease or fire on larger reserves.

For more information on the broader biodiversity conservation landscape in Cape Town please see the following:

City of Cape Town	City of Cape Town Biodiversity report 2018
City of Cape Town	Local Biodiversity Strategy and Action Plan
Fynbos Forum	Ecosystem Guidelines for Environmental Assessment in the Western Cape
South African National Biodiversity Institute	Growing Together

2. Bridge Socio-Ecological Divides

As previously noted, Cape Town is recognised as one of the most unequal and spatially divided cities in the world. Residents of the Cape Flats have a radically different level of access to quality natural spaces and resources than residents living in the wealthier former 'white' areas that are concentrated closer to Table Mountain. Biodiversity suffers under the same historical landscape scars. The simple yet stark reality of so called 'green apartheid' that is still evident within the city can be explored <u>here</u>.

To address these enmeshed socio-ecological issues requires the facilitation of connection on various levels. The Fynbos stepping-stone framework not only aims to provide movement opportunities for biodiversity, but also to provide opportunities for connecting people by

encouraging collaboration and relationships across spatial and social divides by working toward a common goal of connecting various Fynbos stepping-stones.

3. Elevate Urban Greening and Gardening

Urban greening and gardening are general activities which add vegetation to urban areas for a variety of purposes. These activities often use a combination of indigenous plants (those originating from South Africa) and exotic species. In most residential areas there are members of the public involved in greening public and private urban spaces. It is our hope that this strategy will inform and guide the public to incorporate *locally* indigenous and endemic Fynbos vegetation into their stepping-stone gardens within Cape Town. By shifting the focus to locally indigenous species and restoration-focused methods, these protocols aim to elevate urban greening and gardening towards functional habitat rehabilitation of urban areas that support local biodiversity conservation.

What makes our work different from other gardening activities is that the goal of each Fynbos stepping-stone is to assist indigenous Fynbos rehabilitation and to reflect, insofar as possible, the corresponding historical vegetation type of the area. Indigenous Fynbos rehabilitation gardening is guided by <u>international best practice of ecological restoration</u> and adopts a policy of continuous improvement along the suggested Fynbos restorative continuum that seeks the highest level of ecological functioning to support our local biodiversity. The most important distinction is gardening with locally indigenous and endemic species, and strategically designing gardens that support key bird and insect pollinators to increase habitat connectivity in Cape Town's fragmented landscape. We therefore use gardening as a restorative act to rehabilitate Fynbos ecosystems one stepping-stone garden at a time.

People relate to nature in urban spaces differently and ascribe different terms according to their own relationship and understanding of nature. Some people prefer their green space to resemble the wildness of natural areas while others prefer a more manicured aesthetic. This stepping-stone strategy uses the term 'gardens' or 'gardening' as an entry point to invite enthusiastic members of the public to participate in Fynbos rehabilitation activities. It focuses on stewardship of nature which highlights the positive human agency in urban ecosystems. This tactic allows for increased flexibility in approaches to biodiversity conservation that allow Fynbos rehabilitation goals to fit various communities and their specific cultural contexts. In addition, we aim to use gardening to inspire urban biodiversity conservation by making the science of ecosystem rehabilitation more relatable and context specific.

4. Connect Fynbos Stepping-Stones



Fynbos stepping-stones (see example to the left¹⁸) are small indigenous Fynbos gardens that are close enough to one another to support movement of keystone pollinator species. When strategically placed in areas in need of connectivity, and in close enough proximity, these 'gardens' act as stepping-stones for species to move between natural habitats¹⁹. Fynbos ecosystems are complex and require linkages and networks among organisms to ensure the long-term survival of species and ecosystem resilience in the face of disturbance and ongoing threats²⁰.

Many of the remaining protected remnants of Fynbos in Cape Town are either too small, too fragmented or too isolated to provide such linkages and networks²¹. When done collectively, and implemented following a shared protocol, Fynbos stepping-stones are a complimentary and supportive approach to existing urban conservation efforts. There is also potential for rehabilitation to foster connection between divided communities through collective stepping-stone corridor building, where collaboration is key to the success and longevity of the stepping-stone network.

5. Move Along the Habitat Restorative Continuum

The full recovery of Fynbos ecosystems is no longer possible within Cape Town's urban landscape as key ecological processes, like burn cycles, are difficult to apply to small and fragmented Fynbos habitat patches or stepping-stones. However, most urban spaces have the potential to be enhanced to support biodiversity. This strategy aims to foster an attitude of continuous improvement along a Fynbos habitat restorative continuum that can be adaptable to various local urban contexts. It is a framework that aims to move traditional restoration theory to practice in highly social contexts by empowering and mobilizing people toward Fynbos rehabilitation action. We want to instill a philosophy of 'every bit counts' in multifunctional (both social and ecological) and highly transformed urban areas.

¹⁸ Sicirec. 2009.

¹⁹ Mnisi et al. 2021

²⁰ Holmes. 2000.

²¹ Pitt & Boulle. 2010.

6. Champion Flagship Fynbos Pollinating Species

The incredibly diverse nature of Fynbos means that these habitats are home to an extraordinary number of plant and animal species, and full of wonderful and intricate ecological adaptations, species interactions and dependencies. It is, however, beyond the scope of this strategy to suggest a Fynbos stepping-stone corridor that caters for all species in need of conservation in the city. The flagship pollinating species selected include the sunbird guild and a number of insects, including monkey beetles and bees, due to the fact that they underpin many vital processes, like pollination, and are considered to be good bioindicators (that is to say, they are very sensitive to changes in the landscape²²). Locally indigenous gardens increase natural habitat and provide benefits to a number of species, including humans²³. Focussing our rehabilitation efforts on a handful of flagship pollinators will enable rehabilitation projects to have measurable and attainable goals and visible project results to encourage continued restorative actions. It will also make it easier to introduce methods of citizen science to monitor the gardens, and apply adaptive measures accordingly, that will ultimately make Fynbos conservation more successful, accessible and pragmatic. Furthermore, planting and caring for spaces branded as Fynbos pollinator stepping-stones, creates an opportunity for interactive educational experiences between people and local biodiversity, to foster guardianship and long-term engagement in rehabilitation projects.

1.5. Actors

This document is open to a variety of actors with a range of expertise. It is aimed at existing urban greening initiatives or prospective Fynbos rehabilitation projects in Cape Town that seek to work toward a coordinated and cumulative common goal and vision. This document was specifically prepared to assist and guide any individuals, groups or organisations with Fynbos rehabilitation projects, as well as projects that have primarily social aims but could also have ecological outputs, in spaces outside conservation areas. This model of Fynbos protection is open to multiple interpretations and applications including:

- Educational outdoor gardens at schools
- Community or private edible gardens with indigenous Fynbos plants included
- Open space rehabilitation gardens in parks and marginal public open space

²² Samways. 2017: 1.

²³ Samways. 2017: 5.

• Cultural and community restoration spaces where biodiversity and people can heal alongside each other

The following users will benefit from this strategy:

- Environmental educators
- Urban greening organisations
- Cape bush doctors
- Non-environmental NPOs
- Individual and family gardeners
- Improvement districts in Cape Town
- Community groups and organisations
- Schools and student organisations
- Eco-clubs
- Office and business parks
- Scouts groups
- Churches and religious organisations
- Civic societies
- Local government departments

1.6. Chapter Outline

Chapter 1 Introducing the Fynbos Corridor Strategy	The motivation and background to developing the Fynbos Corridor Strategy.	
Chapter 2	An introduction to Cape Town's unique and diverse ecosystems,	
Fynbos wonder: our	the current state of the environment in the city, and the major	
invaluable biodiversity	threats underpinning the rapid loss in biodiversity.	
Chapter 3	An introduction to the science and theories that underpin Fynbos	
Fynbos	rehabilitation. Why Fynbos stepping-stones are a useful approach	
stepping-stones: a	to assist both urban conservation and social integration through	
rehabilitation method	place-making.	
<i>Chapter 4:</i>	A suggested high priority area most in need of social and	
Creating connectivity	ecological connectivity. Addressing biodiversity challenges in an	

	urban context and finding key opportunities for Fynbos stepping-stone sites in Cape Town.
Chapter 5:	An introduction to several best practice protocols to guide
Fynbos stepping-stone	individuals and organisations in creating Fynbos stepping-stone in
protocols	several contexts.

2. Fynbos Wonder: Our Invaluable Biodiversity

The Cape Lowlands, more commonly known as the Cape Flats, sit between Table Mountain on the west and the Stellenbosch Mountains of the east. The indigenous vegetation cover of the mountains has been naturally protected from development and farming due to the difficulty and expense of building and farming slopes. However, without this geological shelter, the Cape Flats have been, and continue to be, under severe pressure from numerous types of human activity including agriculture, development and urban expansion.

In spite of the planning challenges associated with conflicting priorities for this urban space, there have been significant conservation and restoration success stories from nature reserves located on the Cape Flats. The Rondevlei Nature Reserve (which forms part of the False Bay Nature Reserve) has, for many years, hosted reintroduced hippopotamuses which have successfully improved ecological function on the reserve by controlling the alien invasive grasses. It also experimented with the reintroduction of a small group of Eland to control the overgrowth of large shrubs which were outcompeting lower growing indigenous plants. The stunning *Erica verticillata*, or whorled heath, that went extinct due to housing expansion and over harvesting has also been successfully reintroduced and hosted at a few of the remaining areas of wetland under conservation in Cape Town.

Although no one will be adding a hippo to their garden, these on-reserve restoration success stories can provide inspiration for activities in public and private off-reserve spaces as well. With an improved understanding of the fynbos biome, which is described in this chapter, we can start developing the skills to restore it within local gardens and public spaces and create more of the habitats needed for wildlife to flourish within Cape Town's urban areas.

This chapter details the components and functions of Fynbos from a scientific perspective and describes the key Fynbos drivers and processes such as pollination and challenges such as habitat loss and fragmentation. This technical information allows for an understanding of how Fynbos functions, which is an essential foundation for restoration. However, scientific knowledge should also, ideally, be complemented with other ways of understanding and valuing nature held within the local community that are just as important in building sustainable cultural practices for our future.

2.1. Introducing Urban Biodiversity

Cape Town is abundantly rich in biological diversity and has been awarded the title of being the most biodiverse city in the world²⁴. From mountain ranges to sandy flats to wetlands to oceans, Cape Town's exceptional biophysical diversity has resulted in an array of habitats that support a vast variety of flora and fauna. We share the city with an estimated 3400 plant species, 74 mammal species, 374 bird species, 65 species of reptiles, 27 amphibians and thousands of insects and invertebrates.

2.1.1. Terrestrial Diversity

2.1.1.1. Flora

As previously introduced in Chapter 1, Cape Town is located in the south-west biogeographical region of the Cape Floristic Region (CFR), the smallest and richest of only 6 floral kingdoms in the world. Fynbos is the dominant historical vegetation type found in Cape Town. Viewed from afar, the low shrubbery may seem rather unimpressive, but at closer glance the extraordinary diversity is clear.

The biophysical variation across Cape Town's landscape, including a wide range of soil types, topographic differences and rainfall patterns, has created the conditions for 20 <u>different</u> terrestrial vegetation types²⁵ to exist within the city's borders. Of these 20 types, seven are <u>endemic</u> to Cape Town and found nowhere else on earth; Cape Flats Dune Strandveld (EN), Cape Flats Sand Fynbos (CR), Lourensford Alluvium Fynbos (CR), Peninsula Granite Fynbos (CR), Peninsula Sandstone Fynbos (CR), Peninsula Shale Fynbos (VU) and Peninsula Shale Renosterveld (CR). The below table provides further information and categorisation of these vegetation types.

Four Broad Vegetation Categories in Cape Town²⁶

Vegetation Categories	Description	Vegetation types
Mountain Fynbos	Found on the upper and lower mountain slopes.	1. <u>Peninsula Sandstone</u> <u>Fynbos</u>

²⁴ City of Cape Town, 2018: 2.

²⁵ National Biodiversity Assessment 2018 Terrestrial Threat Status

²⁶ City of Cape Town. 2018. *State of Environment 2018 Report*: 12-13.

	Plants that characterise this vegetation type include proteas (<i>Proteaceae</i>), such as the King Protea (<i>Protea</i> <i>cynaroides</i>), Sunshine Conebush (<i>Leucadendron</i> <i>salignum</i>) and Tree Pincushion (<i>Leucospermum</i> <i>conocarpodendron</i>), as well as Cape reeds (<i>Restionaceae</i>), Ericas (<i>Ericaceae</i>) and other fine- leaved shrubs.	 Kogelberg Sandstone Fynbos Western Coastal Shaleband vegetation Elgin Shale Fynbos Peninsula Granite Fynbos Boland Granite Fynbos Cape Winelands Shale Fynbos
Lowland Fynbos	Found on the Cape Flats and coastal plains. Plants that characterise this type of fynbos include numerous Erica species, proteas such as the Cape Flats Conebush (<i>Leucadendron levisanus</i>), Cape reeds (<i>Restionaceae</i>) and bulbous plants of the lily and iris families.	 Cape Flats Sand Fynbos Atlantis Sand Fynbos Hangklip Sand Fynbos Lourensford Alluvium Fynbos Swartland Alluvium Fynbos
Renosterveld	The vegetation type is characterised by low, small-leaved shrubs of one to two meters tall. It is dominated by Renosterbos (<i>Elytropappus rhinocerotis</i>) and comprises of ericoids with a ground layer of grasses.	 Peninsula Shale Renosterveld Swartland Shale Renosterveld Swartland Silcrete Renosterveld Swartland Granite Renosterveld
Strandveld	Grows in alkaline coastal sands and dunes.	1. <u>Cape Flats Dune</u> <u>Strandveld</u> : contains

Despite this incredible ecosystem diversity, the IUCN Red List status of Cape Town's vegetation types is alarming; 10 of the vegetation types are classified as *Critically Endangered*, three are listed as *Endangered*, four are listed as *Vulnerable* and only two listed as *Least Concern*. The reasons for the current state of degradation of these vegetation types are numerous and tied to the characteristics of each particular vegetation type.

While Mountain Fynbos has largely been safe on mountain slopes, the same cannot be said for Lowland Fynbos. This type of vegetation, which grows on large swathes of land on the Cape Flats, prefers acidic, nutrient-poor soil. While it, historically, would not have been able to support large game, this vegetation type does provide a home to smaller animals, unique birds, insects and collection of highly unique plant species prized for their beauty worldwide. Over the last few hundred years, urban development and unsustainable wildflower harvesting have transformed Lowland Fynbos into an unrecognisable urban landscape.

While Lowland Fynbos is generally contained on the Cape Flats, Renosterveld historically grew on large swathes of land north of Cape Town. This vegetation prefers rich soil and includes a ground layer of grasses, which in the past supported herds of grazers and, in turn, large predators. However, Renosterveld's rich soil was eventually its downfall as this land was transformed into farmland. Today, Renosterveld areas are largely utilised for wheat cultivation with the exception of a network of protected areas under owner-agreed stewardship programmes such as with Cape Nature.

Lastly, Strandveld can be found surrounding Philippi in the south and Blouberg in the north. This vegetation type prefers to grow in beach sand which is less acidic and more nutrient rich than Lowland Fynbos soils. Strandveld vegetation would have historically supported large game such as hippo and eland. It was generally hard to access amongsts dunefields and seasonal floods, and retained little water, and was therefore the less desirable farming land. Today, Strandveld areas are largely utilised for glass manufacturing, small scale farming in Philippi and housing and other development.

2.1.1.2. Fauna

Cape Town's rich Fynbos habitats still support a diversity of faunal life, however, most of the animals are rather small, inconspicuous, often nocturnal and occur at low densities²⁷.

2.1.1.2.1. Mammals

There are 83 mammal species thought to occur within Cape Town²⁸. Most are confined to nature reserves and their inconspicuous and nocturnal nature makes them difficult to observe.

2.1.1.2.2. Insects & Invertebrates

Cape Town is exceptionally rich in insects and other invertebrates, however, the exact number is unknown. The lack of data and loss of habitat means that we may be losing species we do not even know exist.

2.1.1.2.3. Amphibians

Cape Town is home to 27 indigenous amphibian species of which 10 are threatened with extinction. Some species have been observed at only a few small sites in the city²⁹.

2.1.1.2.4. Reptiles

An estimated 65 species of reptile can be found in Cape Town of which 8 are threatened with extinction. Some species, like the <u>Geometric Tortoise</u> and <u>Southern Adder</u>, are now considered locally extinct.

2.1.1.2.5. Birds

The large diversity of habitats means that over 400 bird species can be found in the Cape

²⁷ City of Cape Town. 2018. *City of Cape Town Biodiversity Report*: 31.

²⁸ City of Cape Town. 2018. *City of Cape Town Biodiversity Report:* 33.

²⁹ City of Cape Town. 2018. City of Cape Town Biodiversity Report: 31.

Town area³⁰. Of special significance are the 6 fynbos endemic birds: Protea Canary (*Crithagra leucoptera*), Cape Siskin (*Crithagra totta*), Victorin's Warbler (*Cryptillas victorin*i), Cape Rockjumper (*Chaetops frenatus*), the nectar-feeding Orange-breasted Sunbird (*Anthobaphes violacea*) and Cape Sugarbird (*Promerops cafer*).

2.1.2. Freshwater Diversity

In addition to having notable terrestrial ecosystem diversity, Cape Town is also home to a considerable network of rivers, waterways and wetlands. These freshwater systems provide habitat for five indigenous fish species, two of which are listed as data deficient and a third is already considered to be extinct. They are also important habitats for some reptiles, like Marsh Terrapins, and provide breeding grounds for fish, invertebrates, frogs and toads. These freshwater systems also act as natural infrastructure for the management, treatment and conveyance of stormwater and treated wastewater³¹ throughout the city. Historically, large areas of the Cape Lowlands were covered with seasonal and perennial wetlands that were interconnected by the groundwater system. Today, Cape Town still supports a number of wetlands, vleis and rivers. Important remaining permanent freshwater wetlands include Rondevlei, Zeekoevlei and Princessvlei and vital seasonal wetlands found at Edith Stephens Nature Reserve (proclaimed Protected Area) and Kenilworth Racecourse. In addition, Zandvlei is the only functioning estuary on the False Bay Coast. However, outside of these areas, many freshwater systems have been modified, drained and canalised³². These modifications of natural freshwater systems, together with pollution and invasive species, are threatening our freshwater biodiversity and degrading natural habitats.

2.1.3. Subterranean Diversity

Below the ground exist a complex ecosystem of bacteria, fungi, protists and animals interacting to promote plant growth³³. There is a close link between the unique diversity of Fynbos above ground and the diversity in soils below ground as many microbial populations are endemic to the area³⁴. A large portion of the geographical focus area for this strategy has soils that are naturally acidic, low in nitrogen (N) and phosphorus (P) and rely on healthy microorganisms and mycorrhizal relationships in the soil to facilitate nutrient uptake. The composition of these communities are strongly affected by abiotic factors like soil pH,

³⁰ City of Cape Town. 2018. City of Cape Town Biodiversity Report: 32.

³¹ City of Cape Town. 2018. State of Environment 2018 Report: 36.

 $^{^{\}scriptscriptstyle 32}$ City of Cape Town. 2018. City of Cape Town Biodiversity Report 2018: 36.

³³ Jacobs et al. 2020: 3.

³⁴ Jacobs et al. 2020: 1.

moisture and availability of nutrients³⁵. It is therefore important to have a holistic view of urban conservation that considers soil biodiversity as it provides the foundation for fauna and flora species to thrive.

2.1.4. Surviving Fire

Fire plays a natural and essential role in sustaining healthy fynbos ecosystems. In Cape Town, it is not a matter of *if* vegetation will burn, but *when*. Fynbos needs to burn roughly every 10 to 15 years and Cape Town's hot, dry and windy summer months create ideal conditions for regular fires. The fire cycle is naturally longer in the mountains, and shorter for the Renosterveld. Strandveld is not fire dependent but has a significant proportion of bird-dispersed species, numerous geophytes and resprouters, and different fire strategies for dune slacks vs dune ridges. These dune ridges host thicket that burns less frequently than the grassier dune slacks.

Most Fynbos plants are designed to burn with their fine leaves containing oils and resin³⁶. Ash from burnt vegetation provides essential nutrients for healthy plant growth³⁷ and chemicals in the fire smoke stimulate the germination of many Fynbos plant species. Furthermore, burn cycles serve to eliminate old dying plants and stimulate germination, reseeding and resprouting for natural regeneration. Without fire, mature fynbos plants eventually deteriorate and die without the opportunity for the regeneration process to occur.

When Fynbos wildfires strike, many people become concerned about the impact on local wildlife. However, while many animals do perish in these fires, most of the animals that live in Fynbos habitat have adapted to survive fires. For example, mice, mole rats and snakes use underground burrows to escape the scorching flames. Padloper and Geometric Tortoises time their breeding seasons to avoid fire by laying their eggs underground in spring and early summer to ensure that, if adults do not survive the fire season, the eggs have a chance to hatch in autumn. Many birds also breed during winter and spring so that young birds are able to fly by the time they have to escape summer fires³⁸. <u>This video</u> provides more information about the relationship between Fynbos and fire.

³⁵ Jacobs et al. 2020: 5.

³⁶ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 8 - Surviving fire.

³⁷ Fernkloof Nature Reserve. No date. Ecology of the fynbos region.

³⁸ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 8 - *Animal survivors*.

2.1.5. Mycorrhiza Symbiosis

In many Fynbos plants there is a symbiotic relationship between the plant roots and fungus in the soil. This relationship is referred to as mycorrhiza. The mycorrhizal fungus acts as soil nutrient-absorbing organs for plants³⁹ by threading, penetrating and covering plant roots, essentially adding additional root hairs that increase absorption of water and nutrients from the soil. In turn the fungus absorbs carbohydrates produced by the plant. This intricate interaction is essential for Fynbos growing in nutrient poor soil and for surviving harsh climatic conditions like droughts because they are able to access resources beyond the reach of their own root system.

2.1.6. Surviving Hot Dry Summers

2.1.6.1. Keeping Leaves Cool

Fynbos plants have various adaptations to help them keep their leaves cool during the hot and dry summer months. Some have leaf colours like grey and silver to reflect more light and heat, for example, the <u>Silver Tree</u> (*Leucadendron argenteum*). Other plants, like <u>Wild</u> <u>Rosemary</u> (*Eriocephalus africanus*) and <u>Bietou</u> (*Osteospermum moniliferum*), have leaves with a woolly or hairy coating that make them appear grey. Their leaves also have a waxing coating to reduce water loss. Other plants keep cool by growing upright rather than flat thereby exposing only the tips of the leaves to the midday sun. In addition, some plants grow so that older leaves shade the younger leaves on the stem.

2.1.6.2. Deciduous Geophytes

Many Fynbos plants, like <u>Arum Lilies</u> (*Zantedeschia aethiopica*), Gladiolus, Sorrels, Moraea and Watsonias, are deciduous geophytes that survive the dry season by remaining dormant underground. During the summer they have no leaves and their bulbs or corms lie dormant in the soil. These plants grow when the first rains set in during Autumn, flower and produce seed during Spring and die back again in Summer.

³⁹ Allsopp and Stock. 1993: 93.

2.1.6.3. Leaf Size & Texture

Most Fynbos plants and shrubs, like <u>Blombos</u> (*Metalasia muricata*), Ericas, <u>Cape May</u> (*Coleonema album*), <u>Renosterbos</u> (*Dicerothamnus rhinocerotis*) and <u>Tortoise Berry</u> (*Muraltia spinosa*), have woody stems and small hard leaves. It is said that the fine-leaved appearance of many of the plants is where the name "Fynbos" was derived. Plants lose most of their water through pores in their leaves. Smaller leaves help the plants to lose less water vapour during evaporation. The hard leaves of the plants are as a result of very strong cell walls that help leaves and stems keep their shape and prevents the cell walls from collapsing when they lose too much water during the summer months. Some plants, like Cape Reeds, have no leaves at all to prevent water loss during the dry season. Instead they have green stems in order to photosynthesise⁴⁰.

2.1.6.4. Surviving Seeds

Plants known as annuals complete their life cycle in a single year. During the dry season the seeds survive in the soil without any rains. After the rains in Autumn the seeds germinate, plants grow during winter and by the time Spring comes, the plants flower and are pollinated by bees and other insects. By the end of Spring, the flowers have produced seed and the plants die back again⁴¹. A common example of this process is the <u>Rain Daisy</u> (*Dimorphotheca pluvialis*). These and other spring flowers form a spectacular carpet display every year on the Cape Flats.

2.1.7. Pollination

The diversity of Fynbos is maintained by birds, insects, mammals and wind. Studies indicate that 83% of Fynbos plants are insect pollinated, 12% wind pollinated, 4% bird pollinated and fewer than 1% are pollinated by mammals (rodents and genets)⁴². Intense rivalry exists between plants species to attract pollinators and some flowers are pollinated by dozens of different species while others have evolved closely alongside a single, highly specialised pollinator⁴³.

⁴⁰ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 8 - Reducing water loss.

⁴¹ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 8 - Avoiding drought.

⁴² Fernkloof Nature Reserve. No date. Ecology of the fynbos region.

⁴³ City of Cape Town. 2018. State of Environment 2018 Report: 13.

2.1.7.1. Nectarivorous Bird Pollinators

This is a group of nectarivorous birds that play a keystone ecological role holding pollination webs together. Around 4% (amounting to some 400 plant species) of Fynbos vegetation is pollinated by the Sunbird guild (Malachite Sunbirds, Southern Double-collared Sunbirds and Orange-breasted Sunbirds) and the Cape Sugarbird. Each species has evolved alongside the unique Fynbos vegetation and performs important and sometimes highly specialized and irreplaceable pollination roles within its environment. In Cape Town the natural landscape is highly fragmented where remaining Fynbos remnants, and other mixed used natural spaces, are engulfed by urban development that is hostile to these species. These flying pollinators are essential helpers of urban conservation as they act as links between the isolated natural habitats to rescue vulnerable plant populations from inbreeding depression. This allows remaining Fynbos to maintain strong gene pools that will make locally indigenous plants more resilient to the current threats they face⁴⁴. However, these species respond very differently to urbanisation; not all of them are able to overcome current urban barriers in order to maintain their functional role in the last remaining remnants of Fynbos in the city.

2.1.7.1.1. Cape Sugarbird (Promerops cafer)

The Cape Sugarbird is endemic to fynbos and pollinates Proteaceae plant species, like proteas and pincushions, and may visit a few hundred plants a day. They migrate along altitudinal gradients in search of nectar yielding flowers which become seasonally available at different altitudes⁴⁵. During the autumn and winter periods they rely heavily on the abundant flowering Protea species and will move in response to available flowering resources. They are mostly restricted to protected areas on the mountains and appear to be absent from Cape Town's urban landscape, indicating high sensitivity to urban barriers. Their larger body size may also play a role as they require more nectar resources and urban areas might not provide enough of the resources for 'refueling'. Being restricted to protected areas, Sugarbirds and the plants they pollinate are at risk from the many issues related to habitat fragmentation and isolation. As a result, their key functional pollinating role is absent in urban areas. However, they have shown to be quite tolerant of urban environments if resources are abundant and utilise a range of non-indigenous nectar producing plants in urban gardens. Additional food sources in urban areas might help populations when flowering season in the protected areas provide low resources or if fire temporarily kills back food sources in natural habitats⁴⁶.

⁴⁴ Pauw and Louw. 2012: 1.

⁴⁵ Sandberg et al. 2016: 6.

⁴⁶ Wright and Lee. 2017: 16.

2.1.7.1.2. The Sunbird Guild

Orange-breasted Sunbird (Anthobaphes violacea)

Orange-breasted Sunbirds are Fynbos endemics, mostly associated with Erica plant species which have long tubular flowers. As with the Cape Sugarbird, they seasonally migrate along altitude gradients in search of flowering plants. Their specialised ecological role within Fynbos makes them vulnerable to habitat loss and fragmentation. They appear to be very reluctant to leave Fynbos, and thus are vulnerable to urban barriers and alien plant invasion. They are highly sensitive to road traffic and some studies suggest they are quite fearful of humans. Thus they are mostly confined to higher altitudes in Cape Town's protected areas and, although not unable to, are unlikely to penetrate urban areas unless their needs are met to allow them to perform specialised pollination functions in the city⁴⁷.

Southern Double-collared Sunbird (Cinnyris chalybeus)

Southern-Double-collared Sunbirds are considered more generalist pollinators as they are able to exploit nectar from flowers with both short and long tubes. These birds are small and do not require large amounts of food, however, they must feed frequently and thus nectar supply needs to be consistent. They are less sensitive to the effects of urbanisation than the other sunbirds, and as such are a common feature in urban gardens where they utilise many non-indigenous species. To an extent, the Southern-Double-collared Sunbird may be able to replace the lost services of the Orange-breasted Sunbirds in urban areas as they have similar bill lengths. However, due to their generalist role they may prefer urban gardens where they have enough resources, resulting in reduced pollinator-plant mutualism and interaction in the small, isolated Fynbos remnants within urban areas.

Malachite Sunbird (Nectarinia famosa)

Fynbos plants with long tubular flowers rely entirely on the long bill of the Malachite Sunbird for pollination. Their sensitivity to urbanisation is of particular concern as they are the exclusive pollinators of flowers with tubes longer than 35mm. These birds are now found in places like False Bay Nature Reserve, Rondevlei Section. They rely heavily on the resources provided in natural areas as they do not venture more than 1km from the nearest natural habitat into the city. Their absence across Cape Town's

⁴⁷ Pauw and Louw. 2012: 4.

urban landscape has severe implications for plants in urban conservation areas that rely on this specialist species for pollination⁴⁸.

2.1.7.2. Insect Pollinators

Fynbos insects are keystone to the ecosystem, primarily through their pollination function. These include, among others: beetles, flies, butterflies and moths, solitary and honey bees, and wasps. This strategy focuses on maximizing insect diversity through maximising plant diversity in each indigenous garden. Notable species include:

2.1.7.2.1. Monkey Beetles

Fynbos is a hotspot for monkey beetle diversity where they occur in a wide range of shapes, sizes and colours. They play a key role in Fynbos habitats as they are an important source of food for birds, other insects and spiders. They are also pollinators of many plant species, especially daisies and bulbs, and the beetle's larvae serve as important decomposers of organic matter in soil⁴⁹. Loss of habitat, inappropriate mowing and invasive grass species pose a major threat to monkey beetles in Cape Town and addressing these by designing landscaping for their food and shelter habitat needs and suspending mowing in spring is essential⁵⁰.

2.1.7.2.2. Cape Honey Bee (Apis mellifera capensis)

The Cape Honey Bee is endemic to the Fynbos region and pollinates around 85% of fynbos flowers. They are attracted to yellow, blue and mauve flowers and are unable to detect the colour red⁵¹. Wild bee populations require a wide variety of pollen and plant products to sterilise their hives and support their immune systems. It is also important to protect local bee populations as they are genetically adapted to local environmental conditions such as vegetation types and local weather patterns, which vary greatly across Cape Town. Habitat loss and commercial honey production pose a threat to local Cape Honey Bees; despite the high plant diversity of fynbos, it generally has low nectar and pollen production. Local bees therefore have to compete with potentially millions of commercially introduced bees for resources. Commercial hives also introduce diseases and have resulted in hybridization

⁴⁸ Pauw and Louw. 2012: 4.

⁴⁹ Colville, J. 2013.

⁵⁰ Reference Peta Brom's thesis to be submitted March 2021.

⁵¹ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 9 - Lowlands.

between different species, which compromises the genetic integrity of these local habitat specialists⁵².

2.1.7.2.3. Long-proboscis flies (Moegistorhynchus longirostris)

The Long-proboscis fly or 'Long-tongued' fly has a tongue of up to 8 cm long; that is five times its body length and the longest proboscis relative to its body size of all known insects⁵³. This incredible species uses its proboscis to suck out the nectar of long, narrow tubes of flowers. They are attracted to pale flowers with red markings and are the exclusive pollinators of at least 20 species of Iridaceae, Geraniaceae and Orchidaceae, including the Long-tubed Painted Lady (*Gladiolus angustus*) and the Pypkalossie (*Ixia paniculata*).

2.1.7.2.4. Carpenter Bee (Xylocopa caffra)

Carpenter bees produce a loud buzzing sound caused by the vibration of its wings to collect pollen. They are responsible for pollination of many flowers including the Sea Rose and many flowers in the Pea family⁵⁴.

2.1.8. Seed Dispersal

As most plants grow in a single location they require wind and a variety of animals as agents of seed dispersal. Fynbos plants naturally grow in nutrient poor soils therefore very few are able to produce fleshy fruits. Instead, most plants produce small hard seeds that are easily dispersed by wind or ants. Many Fynbos plants, like the Rondevlei Spiderhead (*Serruria aemula var. foeniculaceae*) and the Flats Silkypuff (*Diastella proteoides*), rely on indigenous Harvester Ants to disperse, 'plant' and safely store their seeds until conditions are favourable for germination. The ants are attracted by a nutritious coat around the seeds and they are dragged into underground burrows. The coating gets eaten but the seeds are left unharmed in the soil, protected from birds and mice, where it can survive for years until the next burn cycle⁵⁵. Another example is the Karoo Prinia bird which lines its nest with the fluffy seeds of Wild Rosemary plants. After the chicks have grown, the nest disintegrates and the seeds are dispersed. In addition, Molerats help with underground geophyte dispersal as they feed on corms and bulbs.

⁵² City of Cape Town. 2018. City of Cape Town Biodiversity Report: 35.

 $^{^{\}scriptscriptstyle 53}$ Barraclough and Slotow. 2010.

⁵⁴ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 9 - Lowlands.

⁵⁵ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 8 - Reseeding.

Some Fynbos plants that do produce fleshy fruits and berries rely on interactions with animal species to disperse their seed. The Bietou berries attract birds, like the Cape Bulbul, who will eat and disperse the seeds in their droppings. The Tortoise Berry seeds are dispersed by tortoises who rely on the juicy red berries for food and moisture during the dry season. The <u>Sour fig</u> (*Carpobrotus edulis*) fruits are an important source of food for mammals, like Baboons and rodents. The seeds inside the tasty fruits are in turn dispersed through mammal droppings⁵⁶.

2.2. Threats to Urban Biodiversity

Cape Town's unique landscape harbours a wonderful array of biodiversity, however, the city's rich natural history is severely impacted by current styles of urban development and land-use practices, resulting in the destruction and fragmentation of the last remaining natural Fynbos habitat. This continued loss of biodiversity poses a challenge to creating equal access to high quality nature. Moreover, this trend of loss is difficult to shift as our biodiversity is shaped by a complex entanglement of political, social, geophysical and ecological issues. These issues will now be further discussed.

2.2.1. Habitat Loss & Fragmentation

Habitat loss and fragmentation is one of the main challenges of conserving biodiversity in urban areas. Cape Town's urban areas have expanded rapidly in the last eight decades resulting in the loss of around 62.9% of the city's natural habitat⁵⁷ due to development pressure to meet human needs and desires. This loss and fragmentation of natural habitat is associated with increased isolation of natural areas, a decline in plant and animal populations, change in disturbance regimes and microclimates, genetic deterioration, altered species interactions, change in biological processes and ultimately may lead to pollination mutualism collapse⁵⁸.

Specifically, the Cape Lowlands, more commonly known as the Cape Flats, face an intensifying biodiversity crisis with high levels of habitat loss and fragmentation. This area has the highest concentration of threatened plants per hectare of remaining vegetation in the

⁵⁶ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 9 - Dispersal.

⁵⁷ City of Cape Town. 2018. State of Environment 2018 Report: 14.

⁵⁸ Angoh, S. 2016: 1.

world. Cape Flats Sand Fynbos is the most transformed vegetation type with only a few small pockets of habitat remaining⁵⁹



Historic Extent of Vegetation Cover

Current Remnant Vegetation Cover

Cape Town's vegetation types - current and historic extent. The transformation and habitat loss of vegetation types in Cape Town over the last 100 years⁶⁰.

2.2.2. Invasive Species

Alien plant invasion is the second biggest cause of biodiversity loss in Fynbos ecosystems. Invasive animal and plant species are freed from their natural parasites and therefore out-compete indigenous biodiversity for resources. Many invasive alien plant species are

⁵⁹ City of Cape Town. 2011. Cape Town's unique endemic ecosystems - Cape Flats Sand Fynbos.

 $^{^{\}scriptscriptstyle 60}$ City of Cape Town. 2015. The Cape Town Bioregional Plan - Policy 44854: 27 & 30.
considered ecosystem transformers as they alter natural ecosystem processes, like nutrient cycling, fire and hydrological regimes⁶¹.

Invasive plants drastically reduce the species diversity of Fynbos and change natural plant community structures. They also pose a great challenge to maintaining natural fire cycles in Cape Town as invasives usually grow in dense stands that are often inaccessible and greatly increase the hazard and intensity of fires. These plants also reduce the availability of scarce water resources and ultimately reduce the aesthetic, recreational and scientific value of Fynbos communities⁶².

It is also worth noting that domestic and feral dogs and cats, as well as cattle, goats and sheep and the liberal use of poison intended for pests in urban areas also have a great impact biodiversity⁶³.

2.2.3. Inappropriate Fires

The successful management of healthy Fynbos means regular management of fires. The fire cycles of Fynbos in Cape Town is no longer a natural process. Instead, controlled fires are implemented to mimic natural cycles, as uncontrolled burns in a highly urbanised city pose a danger to homes and businesses. In some parts of the city, veld fires happen too often, mostly due to both accident and arson, and burn too intensely due to invasive alien plants, like the recent fires on Table Mountain, causing plants to burn before they have flowered and produced seed to continue natural regeneration. The additional biomass added by alien plants increases the intensity of fires that potentially damage the seed stock of plants in the soil.

In other areas, like the Cape Flats, the veld does not burn often enough. Urbanisation on the lowlands has fragmented remaining natural Fynbos habitat preventing fires to burn naturally across the landscape threatening many plants that depend of fire to restart their life cycle⁶⁴. In 2021 local authorities successfully implemented ecological burns at some of the last remaining Cape Flats Sand Fynbos remnants. These include Kenilworth Racecourse Conservation Area and Tokai Park.

⁶¹ Pitt & Boulle. 2010: 107 - 108.

⁶² Van Wilgen and Richardson. 1985: 955.

⁶³ Pitt & Boulle. 2010: 107 - 108.

⁶⁴ E-Kapa. 2007. Cape Town's Lowlands - a Global Treasure: Module 8 - Surviving fire.

2.2.4. Inappropriate Mowing

Mowing that is done appropriately with sensitivity to the seeding of annual plants can be useful in controlling the seeding and dispersal of other invasive alien species. Mowing in spring causes contention as some residents are delighted to have trimmed lawns while other residents are dismayed at the destruction of the annual wild flower display. In areas of higher rainfall mowing eliminates most plant species, except for the hardier indigenous species, which leads to increased domination by grasses. In the drier areas, mowing destroys most vegetation and reduces plant cover and causes erosion. Due to rapid urbanisation, private gardens, public open spaces and road verges are often the only remaining remnants of vegetation and viable indigenous seed banks. Thus, the inappropriate mowing regimes of these spaces severely decreases the potential of these sites to be maintained for Fynbos conservation and therefore continue to support insect, bird and mammal life still persisting in urban areas⁶⁵.

2.2.5. Pollution & Illegal Dumping

Pollution as a result of nitrogen deposition from car exhausts enriches the city's soil making it less suitable for fynbos species that are adapted to nutrient-poor soils. It also increases competitive species, such as grasses (often invasive Kikuyu grass) which out-compete other indigenous species. This transformation in vegetation towards a more herbaceous structure also contributes to inappropriate and more frequent fires.

Cape Town's seasonal wetlands and rivers are frequently polluted by the stormwater system. Additionally, ineffectively treated wastewater increases available nutrients and encourages invasive species. Moreover, the use of fertilizers, insecticides and pesticides on lawns and in gardens affect local species and the illegal dumping of rubble and toxic waste, poaching and arson have a direct adverse effect on the city's biodiversity by degrading ecosystems⁶⁶.

2.2.6. Altered Hydrology

Urbanisation has led to the large-scale hardening of surface cover in Cape Town. Roads and paving with impermeable surfaces increase the risk of flooding and decrease natural ecosystem services like infiltration. This increases pollution in urban areas affecting the long term quality of the natural habitat and quantity of water supplies. The canalisation of urban

⁶⁵ Holmes et al. 2008. Biodiversity report: 31.

⁶⁶ Holmes et al. 2008. Biodiversity report: 32.

streams and rivers has also altered natural ecosystem functions and the functioning of wetlands. The lowland areas of Cape Town used to be covered with seasonal and perennial wetlands that were interconnected by the groundwater system. The large-scale alteration and interference of freshwater networks has impacted vegetation remnants resulting in changes in species composition as some species adapted to the low lying areas no longer have access to seasonal wetland conditions⁶⁷.

2.2.7. A Note on Climate Change

Climate change modelled projections of species distributions suggest an eastward shift in bioclimatically suitable habitat for many fynbos plants which will result in much of the Cape Lowlands being unsuitable for many of the plants adapted to the area. Mean annual temperatures are projected to increase by roughly 1.8°C by 2050. This is not enough time for plants and animals to adapt to sudden climatic changes. The secondary effects of increased global temperatures on Fynbos include changes to precipitation patterns and fire regimes⁶⁸. Increasingly prolonged hot and dry weather, particularly in the first year after a fire, reduces the ability for Fynbos to successfully regenerate. <u>Watch this video</u> to learn more about the effects of climate change on Fynbos.

While all of these challenges are significantly complex and compounding, it is essential to tackle these issues in order to retain resilience from inevitable environmental shocks, such as droughts and climate change, and for healthy urban communities. Off-reserve Fynbos rehabilitation has the potential to contribute towards addressing many of these challenges.

2.3. Ecosystem Services of Urban Biodiversity

From the previous section it is clear that Cape Town has been blessed with incredible plant and animal diversity, however, the city faces a biodiversity crisis due to ongoing threats. The intrinsic value of Fynbos lies in its exceptional and unique biodiversity, however, healthy functioning Fynbos ecosystems also have great socio-economic value to urban residents. It is, therefore, vital to foster a collective sense of pride and care for our urban nature to assist conservation efforts. The following table briefly describes the value of healthy functioning Fynbos ecosystems in Cape Town⁶⁹:

⁶⁷ Pitt & Boulle. 2010: 107 - 108.

⁶⁸ Keith, D. 2013: 4.

⁶⁹ City of Cape Town. 2018. City of Cape Town's state of the environment report 2018: 10.

Cultural, spiritual & aesthetic value	Sense of place, religious and spiritual practices, emotional wellbeing.
Ecological value	Providing habitat for species and maintaining genetic diversity. Natural hazard regulation, water purification and waste treatment, climate regulation and climate change mitigation, pollination, erosion regulation, freshwater and marine resources, disease and pest reduction, soil formation.
Recreational value	Place making and sense of community.
Human health	Fresh water provision, air quality, pollution reduction, medicines and food.
Socio-economic value	Tourism, employment, education, materials for livelihoods, crafts and building, harvesting, reduced levels of crime, increased property values.

2.4. A Way Forward

As the threats to urban biodiversity in the city are so intimately linked to human social systems, a large-scale adjustment is needed to change direction and become culturally restorative rather than destructive. As a part of this alternative future, this strategy aims to empower existing plant and wildlife users and enthusiasts to become active citizens of change by encouraging small local natural vegetation rehabilitation initiatives. If driven by local communities and groups, but coordinated with the needs of the larger ecosystem as a whole, this will improve our overall access to local ecosystem services. And if done with restoration principles in mind, and coordinated with neighbouring initiatives, this could bring considerable ecosystem benefits that ultimately contributes to a more resilient Cape Town overall.

In the next chapter we explore the concept of urban Fynbos rehabilitation, in the form of indigenous stepping-stone gardens and community corridor building, as a collective resolution to our current biodiversity crisis.

3. Fynbos Stepping-Stones: A Rehabilitation Method

There are many people in Cape Town that appreciate the value of Fynbos, as described in chapter 2, through daily practices of nature recreation, by using it in cut flower or medicinal form, or through active involvement in indigenous gardening and tree planting as a way to actively support indigenous plants and animals.

Limited by a lack of access to knowledge on the rehabilitation steps needed to reactivate the inherent healing agency of succession within Fynbos, this gardening effort is not as impactful as it could be. Instead of supporting the local specialist animal and bird species that really need our support, this type of broadly defined indigenous gardening supports the generalist animal and bird species that least need support.

This chapter describes Fynbos ecosystem rehabilitation principles suitable to the layperson aiming to create spaces with both social and ecological uses. By following these principles, community members can create the physical conditions, structure and species composition that creates a wildlife sanctuary for local animals and birds most in need of support.

As has been established, the remaining indigenous vegetation in Cape Town is made vulnerable by being isolated from other similar vegetation. As such, creating connectivity is a primary generator of ecosystem resilience in this urban context. A key focus of this restoration process as described below is therefore creating habitat for key flying pollinators that can make their way between isolated patches and re-create interconnectivity that was lost when farming and development isolated these ecosystem parts from one another.

3.1. The Stepping-Stone Gardens Approach

Fynbos stepping-stones are small patches of indigenous Fynbos gardens that are close enough to one another to support the persistence and movement of keystone pollinator species across the fragmented urban landscape. When strategically placed in areas in need of connectivity, and in close enough proximity, these 'gardens' act as stepping-stones for species to move between natural habitats. By prioritising acess to high quality nature in areas that need it the most, this has the potential to balance out green apartheid patterns. In addition, this approach has the potential to facilitate the social connectivity of people through collective stepping-stone corridor building across different communities and urban areas.

3.2. Fynbos Rehabilitation Goals

The Fynbos Stepping-Stone garden approach has 5 main goals:

- 1. **Transform** ecologically low-functioning urban spaces into Fynbos indigenous gardens, by planting locally indigenous vegetation, sourced from appropriate genetic plant stock, that support key pollinator insects and birds and restoring plant-pollinator mutualisms.
- 2. **Establish** resilient and thriving locally indigenous Fynbos gardens which contribute to increased ecological function and biological diversity within Cape Town's urban landscape.
- 3. **Connect** individual Fynbos indigenous gardens to create a stepping-stone corridor network for key pollinators. By planting these stepping-stones in close proximity to each other, we aim to facilitate the movement of important pollinator insects and birds between indigenous gardens and protected Fynbos remnants.
- 4. **Encourage** stewardship of local biodiversity and reconnect communities to nature by rebranding open and gardened spaces as functional (ecology), useful (medicinal, cut flowers) and living entities (need care) that are valuable spaces of natural and cultural heritage rather than areas good for nothing except development or dumping.
- 5. **Bridge** social divides in Cape Town by improving connectivity through corridor building and promoting multi-purpose shared spaces that have social, cultural and ecological significance.

3.3. Guiding Principles of Fynbos Stepping-Stone Rehabilitation

The following principles aim to guide best practice Fynbos rehabilitation in Cape Town's urban areas.

3.3.1. A Locally Adaptive 'Safe-to-Fail' Approach

Although the concept of fynbos restoration is not new, how to best adapt this knowledge to urban landscapes with heavy social demands is not yet fully understood. Additionally, applying well researched restoration practices for larger legally protected conservation areas to smaller urban fragments with multiple social functions present difficulties and low levels of success. The urban areas in Cape Town most in need of Fynbos rehabilitation require the establishment of gardens under harsh physical conditions which affect their survival rates. For example, the arid landscape of the Cape Flats and the Cape Doctor (persistent and dry south-easterly wind from spring to late summer) in itself poses a challenge. In addition, the diverse nature of Cape Town's urban landscape means that there is no magic recipe that will fit all spaces or social and cultural contexts. A flexible and adaptive approach is required to maximise rehabilitation in any given social, cultural and ecological context and highlights the importance of multi-functional <u>shared spaces</u> that are, at heart, social spaces that create a sense of community.

This strategy therefore aims to encourage interventions using an adaptive approach, that can be applied to multi-functional urban areas, that conceives 'challenges' of working in difficult and multi-used spaces, and making decisions with imperfect knowledge about change and uncertainties, as an 'opportunity' to 'learn by doing'. These experiments allow for new knowledge to be gained through monitoring and analysis to better understand how we can adapt and improve off-reserve conservation efforts. As such, we promote a 'safe-to-fail' city-wide experiment with rehabilitating Fynbos in various urban contexts⁷⁰. The sharing of knowledge across networks will be vital to continuously bring new light and understanding of urban conservation in Cape Town as the challenges and failures of one stepping-stone garden may result in the success of another, therefore continuously improving the pilot framework suggested in this strategy.

3.3.2. Involvement of Active Restorers

Creating Fynbos stepping-stones is a dynamic, engaging and long-term process that requires active agents of care and interest in enhancing urban areas for both people and biodiversity. People play a key role in caring for nature in urban areas and can collectively contribute to urban conservation through biodiversity-sensitive gardening. Fynbos stepping-stones are

⁷⁰ Ahern, J. 2011: 7.

long-term rehabilitation gardens that involve the active and continuous introducing and replacing of desirable plants that support key bird and insect pollinators. It will also require ongoing ecosystem maintenance where gardeners perform some missing functions, for example the role of browsing herbivores, by pruning plants to prevent the overgrowth of the low growing species.

Working with locally indigenous plants means they are well adapted to local climatic conditions and require very little input, however, they will require initial assistance when introduced to urban spaces to create the right conditions for the garden to establish and thrive. Once the garden has survived the pioneer phase it will require less watering, for example, but might need some nurturing during the first few summers and during unusually dry periods.

Some gardens, especially in public areas, will likely have to be kept neat, mostly by pruning and weeding, for safety reasons that ensure the garden is socially acceptable. Working in public spaces requires working with local stakeholders, including getting written permission from relevant government departments when working on government-owned land, and maintaining that space according to local use and needs. In privately owned spaces, where the desire is to have a wild and less manicured Fynbos stepping-stone, ongoing care might have more of an emphasis on removing invasive species and increasing diversity through successional planting.

Fostering stewardship of Fynbos gardens is at the heart of connecting the social to the ecological, and so rehabilitation work necessarily ties in closely with the surrounding custodians. Therefore, fostering custodianship underpins simulating missing ecosystem processes fundamental to urban spaces becoming resilient indigenous habitats.

3.3.3. Assisted Natural Succession

Part of the process of Fynbos rehabilitation is the concept of natural succession. It refers to the stages of planting and recovery underpinning the development of plant communities. Natural succession in Fynbos is a slow process and is closely interlinked with fire regimes. As we are working in urban areas, people are required as active assistants of succession. In practice this means that stepping-stone gardeners will have to follow a roughly three-stage successional planting plan and perform certain roles to assist natural succession towards the highest degree possible within a particular urban context. This plan is detailed in the following table.

Pioneer phase (Early succession)	Insect & bird phase (Middle succession)	Specialist & climax phase (Late succession)
Year 1	Year 2	Year 3
Pioneer plants are used to establish the garden. They are hardy plants that can establish in harsh environments, and once they have settled in they provide protection from sun, rain, and wind. They improve the soil health by shading the soil and preventing water loss. They also hold the soil in place preventing erosion and root disturbance, and add soil bacteria and fungi to the site that help provide extra nutrients, vitamins, minerals and water to the plants. Pioneers create an ideal nursery environment for more sensitive species. Introducing pioneers to a site is the first step in fynbos ecosystem recovery, thereafter enriching the fynbos patch with more	Once pioneer plants have established and the soil has stabilized, more sensitive nectar-rich plant species, that attract insect and bird pollinators, should be added to the gardens. This phase might require the removal of some pioneers to make room for a more diverse range of plants that enhances the functionality diversity of the garden. Second-year plants provide resources for 'refueling' and allow key Fynbos pollinators to use the garden as a stepping-stone to move between protected remnant Fynbos habitat. During this phase gene flow occurs and plant-pollinator mutualisms are enhanced.	Once the diversity and functionality of the garden has increased, the garden is well established and absent from threats and disturbance, more specialist species can be introduced such as climax, endemic and endangered plants. Climax species are those species that will only start to thrive once the ground cover and pioneer community is already established. This will allow gardens to function not only as movement corridors, but also harbour unique and endangered species to assist urban conservation efforts.

*Three-year successional planting plan*⁷¹.

⁷¹ Adapted from: Sustainable Livelihoods Foundation. 2015: 14.

3.3.4. Recovery Along the Urban Fynbos Restorative Continuum

Repairing Fynbos ecosystems is a process that can be viewed as a restorative continuum with three key areas including: ecosystem remediation (reducing harmful threats and impacts), rehabilitation (enhancing indigenous habitat) and restoration (restore indigenous habitat to its original state). Full restoration of Fynbos habitat within the local context, that is Cape Town's urban and residential areas, is not always possible because certain processes key to restoration, like fire regimes, are difficult to reinstate in the spaces we are working in. Restoration aims to return areas to its original natural state, while rehabilitation acknowledges that habitats will be permanently altered, but it still seeks to return a self-sustaining indigenous plant community that is as close to the original habitat as possible, and resilient to inevitable changing environmental conditions⁷².

Since this strategy promotes repairing Fynbos ecosystems in urban areas that have been permanently altered and transformed through destructive development habits, rehabilitation as an ecosystem repair process is more realistic and appropriate. We therefore have the opportunity to enhance the urban spaces we are working in by reintroducing locally indigenous plants, through Fynbos rehabilitation gardening and stepping-stone corridor building.



The urban Fynbos restorative continuum⁷³.

⁷² Society for ecological Restoration. 2017.

⁷³ Gann et al. 2019: 7.

Fynbos rehabilitation should seek the highest practical and realistically appropriate level of Fynbos recovery possible relative to each specific situation and local context along the urban Fynbos restorative continuum. Ecosystem remediation starts if the negative impacts and threats at the Fynbos garden is reduced, for example, if all invasive alien plants are removed. The level of recovery towards ecosystem rehabilitation can be achieved by improving the ecological functioning of the garden through successional planting that over time moves a stepping-stone garden from a low-functioning, for example a road verge overgrown by invasive Kikuyu grass, to functional and diverse Fynbos garden. To increase the functionality of a Fynbos stepping-stone, the following elements should be considered:

Functional diversity	Providing habitat for pollinators using a diversity of flowering plants of different functional types.
Species richness	The more diverse the garden the better. Increase the number of species at the garden to reflect the diversity of the corresponding vegetation type.
Vegetation structure	Increase the diversity of the growth form of the plant species (i.e. canopy cover, plant height, texture)
Flowering phenology	It is important to consider the start, peak and lengths of the flowering period of plant species. As stepping-stones are essentially fueling stations that facilitate the movement of biodiversity, it is important that they provide nectar resources all year round.

The following section is a case study example and representation of a public space that has increased in recovery along the urban Fynbos restorative continuum, from remediation to rehabilitation, through following the three-stage successional planting plan and increasing in functionality by focussing on enhancing functional diversity, species richness, vegetation structure and flowering phenology.

Pioneer phase (early succession)



A Fynbos stepping-stone garden in Rosebank, created by retirees in a neighbouring retirement village. From invasive *Kikuyu* grass to locally sourced indigenous groundcovers. A pedestrian path provides a 'cue to care' to reduce dumping and littering from vagrants in the area. Threats from invasive plants and physical disturbance are being remediated through regular weeding.

Structure and diversity phase (middle succession)



Locally sourced pioneer shrubs add texture and layers to the Communitree public garden in Rosebank Cape Town, and provide nectar resources for indigenous Cape Honey bees and other insect pollinators. The species richness, vegetation structure (low

growing, small shrub and taller shrubs), flowering phenology (flowering in all seasons) and functional diversity (plants with different roles within the community) has improved as the garden has progressed from remediation to rehabilitation on the Fynbos restorative continuum.

Specialist & climax phase (late succession)



An *Erica verticillata* introduced at the Fynbos rehabilitation stepping-stone garden. This species is classified as extinct in the wild (EW) and provides nectar resources for specialist pollinators of the Sunbird guild. The garden not only functions as a movement corridor for pollinator insects and birds, but also harbors unique and endangered species to assist urban conservation efforts.

3.3.5. Creating Connectivity

3.3.5.1. Habitat Connectivity

Connectivity is arguably the primary generator of urban ecosystem resilience, as one of the main challenges to urban biodiversity conservation in Cape Town is habitat fragmentation⁷⁴. The levels of complexity within the highly diverse and endemic Fynbos ecosystems puts impetus on the capability of key flying insect and bird pollinators to maintain gene-flow networks, as they are the group of species that are able to move across urban barriers, such

⁷⁴ Bentrup, G. 2008: 47.

as buildings and roads, to reach small isolated plant populations, to maintain the necessary connections, and to prevent inbreeding and plant and animal species decline.

This highlights the need for ecological connectivity between suitable remaining Fynbos habitat and the important role of small patches of indigenous vegetation, between protected and remnant Fynbos habitats, that form support areas for larger isolated protected areas and play a critical role in sustaining biodiversity in urban areas where habitat is limited and fragmented⁷⁵.

Since the option for continuous green corridors is no longer viable throughout all parts of the city, we have an opportunity to enhance what spaces we have left by creating linkages between isolated Fynbos remnants through strategically planting locally indigenous gardens that make the urban matrix more penetrable and useable for biodiversity⁷⁶. The City of Cape Town's Green Infrastructure Programme aims to support this in parts of Cape Town where it is possible to utilise roadsides and other government managed land for corridors. In the case of Fynbos stepping-stones and linear roadside planting, each garden increases in function through connectivity to other gardens, and together builds a complex network that increases capacity for resilience. When these gardens are strategically placed in areas most in need of connectivity, and in close enough proximity to each other, they act as stepping-stones for species to move between remnant natural habitats.

3.3.5.2. Community Connectivity

The human element, collaboration and connectivity as a unifying concept is essential in building Fynbos stepping-stones that connect biodiversity. Therefore, building a network of relationships in and between communities forms the basis of Fynbos rehabilitation stepping-stones, where inclusivity and stewardship becomes a reciprocal process, and sincere engagement over time leads to increased tangible benefits for both people and biodiversity.

We aim to cultivate collaboration and continuous engagement that facilitates the transfer of knowledge and allows for the broadening of the range of ways people value local biodiversity. In addition, this stepping-stone approach facilitates the connectivity of people across the equally socially fragmented and divided urban landscape, through collaborative

⁷⁵ Bentrup, G. 2008: 47.

⁷⁶ Pauw and Louw. 2012: 4.

stepping-stone corridor building, towards a unifying common goal that benefits both people and biodiversity⁷⁷.

3.3.6. Guided by a Locally Indigenous Reference Ecosystem

Fynbos rehabilitation should aim to resemble, in so far as possible, the most appropriate locally indigenous reference site from the corresponding historical vegetation type to contribute to the conservation of local biodiversity. The aim should not be to reinstate Fynbos exactly as it were in a frozen point in time, but rather increase the functionality of indigenous ecosystems that are more resilient to environmental change and disturbance. The active revegetation of private and public spaces should consider and, in so far as possible, reflect the species composition and structure of the appropriate indigenous reference ecosystem. In practice this means that Fynbos stepping-stones should be planted with specific plant species, sourced from local gene pools, that mimic the diversity and vegetation layers typical of the specific vegetation type within which the garden patch is located. The ecosystem attributes refer to physical conditions, species composition and structural diversity of a specific vegetation type that will inform the desired level of recovery of stepping-stones.

For example, the level of recovery of Fynbos rehabilitation gardens located in Cape Flats Sand Fynbos should be informed by the nearest natural remnant, like Kenilworth Racecourse. The gardens located here should aim to reflect the living (i.e. ericas, proteas, Cape reeds and bulbous plants of the lily and iris families) and non-living (i.e acidic and nutrient poor sandy soils) physical components and structure of the nearest Fynbos remnant. In addition, the gardens should aim to reflect key floral species that attract key faunal species that resemble the composition of the nearest Fynbos remnant to assist with ecosystem functions like pollination (i.e. characteristic nectar rich plant species pollinated by sunbirds and insects). However, existing soil conditions, such as pH and texture, as well as water availability will be primary factors directing rehabilitation. Chapter 5, Fynbos Rehabilitation Protocols, provides resources and practical guidelines to do so.

3.3.7. Maintain Locally Indigenous Gene Pools

The plant species used in Fynbos stepping-stone gardens should, in so far as possible, have been grown from seeds or cuttings that have been sustainably and responsibly sourced from the nearest naturally occurring Fynbos remnant from the specific vegetation type of the

⁷⁷ Ahern, J. 2011: 6-7.

garden site. The diverse nature of Fynbos plants, and the diverse range of habitats in the Cape Town area, means that the same species of plants occur across different vegetation types in the city, however, the same species will have adapted to the various local microclimates.

Eco-sourcing plants assists urban biodiversity conservation by ensuring we maintain the genetic diversity and integrity of unique diversity of Fynbos plants that have evolved over long periods of time to be adapted to the various local microclimates in Cape Town. In addition, a more diverse range of gene pools also makes plant populations more resilient to environmental change. Eco-sourcing plants also avoids the creation of 'frankenflora'; these are hybrids of two plants that are similar/same species but adapted to different places and environmental conditions within the Fynbos biome. If the two plants adapted to two different habitats, say high and low altitude, cross-pollinate, their offspring can end up adapted to neither high nor low altitude conditions and become unable to live in that are maladaptive to where they are. In general, bird- and wind-pollinated plants have a larger sourcing scope than insect pollinated plants because of the larger area they already cross-pollinated between⁷⁸. Chapter 5 provides further guidelines to eco-sourcing plants for rehabilitation gardens. Please see CapeNature conditions for plant collection, transport and reintroduction

3.3.8. Reducing Impacts and Threats

The degree of threats, impacts and disturbance can be used to motivate a stepping-stone garden and to guide the Fynbos rehabilitation goals of a particular location. Reducing the impacts and threats initiates the recovery of Fynbos along the restorative continuum from ecosystem remediation towards Fynbos rehabilitation. Rehabilitating Fynbos includes the reduction of the threats caused by physical disturbances and the presence of alien invasive plants by replacing them with locally indigenous pioneer plants that remediates the soil and creates the right environmental conditions for local biodiversity to thrive in.

Threats to Fynbos ecosystem biodiversity	Reducing impacts and threats - what to do?
Habitat loss and fragmentation	 Fynbos stepping-stone gardens directly target this threat Encourage stewardship of Fynbos on land still covered

⁷⁸ September. 2016: 2.

	with a Fynbos original vegetation type
Invasive species	 Remove the flowers of invasive plants before they set seed remove and control regrowth of alien and invasive species from home and public gardens Call the <u>invasive species unit</u> if you sight priority species in your area
Over-harvesting	 Work with restoration nurseries to source your plants and keep a detailed log of the plants you buy and any plant material donated. If taking the route of harvesting, which requires an advanced level of plant knowledge and skill, get a permit from the conservation authority (usually CapeNature) and landowner as they factor the capacity of reserves for harvesting.
Inappropriate fires	 Plan for regular fires roughly every 15 years, when the vegetation likely has reached its climax phase and all species have set seed Where not possible, cut back heavily, burn off site and return ash Pre-harvest seed that needs smoke treatment to do that manually
Inappropriate mowing	 Check for spring flowers and wait until they have seeded before the first summer mow Remove annual long grasses manually to keep the space neat if neatness is required
Pollution and illegal dumping	 Report pollution and illegal dumping Create strong borders and signage called 'cues to care' around areas with wildflowers to ensure the space looks cared for and is less likely to be a site for dumping.
Altered hydrology	 Replace concrete, paving and tarred areas with porous options. These come in brick and concrete like forms. Divert roof and road rainwater into <u>rain gardens</u> and swails

	to ensure water has time to slowly sink into the soil and get filtered on its way into the ground water system instead of being rapidly washed out to sea. Create a wetland habitat by planting with locally indingeous wetland species sourced from restoration nurseries with local gene pool stock.
Climate change	 Live as a low carbon a lifestyle as possible: reduce meat consumption, walk, cycle or skate to the shops, use public transport where possible, share private transport with others, reduce the number of flights to a minimum, eat local food with little processing.

A common example of physical disturbance in urban areas includes illegal dumping, especially in public open spaces, that are ideal opportunities to be upgraded to Fynbos stepping-stones. The various types of vegetation within Cape Town's Fynbos are determined by the soil pH and the amount of nutrients available, so the pollutants and toxins from waste and rubble leach into the soil and disturb the chemical composition. In addition, the presence of impermeable material, like concrete, may affect the proper water drainage required by most Fynbos plants, especially Cape Flats Sand Fynbos species. Working in spaces that are prone to dumping means that gardens will have to be safeguarded against such a threat in future. Urban areas in Cape Town are often covered with alien grasses and annuals (such as Kikuyu grass) and the soil may have elevated nutrient levels due to nitrogen fixing by invasive species and the application of fertilizers⁷⁹.

Working in urban spaces means that some stepping-stones will need to be safeguarded from threats and physical disturbance. For example, when starting a stepping-stone Fynbos garden on a public road verge, care should be taken that the City's yearly mowing does not damage the garden. This is usually mitigated by keeping the garden clear of weeds and grasses, and by adding additional cues to care that make it clear the space is cared for and valued. Caring for spaces also means they are less prone to dumping and working with existing desire lines minimises trampling from pedestrians. Please read the <u>CCT Public Parks By-law 2010 for guidance on what is legally permissible in Public Open Space</u>, especially Clauses 10 and 11.

⁷⁹ Holmes. 2007: 33.

3.3.9. Monitoring

The monitoring of a Fynbos rehabilitation garden is important for generating social learning and to measure the level of recovery of the Fynbos stepping-stone. Monitoring provides evidence of the garden's benefits and helps rehabilitation gardeners to respond to challenges and apply adaptive management. Specific indicators are used as 'cues' to assess the progress of the garden. There is no single easy-to-measure indicator to measure the level of recovery when working with Fynbos.

Instead we focus on measuring the level of recovery of the specific functions we want to reinstate at a rehabilitation garden such as plant-pollinator mutualisms. It is possible to monitor pollinator networks by conducting bird and insect monitoring to measure the presence or absence of key pollinators like sunbirds, bees and monkey beetles. Similarly, locally indigenous plant diversity can be measured by monitoring plant species density, richness and plant cover. The aim of monitoring is to record the species abundance and diversity of the garden to measure the level of Fynbos recovery. The monitoring data can then be used as an indicator to determine the success of ecological rehabilitation in terms of re-establishing key ecosystem attributes such as plant-pollinator relationships, species richness and diversity.

The data collected during monitoring is then compared to the baseline conditions recorded before starting the rehabilitation garden, as well as measured against the appropriate corresponding vegetation type or reference ecosystem. It is recommended that monitoring is regularly conducted on a continual basis and that the data gathered from monitoring is shared to increase knowledge across the stepping-stone corridor network and improve the success of gardens.

3.4. Possible Negative Consequences of Fynbos Rehabilitation Gardens

The following aspects should be considered as possible negative impacts of rehabilitation gardens.

	Possible risk	Suggested mitigation
Local plant gene pool contamination	Horticultural varieties of indigenous plants are often selected for specific traits, such as prolonged flowering, that are not necessarily adapted to local environmental conditions. Using these plants in gardens, where birds and insects move pollen between stepping-stones, could possibly contaminate 'wild' plant gene pools that are more resilient ⁸⁰ .	Ensure that plants used in gardens are sourced from the closest possible Fynbos remnant by using locally indigenous nurseries that practice eco-sourcing. Alternatively the nearest nature reserve could be contacted to provide cuttings or seeds to be used in Fynbos stepping-stones.
Damaging Fynbos seed banks in public spaces	Most public open spaces are covered with invasive grass, however, some (namely road verges) may contain endangered plants and hold viable Fynbos seed banks. The removal of grass and landscaping activities to create a Fynbos stepping-stone might damage plant populations and seed banks in the soil.	Monitor public spaces well before deciding to start a stepping-stone garden to see if it harbours any indigenous plants. Especially during Spring and Summer months when dormant geophytes and annuals come to life. Special care should be taken not to cause degradation for the sake of rehabilitation.

There is no single recipe for Fynbos rehabilitation in urban areas, however, there are some core principles to follow to do it effectively and safely. There are many opportunities to experiment and explore how the stepping-stone approach can be locally applied and adapted to enhance urban spaces for people and biodiversity. The next chapter addresses the 'where' of Fynbos rehabilitation gardening in Cape Town, by mapping out key areas for greeners to focus on building up a Fynbos stepping-stone network. Then chapter 5 of this strategy describes the 'how to' of Fynbos rehabilitation gardening.

⁸⁰ Pauw and Louw. 2012: 5.

4. Collective Fynbos Stepping-Stone Corridor Building

Rehabilitating Fynbos through creating stepping-stone gardens gains cumulative impact when we increase the connectivity between each garden to form a stepping-stone corridor. This chapter looks at how Fynbos stepping-stone gardens can be integrated into urban spaces to create meaningful socio-ecological connectivity across Cape Town's fragmented urban landscape. By encouraging Fynbos rehabilitation efforts as not only an investment in nature, but as multi-functional human and nature spaces in between nature-dedicated reserves, the Fynbos stepping-stone corridor network seeks to bring together nature and nature, people and nature, and people and people.

4.1. Where to Create Connectivity?

In order to focus stepping-stone corridor building efforts strategically, it is important to consider where connectivity is more urgently needed. As mentioned earlier in the document, the Cape Flats is burdened by a number of socio-ecological challenges that in many ways reduces access to high quality nature for health, recreational and cultural purposes.



Vegetation_Indigenous_Remnants
 People within 5 min walk of Fynbos
 People within 10 min walk of Fynbos
 People within 20 min walk of Fynbos

Firstly, there is a strong correlation between ecosystem health and the socio-economic status of neighbourhoods. The map above illustrates the absence of intact biodiversity in a number of areas in Cape Town and thereby the lack of access for many Cape Flats residents to quality nature and its benefits.



Secondly, the dominant vegetation types occurring in the Cape Flats area are endemic to Cape Town and are regarded as being at high risk of extinction. On the above map, in red you can see the critically endangered (CR) <u>Cape Flats Sand Fynbos</u> and in yellow you can see the endangered (E) <u>Cape Flats Dune Strandveld</u>. The fragmented nature of the remaining isolated pockets of Fynbos remnants found on the Cape Flats necessitates functional habitat connectivity to support urban biodiversity conservation. However, there is a lack of suitable space that can be designated for exclusive protection of biodiversity to meet the targets required for resilience and long-term conservation of Fynbos. Given the number of challenges that occur on the Cape Flats simultaneously, we suggest Fynbos stepping-stone corridor building efforts should be prioritised here, and suitably responsive to multiple challenges, human and ecosystem-based.



Thirdly, the very different economic status groups across Cape Town further compound lack of access to natural resources, as people with less money are less mobile and therefore less able to access nature beyond their immediate surroundings; are more in need of natural resources for survival ends such as food and medicine; and because lower income areas are more burdened with nature disbenefits such as polluted rivers that are a burden rather than a resource to humans nearby. Economic status is therefore an indicator of a greater need for high quality nature nearby and a constrained ability to access that nature. The challenge in these most densely populated areas where space is at a premium, is to find ways of optimising different kinds of greening needs, such as food security through vegetable gardening, access to medicine through wildflower harvesting, and access to a healthy environment, and nature for beauty and recreational activity.

4.2. Fynbos Stepping-Stone Opportunities

This section explores the various existing spaces in the urban matrix that are ideal places to host a Fynbos stepping-stone. Some are already dedicated green spaces such as parks that

could be ecologically enhanced through Fynbos rehabilitation, while others are overlooked opportunities for nature integration into undergreened areas and communities.

Prior to reviewing these opportunities, it is necessary to take note of the following important considerations for creating Fynbos stepping-stones in urban areas.

4.2.1. Size

The minimum size for a Fynbos stepping-stone is unknown and there is currently little research on the size of local functional stepping-stone corridors to draw from⁸¹. An approximate indication is that a remnant of about 1 hectare, roughly the size of Rondebosch Common, can persist and self-sustain a good level of function. Stepping-stones are much smaller, so aim to create as many small stepping-stones, as close to one another as possible, to add up in total to approximately 1 hectare. This is a very rough guide but gives a target to work towards. Learning from doing is key. Working in complex spaces towards multifunctional place-making on the Cape Flats requires intuitive, innovative and adaptive solutions⁸². We therefore encourage a philosophy of 'every bit counts' and do what is possible with the spaces there are to work with.

4.2.2. Proximity to the Next Stepping-Stone

Promoting connectivity among individual stepping-stones is of equal significance to size, because our approach is to gain cumulative beneficial impacts through increasing connectivity. Smaller habitat patches do not necessarily have to host Fynbos pollinators for long periods of time, however, it is important that they are of sufficient quality to provide resource support, such as nectar and refugia, and facilitate movement of biodiversity across urban areas. The more smaller garden patches there are in close enough proximity to each other, that serve as rest stops between larger more suitable habitat patches, or as their own metapopulation, the better⁸³. The distance between stepping-stones should ideally be 500 meters or less.

⁸¹ Samways. 2017: 1.

⁸² Samways. 2017: 3.

⁸³ Cash. 2018.

4.2.3. Local Focus

Costs expand when people and organisations work far beyond where they are based. Resources such as volunteer time are therefore not always available and efficiently spent very far from where they are based. Local action is therefore encouraged, if the resource is available only locally.

4.3. Ideal Urban Fynbos Stepping-Stones

This section suggests opportune urban spaces that could be socio-ecologically enhanced by transforming them into Fynbos stepping-stone gardens.

4.3.1. Private Gardens

Collectively, gardens in residential areas comprise a substantial amount of available green space in urban areas. Members of the public who have access to private garden space can support urban biodiversity by transforming their gardens into a Fynbos rehabilitation stepping-stone to facilitate the movement of insect and bird pollinators between various other green spaces and protected areas. This allows individuals to foster an intimate relationship with local biodiversity within their own space and such private reserves for nature will have the benefit of long standing protection and care.

However, in Cape Town, and especially on the Cape Flats, many people do not have access to private garden spaces. This highlights an opportunity within undergreened communities to create Fynbos stepping-stones in public communal spaces as a way to reintroduce the experience benefits of nature and heal the relationship with nature.

4.3.2. Open Green Space

Open green space is a broad term describing publicly accessible communal spaces of social interaction and cultural identity with an element of greenery, such as trees, grass and gardens, for the experience of nature and encouraged for recreational use⁸⁴. They vary in functional use and include areas like public parks, greenbelts, sports fields and cemeteries.

⁸⁴ Milliken. 2015: 5.

These spaces may already serve as stepping-stones for biodiversity as they contain some greenery, however, they are not always geared toward rehabilitating locally indigenous Fynbos that cater for key bird and insect pollinators.

Being a very low density city, most residential areas in Cape Town have green open spaces or community parks that are ideal areas to start a Fynbos stepping-stone, if government permission can be obtained. Since these spaces are already designated as green spaces by the City, the Fynbos rehabilitation garden will enjoy long-term protection from physical disturbance and development. Working in public green spaces provides greater exposure to Fynbos that enhances interest in local Fynbos biodiversity and provides opportunity for social cohesion. Rehabilitation gardening and place-making can be done in a way that builds or enhances a sense of pride and identity for a community. As previously mentioned these are also ideal spaces of opportunity to work in for those who do not have access to a private garden and enhance the quality of nature in undergreened communities.

4.3.3. Neglected Public Spaces

Neglected public spaces are public areas that are underused, overlooked and undervalued. This may include vacant lots, railway and canalised river margins and road verges. They are often covered with invasive grasses, harbour illicit activity and criminal behavior, and are prone to illegal dumping which causes the accumulation of trash and pollution. These spaces can be hazardous to the residents living near them and their dilapidated nature casts a negative light on the value of public space. There is opportunity, through place-making and Fynbos stepping-stone corridor building, to increase their safety and usage by creating cared-for spaces that enhance the urban landscape for people and biodiversity.

For both Open green space and Neglected public spaces, it is important to do background research before planning any type of greening project. So as not to waste time and resources, it is imperative to confirm (1) the current use of the land as it may be a servitude for infrastructure such as water pipes, (2) the future planned use of Public Open Space before initiating any rehabilitation planting, and (3) get written permissions and by-in from the land owner. This could be the <u>Recreation and Parks Department</u> or <u>Transport</u> (including roads and stormwater) Department).

4.3.4. Community Facilities

Starting a Fynbos stepping-stone at an existing community facility is a great way to engage different members of the same community and may improve social cohesion through gardening towards a common goal of enhancing shared spaces for biodiversity and people. Examples include places of worship, community centres, libraries and cemeteries. In addition, Fynbos gardens at community facilities that connect members of different communities along existing human corridors, like bus stops and train stations, may provide ideal opportunities to build stepping-stone networks across social and spatial divides.

4.3.5. Schools

School grounds on the Cape Flats also serve as ideal locations for Fynbos stepping-stone gardens as they generally have underutilised spaces and are lacking indigenous greenery. By planting on school grounds, not only do we ensure that the sites are secure and well maintained, but we can also draw upon education as a tool for developing conservation stewards that will promote the sustainability of the Fynbos stepping-stone project as well as inspire a more environmentally conscious future generation. Providing access to natural green spaces to youth can combat the effects of *nature deficit disorder*, a term coined by Richard Louv as the developmental gaps, behavior problems, and disconnect from nature that many children living in urban areas suffer from. By planting at schools, we can expose our youth to their natural heritage and present them with opportunities to be active citizens within their communities. In doing so, we can encourage this next generation to be the knowledgeable and passionate stewards the fynbos biome desperately needs.

To maximise efficacy and ensure successful implementation, it is recommended that schools be selected with various criteria and considerations in mind including commitment of community involvement, previous successful greening intervention, existence of established eco-clubs, WESSA affiliation, compatibility with current curriculum, and geographical need.



Fynbos Stepping-Stone Garden created by The Greenpop Foundation at Mountain Road Primary School in Woodstock.

4.4. Creating Connectivity among Stepping-Stones

Socio-ecological connectivity across the urban matrix of the Cape Flats is important as it increases the benefits and cumulative impact of Fynbos stepping-stones. By developing meaningful social relationships and functional ecological networks, through collaborative corridor building, we aim to ultimately increase the access to quality nature in areas where it is most needed. Provided here are suggestions of how we can work with existing urban infrastructure and enhance it, through place-making and Fynbos rehabilitation gardening, to facilitate moments of connection within and between different communities. Continuous infrastructure that already facilitates human and wildlife movement includes roads, railways and rivers. These existing movement corridors can be used as spines for Fynbos stepping-stone corridor-building, to bridge spatial and social barriers by creating connectivity between different communities and their Fynbos patches.

4.4.1. Rivers

Rivers flow throughout Cape Town's residential areas and inherently provide vital ecosystem services to urban communities and important habitat to a diversity of fauna and flora. However, most of the rivers on the Cape Flats are canalised and have poor to unacceptable river health status, as indicated by their red colour in the map at the beginning of this chapter. Bare concrete in canalised rivers prevents plants from growing in the streams and along river banks and without plants, there is essentially no ecosystem to support wildlife and ecosystem processes are completely disrupted. This highlights the opportunity for Fynbos rehabilitation next to canalised rivers to enhance some missing natural processes and draw attention to the state of rivers. Sediment islands in rivers can be vegetated and used as a way to bring some aesthetic beauty and ecological function back to the river, an opportunity to optimise water flow, filtration and biodiversity habitat provision.

Rivers can be seen as 'wet corridors' that run through different neighbourhoods and also provide opportunity for increased connectivity across social and spatial divides making them ideal spines for Fynbos stepping-stone corridor building. Fynbos gardens next to canalised rivers, connected by a pathway for example, could potentially connect communities that have previously been isolated by physical and social barriers. In addition, rivers have standing legal protection, which somewhat safeguards any rehabilitation activities against the potential risk of the space being used for further urban development.

Creating cared-for spaces along canalised rivers may also mobilize communities to tackle issues relating to poor river health and reduce littering and pollution. Visual restorative activity along the river banks sparks curiosity and could help raise broader awareness about the current state of rivers and help those disinterested parts of each community to appreciate the specific river within their community and realise the potential it has. This process can be facilitated through place-making and Fynbos rehabilitation to enhance pride and appreciation which could potentially initiate larger scale river restoration⁸⁵. It is, however, beyond the scope of this strategy to go into detail on how to weave river health into Fynbos rehabilitation. Note that the rehabilitation of riparian zones and river banks that are not canalised will require different treatments to the restorative action promoted within this strategy.

⁸⁵ City of Cape Town. 2011.



An example of Fynbos rehabilitation garden combined with a public vegetable garden that serves as a stepping-stone for pollinators along a canalised section of the Liesbeek river. The stretch of indigenous garden was a joint effort between local residents and community groups led by Friends of Rosebank Greenbelt, to enhance an underused public space for both pedestrians and biodiversity.

4.4.2. Roads

Although roads are built infrastructure that cause fragmentation, they also facilitate the movement of people across social and spatial divides. The micro-urban spaces that exist along roads, such as road verges, are often ecologically low-functioning and covered in invasive grass, while others may harbour unique plant and insect diversity. This highlights the potential to use roads as spines for Fynbos stepping-stone corridor building. By greening so-called "grey infrastructure" with locally indigenous plants it is possible to create a connection to the next closest Fynbos stepping-stone. Road verge stepping-stones might not

always be able to support much more than a Sour fig groundcover. However, if plant selection is done carefully, it could still create a link for insects and birds to move through while enhancing the aesthetic of public spaces.



A school group planting 'insect stepping-stones' with Communitree next to a road using Sour fig. Sour fig is easy to grow, edible, medicinal, widely available and supports a broad range of insects making it a great plant to use to fill in the gaps between Fynbos rehabilitation gardens. This project was part of The Sour Fig Challenge which was a joint effort between local residents, schools and greening groups to improve the connectivity of indigenous or other green garden patches in their area.

4.4.3. Railway Lines

Railway margins are often unsightly and underused areas that are overgrown with invasive plants and often prone to illegal dumping. Train stations, private and public land along railway lines provide ideal opportunities for enhancing biodiversity through Fynbos stepping-stones and collaborative corridor building. In Cape Town there is the Southern line, Cape Flats line, Central line and Northern line. These railway lines provide an ideal opportunity for a long stretch of degraded land to be transformed into relatively undisturbed Fynbos rehabilitation gardens that support insect and bird pollinators. Railways are also ideal corridor spines that could promote social cohesion across different communities from different neighbourhoods through collective corridor building. Working along railways also has the benefit of long-term safety from physical disturbance as these spaces are unlikely to be encroached upon for further urban development. An example is the Southern Suburbs Railway Corridor that aims to beautify railway margins and encourage civic participation. Any planting along railway lines should not include fire-prone species and be planned with the station's railway authorities and done with safety protocols in place.

4.5. Identifying Key Focus Areas

Instead of recommending a single, specific corridor to be formed in Cape Town, the Fynbos Corridor Collaboration encourages the formation of stepping-stone garden networks from the ground up. We support individuals, groups, and organisations to team up and link their efforts, and thus set up a corridor within their own area or area of interest. Linking people and harnessing existing energy is what we aim for, rather than prescribing everyone to work on the same, single corridor.

However, we do highly encourage people to pick a strategic location for their work. For individuals wanting to start a Fynbos stepping-stone garden in their own area, we have developed an <u>Instant Site Analysis tool</u>. This tool allows for the strategic selection of a site within your own neighborhood, depending on nearby infrastructure that permits corridor building later on.

Secondly, there are different organisations active in Cape Town that are working towards specific corridor goals. We encourage people living in these areas to link up with these initiatives and look into connecting new gardens with the existing work. Please check out our <u>existing corridor maps</u> to see what is currently being worked on. We invite organisations that are missing from this map to get in touch with us in order to have their work added to this map.

Thirdly, we appreciate that there might be groups or organisations that are interested in starting a large-scale ecological restoration or complementary project in the city. The Fynbos Corridor Collaboration aims to assist these initiatives by providing insights into <u>high-impact</u>

strategic river corridors. These are areas that were specifically selected with the goal of both being ecologically valuable and also having a high social impact potential. For those that are flexible in where they work, and that have ambitious goals, we recommend you check out our high-impact strategic river corridors.

4.5.1. Individual and Community Groups Working Locally

For individuals and community groups that are interested in and limited to their own area, we have two tools to help make that local effort more impactful, and help that local effort link up with a larger effort.

The first is the <u>Instant Site Analysis Tool</u> which helps individuals or community groups better understand their greening options. This gives people an overview of different types of spaces to green, and how they can link with existing Fynbos stepping-stone Gardens, green spaces and connectors such as rivers and railways.



The second tool is the <u>Fynbos Stepping-Stone Garden Network</u> where individuals and groups can register their garden and find their place within a garden network to start working with one another.



Register a Fynbos-stepping Stone Garden profile at our <u>Fynbos Stepping-Stone Garden Network</u> to be seen and connect with others doing work nearby.

4.5.2. Larger Collaboration Across Areas: High-Impact Strategic River Corridors

As previously mentioned, we appreciate that there might be groups or organisations that are interested in starting a large-scale ecological restoration project in Cape Town. The Fynbos Corridor Collaboration aims to assist these initiatives by providing insights into five <u>high-impact river corridors</u>. These corridors were identified through <u>this methodology</u> which seeks to identify priority areas by:

- Drawing a buffer around existing rivers that are known for their poor water quality
- Overlaying this with a layer from Bionet which indicates in which areas people already have access to nature, and therefore where people lack access to high quality nature

• Then removing those river buffer zones from the high priority areas if they are already close to nature



The below series of maps shows how this process was mapped:

The next map shows a collection of rivers that are socio-ecologically high priority spines around which stepping-stone corridors can be built.



Each of these priority river corridors traverse high and low income areas necessitating cross-subsidisation along the corridor. They also traverse many different cultures and ways of valuing nature, and therefore necessitate skills in cultural translation, conflict management and collective vision building. For more socio-economic information on each priority river corridor, please see the <u>online profile of each</u>.

The last chapter now takes this strategic approach to greening the Fynbos Stepping-stone corridor way, and provides a step-by-step framework for the best chance of success.
5. Making a Fynbos Stepping-Stone Garden

Before you start working at a site, it is important to understand the human user community, the current, past and potential ecology of the site, and then do design and planning that integrate both human social and ecological desires. The six stages of developing a Fynbos stepping-stone garden are 1) Select a site, 2) Assess and imagine, 3) Choose plants, 4) Design your garden, 5) Make a work plan and 6) Monitor & adapt.



These stages are aimed at guiding successful Fynbos rehabilitation gardening projects using best practice protocols informed by various sources of knowledge gained through practical experience and consultation with community gardeners, grassroot organisations, scientists and local government. Each step in the Fynbos rehabilitation project process would ideally be carefully planned, evaluated and recorded and shared to contribute to the success of similar current and future projects.

5.1. Stage 1: Select a Site

5.1.1. General Guidelines for Creating Connectivity

Corridor building will start with a single garden, however, it is important to think about how the garden will form part of a greater socio-ecological network. The aim is to build a corridor made up of stepping-stones roughly within a 500m range of each other so that flying pollinators like birds and insects can link your side to the nearest public green space or Fynbos remnant. The following steps provide guidelines and important considerations when envisioning a single patch within a larger Fynbos stepping-stone corridor:

5.1.1.1. Starting a Stepping-Stone Garden

Starting within your immediate environment, identify where you as an individual, community group or organisation can start a Fynbos stepping-stone. This could be a private garden, a road verge close to where you live, an underused and problematic public space, a school garden, a garden at your nearest old age home facility, your library, community centre, or even a memorial patch for a loved one in a cemetery. In areas where private gardens are not an option, road verges between living areas could be transformed into indigenous Fynbos stepping-stones that link to the nearest green space or public park.

5.1.1.2. Stepping-Stone Biogeography

There are some design elements that can be incorporated into the garden design to help maximise the functionality for biodiversity in fragmented urban areas. Some stepping-stone corridor garden design considerations to include:

Size	The bigger the better, as this decreases the part of the garden exposed to disturbance, and increases the abundance and diversity of species that can be present and therefore the robustness of the site as an isolated fragment of an ecosystem.
Shape	The rounder the better. The more round a garden is, the less edge it has, and the less the disturbance from edge effects it experiences. See edge below.
Layout	Make as much of the available space into gardened space to increase the

	maximum abundance of each species that is present, and match the micro-habitat to each species' needs. The more microhabitats you allow for, the more species you can host, and higher the biodiversity of the plant palette and the greater variety of birds and insects the site will attract.
Edge	Edge effects are the impacts of various activities happening on the edge of a garden. For example, people running and cycling past a garden will damage any vegetation on the edge of the garden. Or concrete or tar on the edge of the garden will hold a lot of heat and therefore dry the soil of the garden out more quickly. The more edge there is to the garden, the more impact to the garden. Try to minimise the edge of the garden by minimising these impacts. For example, keep pathways limited to the essential ones, by putting up clear walking and no walking areas and clear mowing and no mowing areas. Plant species and climax species well into the garden away from the edge as they will likely not tolerate soil disruptions and other harsh edge effects.
Barriers	Think of the perimeter of the garden as something that needs to balance keeping unwanted activity outside of the garden, but also letting animals like moles, small rodents, chameleons, birds and insects in. Also consider how this garden will connect with the next closest garden, and what specific barriers there are for each type of animal to move between them. For example, a railway line is a barrier for land animals, but not for insects and birds. Consider <u>different</u> wildlife corridor designs that are particular to the needs of the animal species of concern at that site.

5.1.1.3. Connecting Stepping-Stones within Suburbs

The next step is to try and connect the first Fynbos stepping-stone garden to the next closest stepping-stone. This could be a neighbouring garden, a local community garden, the nearest public green space, or school garden. A great way to connect individual Fynbos gardens in residential areas is through road verges. Since most people are not within walking distance of high quality Fynbos remnants, and public green spaces already serve as stepping-stones for biodiversity and opportunity for moments of connection between people, these are ideal areas to map as 'milestones' within the stepping-stone corridor building towards the ultimate goal of the nearest Fynbos remnant. A good alliance is to pair an indigenous stretch of pavement with routes of walkers, cyclists, runners and the disabled. Wildlife is disturbed by heavy traffic so quieter roads used for other non-motorised activities are ideal.

5.1.1.4. Connecting Stepping-Stones between Suburbs

The fragmented nature of the remaining Fynbos remnants in Cape Town means that stepping-stone corridor building ideally needs to stretch across different suburbs and communities to provide the most benefit for ecological connectivity. This provides an opportunity for social connectivity through collaborative corridor building. Rivers and existing human corridors, like roads and railway lines, that provide a link between different areas are great stepping-stone corridor spines. Some public green spaces already facilitate social connectivity between different communities and therefore form ideal nodes for connectivity between stepping-stones from different communities.

5.1.1.5: Aim Towards the Closest Fynbos Remnant

Since the ultimate ecological goal here is to build a network that helps pollinating insects and birds move between high quality natural areas, it is important to identify the nearest and most appropriate Fynbos remnant or nature reserve to guide the general direction of the stepping-stone corridor, while enhancing and reintroducing nature for urban residents. Both these are important so aim to optimise them both. The more 'gaps' we fill in with responsibly sourced Fynbos gardens across the city between protected areas, the better.

5.1.2. Select a Site: A Decision Tree



To select a site consider the site size, how close it is to the next potential site, ownership and management. Use our <u>online site selection map tool</u> to start or use the decision tree above to

think through how best to select a site that will be part of a set of sites that create a connected, networked whole.

5.2. Stage 2: Assess and Imagine

Creating a vision first needs an understanding of the specific characteristics of the potential Fynbos rehabilitation site in order to establish the social and ecological rehabilitation strategies envisioned for the space. This initial concept planning is important to identify site specific challenges and opportunities and to clearly define the way forward.

Before starting, refer to the core principles of ecological restoration outlined in the <u>International Standards and Practices of Ecological Restoration</u>. (A very clear 10 page English summary version is available <u>here</u>).

Ideal Fynbos stepping-stone projects will meet the core principles of ecological restoration if they:

- 1. Engage stakeholders
- 2. Draw on many types of knowledge
- 3. Are informed by native reference ecosystems, while considering environmental change
- 4. Support ecosystem recovery processes
- 5. Are assessed against clear goals and objectives, using measurable indicators
- 6. Seek the highest level of ecosystem recovery possible
- 7. Gain cumulative value when applied at large scales
- 8. Are part of a continuum of restorative activities

5.2.1. Baseline Assessment

The first step in Stage 2 is a site visit along with a baseline assessment to get to know the potential garden space. The baseline assessment includes gathering basic site information, doing an ecological assessment to evaluate the environmental conditions, as well as a social assessment that includes community consultation and scoping. The information gathered during the baseline assessment is important for the rest of the decision-making around the potential garden space. This allows for a clear problem statement, an understanding of community needs, and inspires a realistic mission that sets into motion goals, objectives and action steps. The following information should be gathered during the initial site visit:

5.2.1.1. Basic Site Information

Ownership	Getting permission from key partners to start a garden is vital to ensure the long-term success of the Fynbos rehabilitation garden, so it is important to find out who owns the land. Is it privately owned or public space? Important information include the name of landowner, address, site managers or other key persons involved ⁸⁶ . Request written permission from the owner to work there and update them regularly on any rehabilitation activities planned for the site. You can work through the Ward Councillor if it is City owned land but do ensure you get written permission from the department that is responsible for the land.
Site Description	The current land use and any future plans of the potential garden is important to consider to avoid making fruitless investments at the site. Try to get as much information from the land owner or site manager to make a decision on the long-term viability of the site. Also assess the visibility and ease of access of the space to make sure that it is suitable for the social and ecological function planned for the garden. A site that is highly visible and well used tends to have a higher success rate as they are valued and cared for by the surrounding community members, however, if the space is too exposed it might be prone to risks associated with access such as illegal dumping and trampling of plants by garden users. A clear assessment will guide the garden design to take site specific challenges into consideration.
Description of the current state	Record the current condition of the garden site by taking photos and notes. Identify previous, current and predicted threats and stressors causing environmental damage or degradation (illegal dumping, over-harvesting, safety etc). Also note any positive elements that can be worked with (current use, nice views etc.). The current state of the potential site will ultimately shape the rehabilitation activities that should be applied at the site. It will also determine the successional

⁸⁶ Clewell et al. 2005: 3.

phase to start the stepping-stone with and influence the choice of plants that can be introduced.

5.2.1.2. Social Assessment

Current Social Value of Site	Consider the current social value of the potential garden site. Is it beneficial to the surrounding residents or does it pose a threat in terms of safety or even health? It may already be used for recreational purposes, like dog walking or soccer, and for cultural and religious purposes. The garden design should enhance the existing social value or aim to refurbish the space to reduce the negative impacts it currently has on local residents, and fulfil social needs of people in the area. The social assessment should be informed by local residents and be a community-led process. The participation of community members during the assessment phase of the garden space is important to ensure the long-term sustainability of creating a new garden.
Access & Use Patterns	Take note of existing footpaths and use patterns present at the site to guide the function and physical layout design of the garden. If there are any prominent use patterns it is best to keep those particular functions in mind and design the space to enhance the experience for existing frequent garden users.
Community Scoping & Consultation	Whether the stepping-stone garden is an individual endeavour or a group effort, it is important that locally affected partners and resident needs and expectations are included in the entire process, and to determine appropriate resolutions and compromises if conflicting perspectives or challenges arise. This bottom-up collaborative approach increases innovative socio-ecological problem solving through rehabilitation gardening required for working in multifunctional urban contexts. The project is more likely to be successful and beneficial to a wider reach if it is a collaborative and inclusive process from the start as a participatory approach fosters a sense of ownership and pride. Get permission from the landowner and

put up signage with your contact number to gather interested local users.

A useful tool for discussing and visualising key social aspects of the site, and then later measuring your progress, is a social benefits wheel from the <u>International Standards for</u> <u>Ecological Restoration</u>:



5.2.1.3. Ecological Assessment

This step can be done with varying levels of detail but the following basic information should be gathered.

<i>Vegetation Type & Reference Ecosystem</i>	It is important to identify the Fynbos vegetation type of the site, even if there is no Fynbos present, and identify the most appropriate natural reference ecosystem the garden should attempt to reflect. This will help with getting the correct plants for your garden from the appropriate source. You can check the vegetation type <u>here</u> . It is also recommended that the reference site is visited to inspire the vision for the garden.
Closest Natural Remnant or Green Space	The ultimate goal of a Fynbos stepping-stone corridor is to connect your Fynbos stepping-stone to the nearest natural remnant. You can find your nearest Fynbos remnant <u>here</u> .
Current Vegetation Species List	Take note of the current plant species at the site. If you are unable to identify the plants, take photos of each plant and upload it to the iNaturalist app for identification. Once identified, compile a list of indigenous and alien species (note any threatened, endangered or invasive species). If there are any locally indigenous plants, try to find out if they were planted there and where these plants were sourced from. Some species might need to be phased out and replaced with more genetically appropriate plants.
Do a Quick Wildlife Survey	Are there any signs of insects or bird life at the site? If so, which elements or plants at the site are currently supporting wildlife? Take a photo if possible and keep them for monitoring records. The photos can also be uploaded to iNaturalist for identification.
Conditions at Site	The biophysical conditions of the site will also influence the garden design and the plant species selection. Make notes on elements such as topography, sun exposure, the type of soil, water access, and wind exposure. The soil will ultimately determine which vegetation type is best to reintroduce to the site, so note concrete and other chemical substances like batteries that change the soil pH.

The below ecological recovery wheel and restorative continuum⁸⁷ from the <u>International</u> <u>Standards for Ecological Restoration</u> can be used to discuss the current state of the site and clearly define your ecological goals. You can then later assess the site again and track your progress.



⁸⁷ Gann GD, McDonald T, Walder B, Aronson J, Nelson CR, Jonson J, Hallett JG, Eisenberg C, Guariguata MR, Liu J, Hua F, Echeverría C, Gonzales E, Shaw N, Decleer K, Dixon KW (2019) International principles and standards for the practice of ecological restoration. Second edition. Restoration Ecology DOI:10.1111/rec.13035

5.2.2. SWOT Analysis

Assessing the strengths, weaknesses, opportunities and threats of the potential garden site will help determine what there is to work with, what is stopping progress and what can be improved. The SWOT analysis may be used to create a problem statement and guide the mission statement and rehabilitation goals.

An example SWOT analysis of a vacant public site located in a residential area.

Strengths	The surrounding residents are highly motivated to take action to rehabilitate the site by creating a community garden that will benefit biodiversity, improve social bonds and instil a sense of pride of place within the neighbourhood. The site is unlikely to be disturbed by future development plans and is situated close to a bigger open green space that is well used by pedestrians.
Weaknesses	The site is frequently used as an illegal dumping site, and other illicit activities, resulting in increased community health and safety risks. It is currently a very low-functioning ecological site invaded by Kikuyu grass. The site is located within the critically endangered Cape Flats Sand Fynbos vegetation type.
Opportunities	The site can be transformed into a Fynbos stepping-stone rehabilitation garden, as a place that facilitates social bonding within the community, by working together towards a common and unifying goal of bringing back nature and its benefits to their neighbourhood.
Threats	Ongoing threats might include persistent illegal dumping. The site is highly degraded, especially the soil, and biophysical conditions are challenging as it is exposed to harsh winds and there is no easy access to water.

5.2.3. Define a Problem Statement

Stepping-stone rehabilitation garden projects should identify concerns related to the socio-ecological health of a specific site. The need for rehabilitation should primarily be informed by locally affected individuals and groups as they have an in-depth understanding

of community needs and existing challenges. An example of a problem statement of a public space:

"The vacant piece of land is frequently used as an illegal dumping site, and other illicit activities, resulting in increased community health and safety risks. It is currently a very low-functioning ecological site invaded by Kikuyu grass. The site is located within the critically endangered Cape Flats Sand Fynbos vegetation type."

5.2.4. Create a Vision and Mission Statement

A clear problem statement and the most functional, practical and realistic option for the garden should guide the general vision for the rehabilitation garden. The mission statement should be brief and address tasks and overall mission of the project. An example of a problem statement of a public space:

"Transforming this illegal public dumping site into a locally indigenous Fynbos garden to reduce community health and safety risks, and increase the function and biological diversity of a critically endangered vegetation type."

5.2.5. Plan Goals, Objectives & Actions

Fynbos rehabilitation goals describe the ideal states and conditions that the rehabilitation project attempts to achieve through rehabilitation gardening and outlines the expected or desired results. It is a defining step in the rehabilitation planning and design process and sets into motion all other subsequent project decisions and activities. Goals and objectives should be guided by the functional vision of the Fynbos garden and clearly linked to realistic action steps. Lastly, action steps should be measurable, time-bound and specific. The following table provides a few examples:

Goal	Objective	Action	Time-frame	Measured by
Establish	Select	Planting Fynbos	Ongoing -	Bird & insect
networks for key	indigenous and	species like	Pioneer phase	monitoring after
Fynbos	nectar-rich	leonotis	(year 1) to the	introducing
pollinators.	plant species	leonurus, salvia	specialist phase	plants to the
	that support	aurea,	(year 3).	garden. Their

	bird and insect pollinators.	pelargonium capitatum and carpobrotus edulis that supports pollinating insects and sunbirds.	Planting in June to July each year.	presence or absence will indicate if the goal has been achieved.
Increase local biodiversity	Increase the species diversity through successional planting.	Planting pioneer plants to establish the garden. Plant nectar-rich plant species that support bird and insect pollinators. Plant more specialist species such as proteas and ericas, and endemic and endangered plants.	Pioneer phase (year 1) Insect & bird phase (year 2) Specialist and climax species phase (year 3)	Monitoring vegetation cover over a three year period to measure if the plant diversity has increased. Bird & insect monitoring may also indicate increased diversity over this period.
Maintaining locally indigenous gene pools	Using appropriate genetic plant stock and reintroducing locally	Buy plants from locally indigenous nurseries or grow seeds & cuttings	Ongoing - Pioneer phase (year 1) to the specialist phase (year 3).	Keep detailed records of the plants used in the garden in the form of species list and

indigenous	sourced from	their original
plant species.	the right plant	sources.
	stock. Phase out	Compare to the
	plants that are	baseline
	not genetically	assessment
	appropriate.	species list to
		measure
		improvement.

5.3. Stage 3: Choose Plants

This is arguably the most important step and it is closely linked to current, past and site specific conditions and uses. Knowing your historical vegetation type of the site, along with some background on its ecology and social value is a step not to miss before you choose plants. Use our online species selection tool to help start stage 3. As mentioned previously, stepping-stones can be designed for specific social and ecological functions by carefully selecting appropriate plant species. The success of the garden can be increased by carefully considering specific site conditions and then matching your plant list to suit these conditions. This section provides guidelines as to selecting the right plants for local conditions and garden purposes.



Below is an overview of the process before going into the detail

5.3.1. Consider Indigenous and Non-Indigenous Plants

Gardening practices and plant selection decisions are driven by the sets of values the group has, and it is closely linked to a deep sense of family tradition and culture. While considering both the social and ecological values of a site, this strategy encourages a sense of pride and care for local flora and the fauna it supports. We therefore encourage gardens that have locally indigenous plants, as much as is possible within the context. If non-indignous plants are used they should be carefully considered, kept to a minimum and strictly be non-invasive. Horticultural varieties that may hybridise with wild populations should be phased out or avoided and indigenous plants should be sourced appropriately to help conserve genetic diversity and integrity.

The indigenous vegetation found in Cape Town is predominantly Fynbos which is further divided into specific vegetation types found in specific areas in the city. Gardens should reflect those very local specific vegetation types by finding inspiration from the appropriate reference ecosystem at the closest reserve, and using plants found in the specific vegetation type and sourced from nurseries with plants originally from the closest remaining population of plants possible. There are many benefits to gardening with indigenous plants, and it can be done in a way that supports the tireless conservation efforts happening in the remaining natural remnants that surround urban areas. This strategy focuses mostly on Cape Flats Sand Fynbos and Cape Flats Dune Strandveld because of both the social and ecological needs in these areas.

Learn more about indigenous vegetation from PlantZAfrica.

5.3.2. Consider the Reference Ecosystem

It is advised to visit the selected natural reference ecosystem to observe the natural occurring plants patterns and communities to inspire the design process of your rehabilitation garden. The table below includes the vegetation type and their natural reference ecosystems:

Cape Flats Sand Fynbos	Kenilworth Racecourse Conservation Area
Cape Flats Dune Strandveld	North: Blaauwberg Nature Reserve and Witzands Aquifer Nature Reserve

	South: Edith Stephen Nature Reserve, False Bay Nature
	Reserve, Zandvlei Nature Reserve and Wolfgat Nature
	Reserve
	*Please note that the plants in the north and south are two
	distinct populations and plant material is not
	interchangeable between the two.
Peninsula Shale Renosterveld	Signal Hill

5.3.3. Assess your Site and Growing Conditions

Understanding your site is an important step in plant selection and growing a successful Fynbos stepping-stone. It is important to know that the strategy promotes gardening in challenging physical conditions, however, working with the right plants and some initial care it is very possible to establish thriving gardens. Every site will have a unique set of opportunities and challenges to work with. Sites will also vary in microclimate and available natural resources to support the garden. The following elements should be considered:

Available Light	Consider how much direct sunlight the site receives. Is it full sun (around 6 - 8 hours daily), semi-shade (around 4 - 6 hours daily) or shaded (around 0 - 4 hours daily). Is it morning, midday or afternoon sun? Any areas shaded by a tree, wall or build ing? It may be that some areas receive more sun than other areas of the site and the available light might change according to season as the sun's angle changes. Most Fynbos species require full sun, however, there are some species that could tolerate shady sections.
Soil Conditions	Is the soil type sand, clay or loam? Consider the texture, is there good drainage or does the soil seem waterlogged? The pH is also important and it is advisable to test your soil before planting.
	We know that most Fynbos plants naturally grow in sandy and acidic soil. In Cape Town much of the environment has been transformed and polluted making it less suitable for the exact historical vegetation type that once thrived there. For example, if you are in a Cape Flats Sand Fynbos historical area, and the site has a lot of concrete in it, consider

	using some Cape Flats Dune Strandveld plants that tolerate the alkaline concrete leached into the soil, until that has been fully remedied at the site in later years. Mulching with pine needles may assist with lowering alkalinity of the soil and starting your garden off at the pioneer phase will ensure higher levels of plant survival and help amend the soil for more sensitive species. Learn more about <i>Eynbos for alkaline soil</i> .
Wind	Some sites might benefit from adding windbreaks to protect the garden from the persistent and dry south-easterly wind occurring from spring to late summer. Windbreaks can be pioneer plants strategically planted to form a protective barrier for more sensitive plants or physical protective barriers, like shade cloth fencing, can be temporarily added to help protect the garden while plants are still small and vulnerable to wind damage.
Available Water	Establishing plants on the arid landscape of the Cape Flats has its challenges. Sticking to the suggested planting season will set the garden up for success, however, the garden might require some watering during its first summer and during unusually hot and dry periods. Consider landscaping techniques that could be implemented at the garden to increase water retention at the site.

5.3.4. Select your Plants

Use the information provided throughout this section and our <u>online species selection tool</u> to make a final selection of plants that will suit the specific site and the garden's social and ecological purpose. Ensure that you consider the following:

Plant design
(species
richness &
diversity)Fynbos is by nature diverse and composed of a mixture of different species
growing closely together. To create a 'wild' and informal mix that still has a
more manicured feel to it, plant the same species in 3's or 5's. Depending
on what space is available. The more diversity you are able to add, in
terms of species and structure, the better. Also consider growth forms;
some are tall and leggy while others are bushy and spread⁸⁸. Think of plant

⁸⁸ Honig. 2014: 109.

	patterns and quantity. A good balance and representation of a variety of species. It is very possible that a single species, like fast growing groundcovers, can become 'invasive' in the garden and may require extra maintenance. Remove pioneers entirely once the garden is established if this is the case.
Flower colour & phenology	Different plants flower during different times of the year so it is important to plant a selection that will provide food for pollinators throughout the year. A garden that flowers all year long will enhance the experience for people who use the garden. In addition, different colour flowers attract different pollinators so the plant selection can also be designed according to flower colour to assist a more diverse array of insects and birds.
Structural diversity (Height, texture & layers)	To increase the level of functional diversity at the garden it is important to consider the structural diversity of the garden. Structural diversity gives the garden height, texture and layers. Include different plant growth forms like groundcovers, low shrubs, tall shrubs, grassess, succulents and bulbs.
Trees	Fynbos is predominantly shrubland with very few trees that naturally occur. As most fynbos plants require full sun, trees might pose a challenge by providing too much shade. Some sites may be big enough to accommodate trees and Fynbos. If sites currently have trees that add social and ecological value but are invasive or not indigenous, consider replacing them with an <u>indigenous selection</u> instead. Remember to leave at least 2 m from infrastructure for root development when working with trees in urban areas.

5.4. Stage 4: Design your Garden

The previous section was aimed at gathering the necessary information required to understand the specific potential Fynbos rehabilitation garden site. Once it is clear what there is to work with, designing the garden is the next step to achieve the goals set out. Fynbos rehabilitation gardening should aim to create multifunctional spaces that maximise its socio-ecological value. When going through the designing stage always keep in mind both the desired ecological and social outcomes. This process is closely linked to the goals set out in the previous section.

5.4.1. General Design Considerations

Here is an overview of the design guidelines



5.4.1.1. Designing for Function

The function of the garden is closely tied to the choice of plants for the site. The table below provides guidelines for selecting plants that have social and ecological benefits and functions:

Designing for
biodiversityFynbos stepping-stones can be 'themed' to cater for specific pollinators to
guide plant selection and ecological function design. It is important to
always design your space with specific species of animals in mind,

	because each animal species will have specific habitat requirements. For example, some insects need rotting wood on site for parts of their breeding cycle. First consider plants from the corresponding vegetation type of the potential site. Here are a few species lists carefully designed to provide nectar resources for key Fynbos pollinators throughout the year: Insect pollinator plant species Nectar-rich species for sunbird pollinators
Designing for people	When designing for the needs of people consider plants that are medicinal, edible and useful (shade, wind protection). The selected plants should also consider community safety and the aesthetic preference of residents and partners involved. <u>Plant species with medicinal properties</u> <u>Edible Fynbos plants</u>

5.4.1.2. Cues to Care

When choosing a design for the garden include elements that very obviously show that a space is valued and well cared for. This will greatly increase the long-term success of the Fynbos rehabilitation garden. Creating cues for people to care involves keeping a well maintained space by regularly weeding and pruning. Adding features like clear bed boundaries, educational signage, a path, a bench, subtle fencing or a bin can create cues for garden users and bypassers to treat the space with care and respect.

5.4.1.3. Designing for Safety

The safety of residents and garden users should be prioritised to ensure support and long-term viability of the Fynbos rehabilitation garden. Especially in public places and schools. Here are some safety considerations:

- Increase usage and interaction by adding features such as a guiding path, educational signage and benches for bypassers to sit and enjoy the garden space.
- Consider the fire risk of the area and choose the plants and equipment materials for the garden space accordingly.
- Increase visibility by planting groundcovers and low shrubs.
- Maintain a well cared for space by regular weeding and pruning.

- Organise community events to encourage a sense of place and ownership.
- Maintain site lines so that in the garden you can always see other people (no hidden corners)

5.5. Stage 5: Make a Work Plan

5.5.1. Annual Stepping-Stone Garden Calendar

Plan your garden activities around the following calendar to ensure seasonal appropriateness of particular tasks.

Stepping-Stone Stages	Actions for this time of year	Month
Planning & design	Site visit, baseline assessment, SWOT analysis, garden vision & design, community activation & mobalisation.	Jan to Feb
Garden preparation & place-making	Physical layout design, ground preparation, landscaping, cues to care, sourcing plants.	Mar to May
Planting	Introduce locally sourced indigenous Fynbos plants.	Jun to Jul
Ongoing care & monitoring	Garden maintenance, evaluation and applying adaptive management. Monitoring the social and ecological goals. Share skills & knowledge gained.	Aug to Dec

5.5.2. Succession Planning

The strategy suggests that Fynbos stepping-stone gardens follow a three-stage successional planting plan described below to assist natural succession towards the highest degree possible at a specific site. The plant selection will depend on the stage at which you start the stepping-stone. Use the species list compiled during the baseline assessment to see what is

currently growing at the site. If the site already supports pioneers then it may be possible to start your garden at the second phase. However, if it is mostly invasive or a highly disturbed site, start with the pioneers phase. If unsure, rather start with the pioneer phase to avoid disappointment and fruitless efforts as pioneer plants are easy to grow or obtain. If the site is already an established and thriving garden that just needs a locally indigenous Fynbos facelift then you might jump straight into the insect and bird phase, or even specialist phase.

5.5.3. Sourcing Plants through Eco-Sourcing

5.5.3.1. Where to Find the Right Plants

The table below describes the vegetation type and the restoration nursery that will be able to provide the correct genetic plant material for your garden. Most garden centres and large nurseries do not keep locality data on where they get plants from, so their plants are not suitable for stepping-stones, and would in fact be a genetic risk to any local project or nature reserve. Avoid these plants. It is important to note that most restoration nurseries will need you to order your plants the year before you plan to start planting. Some plants also take 2 years to be ready, so factor that into your planning.

Vegetation type species lists	Plant source nursery
Cape Flats Sand Fynbos	<u>Fynbos Life</u>
Cape Flats Dune Strandveld	<u>Fynbos Life</u>
Peninsula Sandstone Fynbos	Good Hope Gardens Nursery

It is not always necessary to buy the correct plant stock from a nursery. There is a network of many existing gardens and projects that could provide cuttings of, for example, pioneer Fynbos species. The propagation of the plants should be planned well in advance in order for them to be ready for planting during the rainy season. Most groundcovers, like Sour fig, root easily and can even be planted directly without roots during the rainy season. It is important to remember that it is a legal offense to harvest plants without a permit from protected or

unprotected public or private land and plant material should always be sourced legally and sustainably. For legal permission to harvest plants please visit <u>CapeNature permits</u>.

5.5.4. Site and Soil Preparation

Draw a rough garden sketch that includes garden beds, the plant placement plan, paths and the envisioned use of space. Bare in mind the physical elements and dimensions of the space, the social and ecological function and available resources at the site. It is a great first step to start visualising the potential of the space and provides a visual guideline to refer back to when implementing gardening activities.

5.5.4.1. Removing Invasives

Fynbos is one of the most severely invaded regions in South Africa so it is almost certain that you will have to apply some sort of invasive plant or animal control at the rehabilitation garden site. If Kikuyu grass is encountered, it is important to note that all the roots in the soil should also be removed. Sheet mulching is a low cost, efficient and effective method to clear out invasive weeds and grass before planting. The link below will help identify which invasive plants and animals to look out for in Cape Town and what to do when they are encountered at the garden.

Invasive plants and animals in Cape Town

5.5.4.2. Install Landscape & Monitoring Features

The following section links in with the process of place-making and provides cues for garden users. Consider installing the the following features at the garden:

Pathways	Use existing footpaths and use patterns identified during the		
	baseline assessment. It is very seldom wise to change an		
	existing pathway as people will revert back to it and damage		
	your hard work. As far as possible, use natural materials in		
	landscaping pathways to avoid possible contamination from		
	pollutants and make use of permeable features that allow		

	water to seep into the soil. Pathways should be easily accessible and consider people with limited mobility.
Borders & Fences	Garden bed borders can be defined through different means but natural materials like stone and wood are advisable. Consider fencing to provide some protection to garden beds from possible damage from existing use patterns like dog walkers or pedestrians. Consider chain-link fencing using natural materials to provide some protection without cutting off access or obstructing the view of the garden. Ease of access is important to encourage increased use of the site.
Landscaping the soil	Consider adding windbreaks to create a nursery environment while the garden establishes (could be temporary) and landscape the garden in such a way that it collects and holds water. This will assist plants during the first few summers and during unusually hot and dry periods. This can be done by levelling the soil in the garden beds in such a way that they form a slight basin to catch and hold rain or redirected stormwater using swales. Also consider installing a rain garden or making use of Olla pots for deep watering in summer.
Garden Features	Add features such as benches, dustbins, bird baths as cues for people to care for the space and invite them to engage with the space in a meaningful way.
Educational Signage	Consider adding educational signage about the ecological purpose of the garden to increase awareness and inspire a similar garden elsewhere. Add contact information for those who are interested in becoming active gardeners of the site. This is a great way to encourage stepping-stone corridor building.
Monitoring	For monitoring purposes select a position where you can add a semi-permanent and clearly marked pole with height measurements. Taking regular photos from this fixed angle with the measuring pole visible in the photos can help

5.5.4.3. A Note on Working with Wood

When using wood for landscape features it is important to make sure that highly invasive and destructive shot-hole-borer beetles are not accidentally introduced to the garden site.

Learn more about the Shot Hole Borer Beetle

5.5.5. Plant Layout

The table below provides some insight to help guide the plant design of the Fynbos stepping-stone garden. It is useful to keep in mind that plant design will be a learning curve and that the design could change as you go along, especially during the first year of starting the garden. In addition, some plants might not make it while others might need to be removed to make space for a more diverse selection. Starting the garden off with pioneers is therefore strongly advised as these will more likely survive the dynamic nature of the three-stage successive planting plan.

How Many Plants?	This will depend on the size of your stepping-stone. Many Fynbos plants cover a square meter or more when fully grown. However, in smaller spaces plants can be maintained and kept small to accommodate more species. An average of 3 plants/m ² is advised. More can be used if you work with smaller species, keep the plants small by regular pruning or add bulbs that will only use up garden space seasonally ⁸⁹ . Some plants will inevitably die because we do not know if the site conditions are necessarily ideal so over plant rather than under plant to make full use of the planting season. Working with locally sourced plants and pioneers will greatly improve the success rate as they are most likely to be well adapted to microclimates.
Spacing Plants	Depends on the height and spread of the plant species. Fynbos is naturally dense and grows as continuous stands in nature. Replicating the dense pattern helps to suppress weeds and helps protect the soil by keeping it

cool. However, it might also mean that the garden will require more frequent pruning at sites where a more manicured growth is preferred for safety reasons or as per aesthetic preference. Giving plants more space to grow cuts down maintenance. To fill in the gaps or empty spaces while the plants grow and fill out, temporary fillers, like groundcovers, can be used and then replanted elsewhere when the time comes. Note that some groundcovers, especially Sour fig, tend to overgrow slower growing shrubs⁹⁰.

5.5.6. Planting

5.5.6.1. Prepare the Soil for Fynbos

True Fynbos vegetation thrives in sandy, nutrient poor and acidic soils. In Cape Town, much of the environment has been transformed and polluted making it less suitable for the exact historical vegetation type that once thrived there. As suggested earlier, if the site has a lot of concrete in it, consider starting off with alkaline-tolerant species. Acid compost can also be introduced at the site if resources allow for that intervention. Otherwise mulching with pine needles after planting may assist in making the soil more acidic and suitable for Fynbos.

A vital part of the soil preparation phase is introducing living mulches such as Sour fig species and pioneer shrubs, thus, starting with the pioneer phase of the three-stage successional planting. These plants will start interacting and working as an underground community to reestablish the natural processes and ultimately once again create a suitable environment for more sensitive and suitable Fynbos plants to be introduced in year two and three of the rehabilitation garden.

5.5.6.2. When to Plant

The best season to plant is during the rainy season (June and July) as temperatures start to cool down and the rain sets in. This ensures that plants receive ample water and allows them to develop a healthy root system before the onset of the first hot dry summer at the site. This is especially important for sites where water access is limited. Planting 'out of season' will require a lot more human care to ensure the plants survive.

⁹⁰ Honig. 2014: 110.

5.5.6.3. Planting Guidelines

- 1. Position the plants where they will be planted in the garden according to your plant design.
- 2. Dig a hole 2 x depth & 2 x width of the planting bag and fill the hole with water.
- 3. At disturbed sites with sandy soil where little topsoil remains it is advisable to add some compost. Acid compost can be mixed in with the soil that was removed from the hole. Use the mixture to fill up the space around the plant once the plant has been placed in the hole.
- 4. Fynbos plants are sensitive to hand temperature and gripping pressure so work as quickly and gently as possible. When removing plants from pots or bags, take extra care not to disturb the highly sensitive rooting system and never loosen the soil from the roots. Start by gently loosening the plant from the original pot, tip the pot upside-down, holding the plant between your fingers, and gently remove the pot. Then place the plant in a pre-dug hole in the soil.
- 5. Cover the entire root system with the remaining mix of soil and compost and gently level the soil around the base of the plant to form a slight basin to catch and hold water.
- 6. Add a layer of mulch (chipped wood, rough compost or pine needles) at least 3 to 5cm thick to help protect the soil and retain moisture⁹¹.
- 7. Give the plants another round of watering, at the base of the plant stems, immediately after planting and adding mulch.

5.5.7. Garden Care

The Fynbos rehabilitation garden care and maintenance is an ongoing process and will require initial regular care and maintenance during the plant establishment period to help set up the garden for success. Best practice is to do a weekly garden visit and establish a regular maintenance routine to eradicate weeds and invasive plants. The garden might require additional watering during the first hot and dry summer months until the plants are strong enough to survive all seasons. A well planned maintenance schedule and weed management programme is an important part of rehabilitation gardening.

⁹¹ Honig. 2014: 108.

5.5.7.1. Fynbos Maintenance Guidelines & Tips⁹²

Pruning	Some species grow faster than others. Prune back after flowering to promote healthy new growth. Pinching the tips of plants or bushes encourages bushy and full growth. Remove some groundcovers and pioneers when they are no longer required. These can be transplanted into the next stepping-stone or used to expand another section in the current garden.
Watering	Stepping-stones will require watering during the first two summers until the plants are well established and adapted to the local microclimate. Deep but infrequent watering is best (15 to 20mm) to imitate natural rainfall. This will encourage plants to grow deeper in search of moisture and set them up to be resilient during dry spells ⁹³ . Adjust watering with the seasons and as the garden becomes established. Over watering may result in rapid growth and more maintenance. It also ultimately shortens the lifespan of some plants.
Mulching	Annual mulching helps maintain healthy soil and moisture during hot dry spells. Mulching is required for as long as there remains bare patches of soil. Groundcovers are essentially living mulches and should be used as much as possible. Note that some grow very fast and may overgrow slower growing species. It is advised to add a 3 to 5cm layer of mulch of chipped wood, rough compost or pine needles ⁹⁴ .
Feeding	Occasionally add organic fertilizer and foliar feed like fish or seaweed extract. Do not use chemical fertilizers high in phosphate or animal manure compost.
Weed & pest control	Avoid using inorganic products in the garden as poison never works in isolation. Rather choose organic remedies of which many can be made at home from inexpensive and safe to use ingredients and increase plant diversity that allows nature to establish a balance. Invasives should be eradicated and reported if necessary.

 ⁹² King, M. 2012.
 ⁹³ Honig. 2014: 109.
 ⁹⁴ Honig. 2014: 108.

5.6. Stage 6: Monitor

Monitoring the recovery and functioning of a Fynbos rehabilitation garden is important to generate social learning, answer specific questions, provide evidence of the garden's benefits and help rehabilitation gardeners to apply adaptive management. The monitoring process essentially starts with the baseline assessment of the site. Any data recorded thereafter will be measured against the conditions of the site before any rehabilitation activities took place. We use indicators as 'cues' to progress, however, there is no single easy-to-measure indicator to measure the level of recovery when working with Fynbos. Especially when working in urban areas where each site is unique.

Instead we focus on measuring the level of recovery of the specific functions we want to reinstate at a rehabilitation garden. For example, if you plan to restore Fynbos pollinator networks then conduct bird and insect monitoring to measure the presence or absence of key pollinators like sunbirds, bees and monkey beetles. Similarly, if you wish to restore local plant biodiversity at the garden you will monitor plant species density, richness and plant cover. The table below provides step-by-step guidelines and monitoring protocols for specific functions.

The data collected during monitoring is then compared to the baseline conditions recorded before starting the rehabilitation garden, as well as measured against the appropriate reference ecosystem of the specific vegetation type of the garden. It is recommended that monitoring is done for two to four years if you plan to rehabilitate the garden site using the three-year successional planting method.

5.6.1. Monitoring Protocols

The table below contains various protocols that can be used to monitor specific social and ecological goals of the garden.

Look online for updates to these protocols in the resource section.

Monitoring bird Monitoring insect Mo	nitoring Social &
pollinators pollinators bio	physical psychological
con	nditions monitoring

Protocol	Ingcungcu Bird Monitoring Protocol	Insect diversity - Pan traps (lethal) Flower check (non-lethal)	Vegetation cover Plant health	Social & psychological impact
	Visit <mark>fynb</mark>	<mark>oscorridors.org</mark> for ti	hese and more M&E r	esources.
Aim	To measure the level of success of the rehabilitation of key plant-pollinator relationships, species richness and diversity.	To measure the level of success of the rehabilitation of key plant-pollinator relationships, species diversity and species abundance.	To measure the level of success of the rehabilitation of indigenous Fynbos vegetation.	To measure the social function of the garden.
Skill level	Enthusiast	Enthusiast	Enthusiast	Enthusiast
Time demand	Monthly	2 x sessions per season	Annually	Annually
Budget demand	Minimal	Minimal	Minimal	Minimal
Duration	Long-term	Long-term	Long-term	Long-term

5.6.2. Garden Evaluation

After the first planting year the Fynbos rehabilitation garden project should be re-evaluated to identify successes, setbacks and next steps. It may be helpful to go through the garden design process again, especially before reintroducing the second and third year plant species. It is important to remember that rehabilitation gardening should continuously aim for the highest level of recovery possible along the Fynbos restorative continuum.

5.6.3. Share Knowledge and Skills Gained

It is best practise to keep detailed records of all the rehabilitation gardening plans, processes and monitoring data in order to share rehabilitation gardening experiences with others for increased success of current and future garden projects. Rehabilitation gardening with Fynbos in urban areas can be seen as an experimental process that requires all levels of knowledge and collaboration in order to be successful.

Conclusion

The first aim of this collective effort was to make information on indigenous greening more accessible so that well-intentioned organisations, as well as citizens who do gardening in their yard or on their pavement, can find and understand their role in maintaining and rehabilitating Fynbos ecosystems in Cape Town. Space in this city is a highly sought-after commodity. As such, every current or potential opportunity for green space to more optimally support healthy human and ecological life must be taken. This document and its accompanying <u>website and mapping platform</u> have made great strides in taking scattered and academic information on off-reserve Fynbos rehabilitation and translating it into a set of tools appropriate for use by the general public. As well as compiling it into a reference document which can be utilised by the general public. The hope is that this strategy, website and framework will allow non-ecologists to better understand the Fynbos garden as an important site for biodiversity rehabilitation.

The second aim of this work was to elevate urban greening in Cape Town so that everyone, no matter their current level of knowledge and experience, can move closer to carrying out high quality indigenous greening, as it would be defined within the field of restoration ecology. While it is easy to select a plant labelled 'indigenous' from a nursery, and quite a bit more challenging -- but not impossible -- to create and maintain a Fynbos Stepping-Stone Garden. By providing a step-by-step guide to the process, and explaining the ecological theory behind the process, this document and website make sound Fynbos rehabilitation practices more accessible to those outside of the professional realm who are passionate about our local ecology.

The third aim of this work was to foster collaboration in order to make it possible for all of these small pockets of good work to add up to something bigger -- a city-wide stepping-stone corridor network. This ecological aim of corridor building is intertwined with broader goals for social connectivity within the socially fractured setting of Cape Town. There are many dimensions beyond the physical in which bridge-building is required, and this is the heart of this collective work going forward. The Fynbos Corridor website has a function which allows people to register their work online and see where others are working to assist in starting the challenging but worthwhile process of collaborating across the landscape.

However, we recognise that this document is only a starting point and has several shortcomings. Firstly, while this document has primarily focused on the ecological benefits of

Fynbos restoration, it is important to recognise that there are many different ways of valuing nature and many different socio-ecological contexts in which greening is desired and needed. These contexts may vary from areas where Fynbos rehabilitation is as close to current theory of restoration as it gets, to areas where people are navigating complicated balancing acts, such as needing to strike a balance between the short-term food security benefits provided by a vegetable patch and the long-term ecosystem health benefits provided by a Fynbos rehabilitation project. Secondly, while this document does include a number of practical guidelines, it does not provide guidance on tackling more complex social-ecological goals such as integrating Fynbos and food gardens or cultivating indigenous plants for medicinal use. Thirdly, while many experts and practitioners were consulted in the creation of this document, these voices by no means represent everyone with a stake in Fynbos rehabilitation in Cape Town. Moving forward, different voices behind the greening in different contexts need to be integrated into this work to continuously improve it. Therefore, in conclusion, for this work to be successful, the knowledge and methods contained within this document and its accompanying website need to be used as a foundation from which to discuss, practice, test, adapt and share. Over time, it is our hope that this work will be reshaped and fine-tuned for different greening scenarios with different budgets, social values, safety levels, access to information and aesthetic styles, and that this be freely shared within the spirit of collaboration for Fynbos rehabilitation. Within this process, the widespread socio-ecological healing that both humans and the landscape need, can take place in earnest.

<u>Useful Resources</u>

The <u>Fynbos Corridor Collaboration website</u> is the best place to start when developing a Fynbos stepping-stone garden.

In addition, here are some other useful resources:

Resources			
Plant & animal identification	<u>iNaturalist</u>		
Plant information	<u>PlantZAfrica</u> Indigenous trees for Fynbos gardens		
Invasive species management guidelines	Invasive species unit Shot-hole borer		
Recommended Fynbos nurseries	<u>CapeNature permits</u> <u>Fynbos LIFE nursery</u> <u>Good Hope Gardens Nursery</u> <u>Veld and Fynbos</u> <u>Silverhill Seeds</u>		
Landscaping & design information	<u>Guide to sheet mulching</u> <u>Guide to creating a rain garden</u> <u>Place-making</u>		
Society for Ecological Restoration course	E-learning course		

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