

# Therapeutic Effects of Nature-based Interventions

ANGELIA SIA  
NATIONAL PARKS BOARD

# Outline

## 1. Introduction

## 2. Research

*Nature-based intervention for physical activity*

*Nature-based intervention for well-being*

## 3. Summary



1.

# Introduction

# 1. Introduction

## Engagement with nature

- Viewing nature, as through a window, or in a painting
- Incidental nature
- Active participation and involvement with nature, such as gardening or visits to green spaces

# Introduction

Nature-based intervention (NBI)

— Treatment that facilitates behavioural change and results in promoting improved well-being

# Introduction

NBIs may involve

 changing behaviour  
*e.g. organized programmes or other activities*

 changing the environment  
*e.g. provision of parks in hospitals or cities*

through promotion of nature-based experiences



# Introduction

## Well-documented benefits

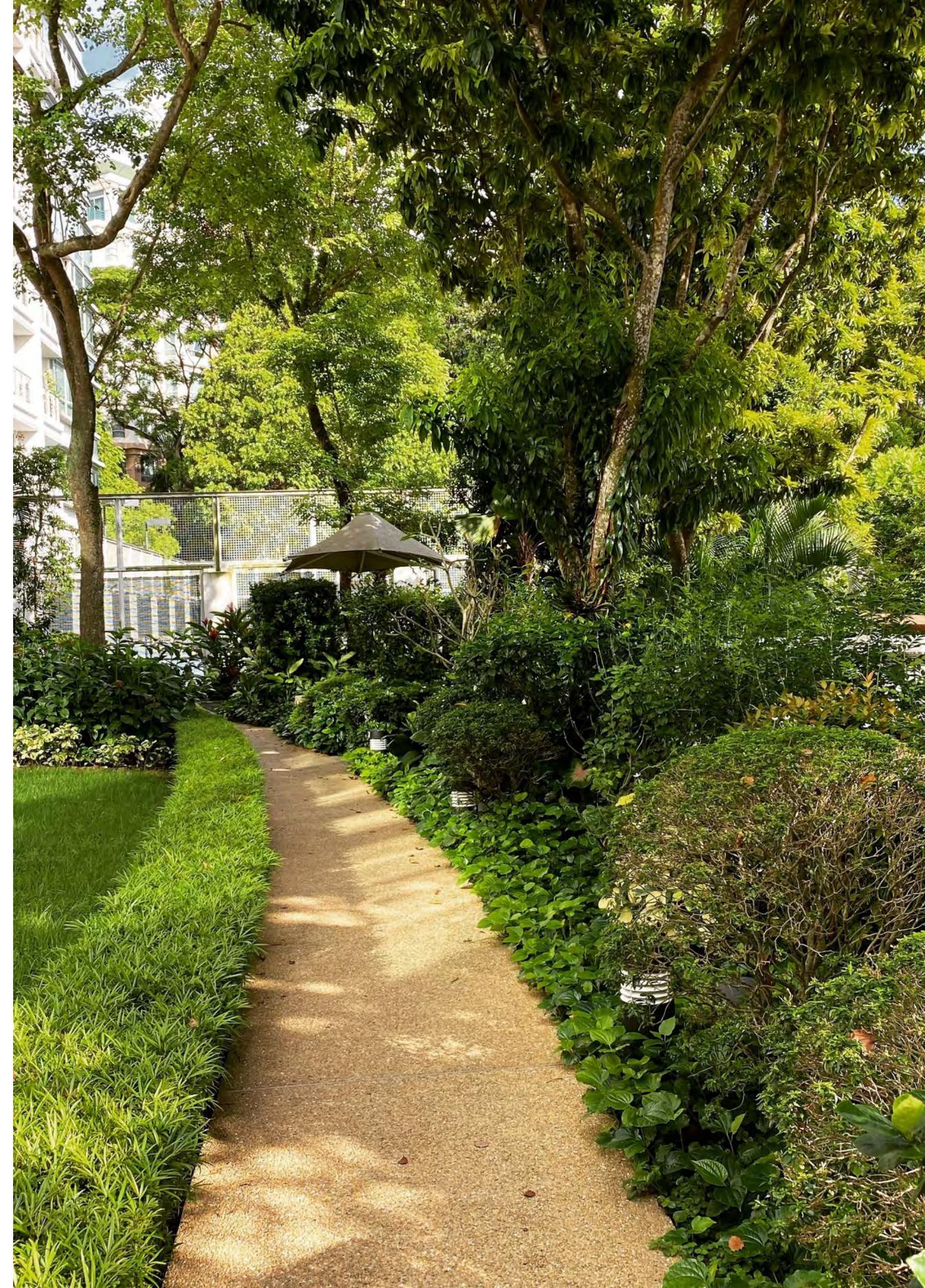
- Visits to outdoor green spaces reduces depression (7%), high blood pressure (9%) & promotes well-being
- Effects on alleviating Covid-19 related stress,  
*Greenspace use and green view through windows increased self-esteem, life satisfaction, and subjective happiness and reduced depression, anxiety, and loneliness*

# Introduction

*“Urban green space is a necessary component for delivering healthy, sustainable and liveable cities”*

in Urban Green Space Interventions and Health

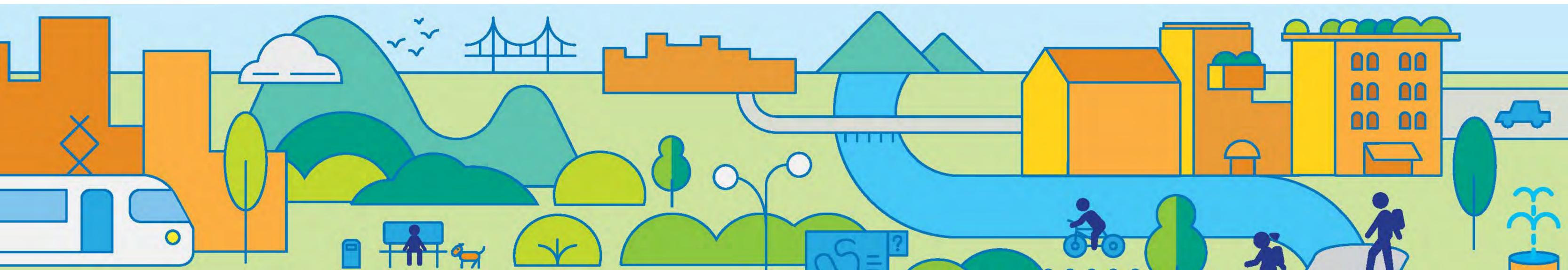
World Health Organization, 2017



# Introduction

*"Each child, no matter where they live in the city, should be in easy walking distance from a safe and welcoming public green space"*

In The Necessity of Urban Green Space for Children's Optimal Development



# 2. Research

## Main Objectives

Extent of benefits from various NBIs  
How benefits can be operationalized



# Research

## Studies

NBI for physical activity

*Park Prescription (Px)*

NBI for well-being

*Therapeutic Horticulture*

*Effects of Landscapes on Brain Activity*



# Park Prescription (Px)



# Park Px

## **INTERVENTION**

- Counselling — park-based exercise goal setting on a prescription sheet, information on exercise options in nearby parks
- Activity log
- Option to join a weekly structured exercise program
- Telephone follow-up

## **PARTICIPANTS**

40-65 year old with inactive lifestyle (n=160)

# Park Px

## Resources

- Park Px sheet – FITP goal setting
- Exercise amenities in nearby parks

*Length of trail*

*Estimated time to complete*

*Difficulty level*


Park  
Prescription

NAME: \_\_\_\_\_  
 DATE: \_\_\_\_\_

F	<p><b>Frequency</b></p> <p>Aim for 150 minutes of physical activity per week</p>	<p>How many days of physical activity per week are you ready to start with?</p> <p> <input type="checkbox"/> 1-3 days  <input type="checkbox"/> 3-5 days  <input type="checkbox"/> 5-7 days         </p>
I	<p><b>Intensity</b></p> <p>Aim for moderate intensity physical activity</p>	<p>When engaging in moderate intensity physical activity, you have enough breathe to talk but not to sing. This roughly reflects a walking speed of 10-15 minutes per 1 kilometre.</p>
T	<p><b>Time</b></p> <p>Aim for at least 150 minutes of moderate intensity physical activity per week</p>	<p>How many minutes of moderate intensity physical activity are you ready to do per week?</p> <p> <input type="checkbox"/> 10-30 minutes    <input type="checkbox"/> 30-60 minutes  <input type="checkbox"/> 60-150 minutes    <input type="checkbox"/> &gt;150 minutes         </p> <p>Each session should last for at least 10 minutes.</p>
P	<p><b>Park</b></p> <p>In parks, you can experience nature, relax and engage in different types of activities</p>	<p>You can engage in cardio activity such as brisk walking in the park to increase your fitness.</p> <p>To improve your strength and balance you can use one of the fitness corners that are available in most parks.</p> <p>Yishun, Yishun Pond, Admiralty, Woodlands Town Park East and Sembawang Park, are within your neighbourhood and provide an excellent opportunity for such activities.</p> <p>Look into the park prescription brochure for walking trails and locations of fitness corners.</p> <p>Are there specific activities of you may enjoy doing in the park?</p>

### Admiralty Park

Located in Woodlands, Admiralty Park is situated on hilly terrain with Sungai Cina river running through it, and houses the largest nature area within an urban park. Encompassing a diverse mix of secondary forest, mangrove, marine and open grassland habitats, and home to more than 100 species of flora and fauna, the park is a favourite of nature lovers.



**Walking Trail**  
Total trail length= 2.9 km  
Estimated time in moderate intensity: 45 mins  
Difficulty level: Average

**Transport**  
MRT: 15 mins walk from Woodlands MRT station

### Yishun Park

Developed on an old rubber estate, Yishun Park is home to an array of tropical fruit trees and natural vegetation. With facilities such as children playgrounds, fitness corners, an amphitheatre and multi-purpose courts, there is something for everyone. The playgrounds provide children with hours of fun while the multi-purpose courts are great venues for family gatherings and activities.



**Walking Trails**  
Long trail length= 1.85 km  
Estimated time in moderate intensity: 25 mins  
Difficulty level: Average  
Short trail length= 1 km  
Estimated time in moderate intensity: 13 mins  
Difficulty level: Easy

**Transport**  
MRT: 15 mins walk from Yishun MRT station

### Yishun Pond Park

Yishun Pond Park is a haven of tranquility for nearby residents. Featuring a pond surrounded by colourful plants and a variety of trees, shrubs and marshland plants as well as several bird species, the park is a great place for visitors to get close to nature. The park is located just next to Khoo Teck Puat Hospital.



**Walking Trail**  
Total trail length= 1 km  
Estimated time in moderate intensity: 13 mins  
Difficulty level: Easy

**Transport**  
MRT: 15 mins walk from Yishun MRT station

# Park Px

## **Structured Exercise Program** *(optional)*

- 26 weekly one-hour sessions
- Exercise trainer
- Exercise designed with input EIMS clinician
- SMS reminder before each session

# Park Px

## Results

Significant improvements in participants'

- PA level
- Well-being (psychological QoL)



# Park Px

## Process Evaluation

- *High satisfaction (>75%) with materials & counselling*

- Exercise Program

***Facilitators:*** *Social interaction, knowledge of instructor*

***Barriers:*** *Lack of time left & preference for unstructured PA*

# Park Px

## Insights

- Aspects like goal-setting & resources are useful  
*Regular participants of structured exercise program achieved highest MVPA/week, non-participants also achieved improvements.*
- Future programs can consider both unstructured and structured PA



# Park Px

## Publications

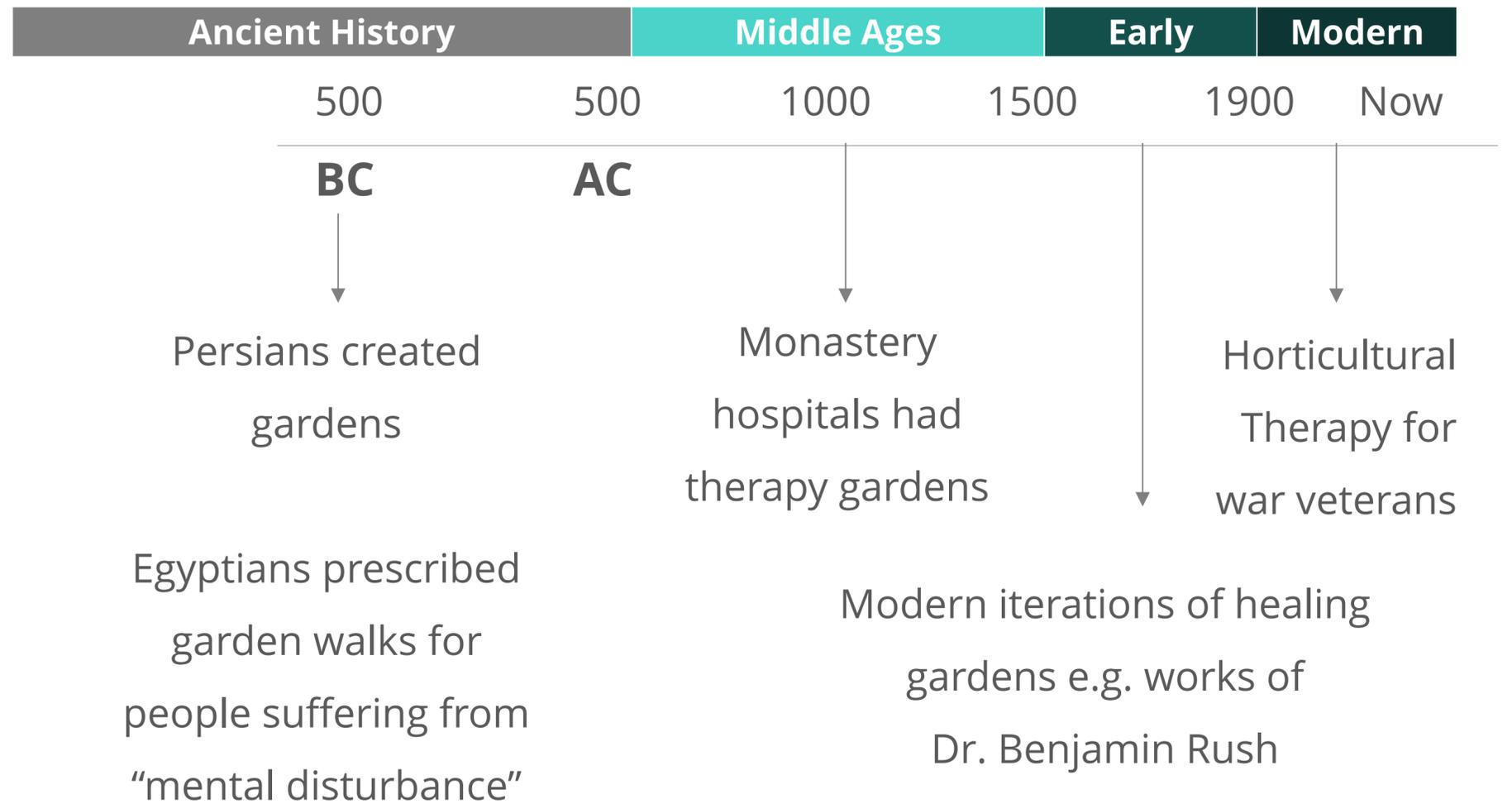
- Petrunoff, N., Yao, J., Sia, A. et al. Activity in nature mediates a park prescription intervention's effects on physical activity, park use and quality of life: a mixed-methods process evaluation. BMC Public Health 21, 204 (2021). <https://doi.org/10.1186/s12889-021-10177-1>
- Müller-Riemenschneider F., Petrunoff N., Yao J., Ng, A., Sia A., Ramiah A., Wong, M., Han, J., Tai, B.C., Uijtdewilligen, L. (2020). Effectiveness of prescribing physical activity in parks to improve health and wellbeing - the park prescription randomized controlled trial. International Journal of Behavioral Nutrition and Physical Activity.
- Uijtdewilligen, L., Waters, C.N-H., Su A.W., Wong M.L., Sia A., Ramiah A., Ng, A., Müller-Riemenschneider F. (2019). The Park Prescription Study: Development of a community-based physical activity intervention for a multi-ethnic Asian population. PLOS One.
- Müller-Riemenschneider F., Petrunoff N., Sia A., Ramiah A., Ng, A., Han, A., Wong, M., Tai, B.C., Uijtdewilligen, L. (2018). Prescribing Physical Activity in Parks to Improve Health and Wellbeing: Protocol of the Park Prescription Randomized Controlled Trial. International Journal of Environment and Public Health.

# **Therapeutic Horticulture**



# Therapeutic Horticulture

Use of gardens and gardening for healing and combating stress has a very long history



# Therapeutic Horticulture

A process through which participants enhance their well-being through involvement in plant and plant-related activities



# Therapeutic Horticulture

Documented benefits

*on seniors*

*for rehabilitation*

*for autism spectrum disorder*

*on the incarcerated*

# Therapeutic Horticulture

Study 1 on healthy seniors

Study 2 on elderly from senior care centers  
with a range of cognitive and physical status

*(funded by MNDRF)*



# Therapeutic Horticulture

Study 1 on healthy seniors

12-week programme comprising guided nature walks, gardening, nature-art activities and nature talks

Improvement in the psychological status, biological markers and immune cell composition of participants



# Therapeutic Horticulture

Study 2 on seniors with a range of cognitive and physical status @ Therapeutic Garden @HortPark

24-week programme developed with input from international expert registered with the American Horticultural Therapy Association



# Therapeutic Horticulture

## Study 2

### Therapeutic Horticulture Programme

This collection of 22 nature-based activities is the result of a therapeutic horticulture intervention programme that was administered as part of a broader research study on the effects of therapeutic horticulture on older adults. The study was a collaboration between the National Parks Board and National University Health System and funded by the MND Research Fund.

The activities were designed in collaboration with CUGE Research Fellow Ms Elizabeth Diehl, who is a horticultural therapist registered with the American Horticultural Therapy Association. The programme was conducted in the Therapeutic Garden @ HartPark, with permission from the HartPark office. They may be adapted for application in private gardens as well.

These activities are provided here for use by horticultural therapists, facilitators or healthcare professionals who are aiming to encourage social interactions, provide sensory stimulation and exercise, reduce stress and tension, and reward nurturing behaviour amongst targeted groups such as the elderly. They have been shown to benefit participants cognitively through the learning of new skills, and regular participation is associated with improved coordination, balance and strength. The activities may be conducted in individual sessions or as part of a programme, and in the latter case it is recommended to begin each session with recall of the previous activity. It is suggested to and all sessions with a time of reflection.

The activities are separated into two types, gardening and nature-art activities. The gardening activities involve growing and nurturing plants, as well as making useful items from garden and plant products. The activities utilise various growing methods, such as from seeds, seedlings or stem cuttings. The nature-art activities, on the other hand, are designed to promote creative expression, allowing for participants to engage beyond direct verbal exchanges.

For more information on NParks' Therapeutic Gardens, you may visit [www.nparks.gov.sg/gardens-parks-and-nature/therapeutic-gardens](http://www.nparks.gov.sg/gardens-parks-and-nature/therapeutic-gardens).



Share your love for nature and animals at  
#NParksBuzz #AnimalBuzzSG



#### LIST OF ACTIVITIES

1. Growing Pea Sprouts
2. Potting Up
3. Making Suncatchers
4. Growing Vegetables from Seeds
5. Growing Vegetable Plugs
6. Making Compost
7. Painting Terracotta Pots
8. Transplanting Stem Cuttings
9. Making Body Scrub
10. Creating Nature-Art Collages
11. Maintaining the Garden
12. Making Enzyme Cleaner
13. Growing Wheatgrass
14. Harvesting Wheatgrass
15. Sketching Leaves
16. Making Prints with Leaves
17. Planting Succulents
18. Making a Terrarium
19. Arranging Flowers
20. Creating Rock Art
21. Making Potpourri
22. Printing with Vegetable Cuttings

🌱 denotes gardening-related activity  
🎨 denotes nature-art activity



Therapeutic Horticulture Program in NParks' Research Study

#### ACTIVITY 22

### Printing with Vegetable Cuttings

#### ACTIVITY GOALS

The activity promotes eye-hand coordination and fine motor skills, as well as participants' ability to focus. It provides an opportunity for creative expression and promotes a sense of achievement through making something usable and artistic.

#### INTRODUCTION PHASE

1. Introduce activity by showing participants the materials involved, including acrylic paints, brushes, vegetables and tote bags.

*Pass around samples of tote bags with prints created by other older adults to show that the task is achievable. Explain that vegetables may be cut to form interesting patterns.*

#### ACTIVITY PHASE

2. Share the vegetables that have been pre-prepared, tote bags, acrylic paints, and dishes to hold the paints.
3. Demonstrate the steps of leaf printing:
  - Cut the different vegetables.
  - Wipe dry with a piece of cloth.
  - Paint generously with acrylic paint, using a paint brush. *Cut one vegetable at a time.*
  - Flip the painted side of the vegetable down onto the tote bag. Press the cutting down firmly to ensure that it contacts the bag entirely.
  - Test on newspaper first to check the print. Remind participants to hold it still if they want a clean print.*
  - Repeat the process for the other cuttings to form the desired pattern on the bag.

#### MAIN MATERIALS

Plain tote bags with handles, pre-made tote bags

Paint brushes, fabric paints of different colours, towels or cloth scraps

Cut vegetables and fruits (e.g. lady's-fingers, Chinese cabbage, onions, lotus roots, oranges)



#### PLANNING NOTES

- The hand-made tote bag is a nice take-home gift for participants.
- If tote bags are not available or cost-prohibitive, you can provide handkerchiefs or fabric squares instead.



Therapeutic Horticulture Program in NParks' Research Study

#### ACTIVITY 8

### Transplanting Stem Cuttings

#### ACTIVITY GOALS

This activity involves removing plant parts to start new plants. It leads to an opportunity to create and care for the new plants, encouraging a sense of purpose, meaningfulness and hope. Overall, the activity promotes a positive mindset and looking ahead, to enable the plant to become healthier and aesthetically more pleasing.

#### INTRODUCTION PHASE

1. Introduce the process of transplanting plant parts, which both hides the appearance of the existing plant, and allows for new plants to grow from the cuttings.

*Explain that when a plant matures, it may require pruning in order to remain aesthetically pleasing. Pruning also removes damaged or unhealthy branches, allowing the plant to become healthier. The stem cuttings may also be used for propagation.*

#### ACTIVITY PHASE

2. Share the garden gloves and gardening scissors. Ask the participants to walk in the garden to collect stem cuttings from plants of their choice, if permitted.  
*Show participants the correct technique of cutting stems: remove 5–25 cm of stem at least 2.5 cm below a leaf node and include 2–3 pairs of leaves.*
3. Demonstrate the steps of transplanting stem cuttings:
  - Scoop potting mix into pot, filling halfway.  
*Pass around a scoop of potting mix and ask participants to describe its feel and fragrance.*
  - Make an indent in the soil and insert the stem cuttings carefully, tamping the potting mix down firmly to hold the cuttings in place.

#### MAIN MATERIALS

Pots (may use the hand-painted terracotta pots from activity 7)

Potting mix, garden spades, garden gloves, gardening scissors, watering cans

*The cuttings should be planted about 10–15 cm apart, to give ample space in-between. Ensure that at least one node is below the soil line.*

- Cover with a thin layer of potting mix. Water the surface lightly.

4. Give participants ample time for gathering the stem cuttings and transplanting. Ask participants to mark their name and date of activity on the pot with masking tape.  
*Facilitators should sit with participants and provide assistance at all stages if necessary.*

#### CONCLUSION PHASE

5. Conclude activity session by praising the group's work.  
*Ask participants to talk about the type of plant that they chose to make their cuttings from.*

6. Discuss the on-going care of the cuttings and provide take-home instructions.  
*The pots should be watered lightly daily, to keep the cuttings moist. Maintain the pots to keep them free of weeds.*



#### PLANNING NOTES

- Facilitators should familiarise themselves with the plants in the garden and show participants which ones are suitable for stem cutting propagation.
- Encourage participants to take photos of their cuttings for sharing at the next session.

# Therapeutic Horticulture

Study 2 on seniors with a range of cognitive and physical status

Participants showed significant reduction in anxiety and improvement in cognitive functioning, reported more positive emotions after each session

# Therapeutic Horticulture

## Publications

Wong G., Ng, K. S. T., Lee, J.L., Lim, P.Y., Chua<sup>3</sup>, S., Tan, C., Chua, M., Tan, J., Lee, S., Sia, A., Ng, M., Mahendran R., Kua, E.H., Ho R., Larbi, A. (2020). Horticultural Therapy Reduces Biomarkers of Immunosenescence and Inflammaging in Community-Dwelling Older Adults: A Feasibility Pilot Randomized Controlled Trial. *Int. J. Gerontol: Series A*, glaa271.

Sia, A., Tam, W.W.S., Fogel, A., Kua, E. H., Khoo, K. and Ho, R. C. M. (2020). Nature-based activities improve the well-being of older adults. *Sci Rep* 10, 18178.

Sia, A., Diehl, E. (2020). Nature-based Activities for Older Adults: A Case Study in Singapore. *Journal of Therapeutic Horticulture* 30(1).

Ng, K. S. T., Sia, A., Ng, M. K. W., Tan, T. Y C., Chan, H. Y., Tan, C. H., Rawtaer, I., Feng, L., Mahendran, R., Larbi, A., Kua, E. H., and Ho, R. C. M. (2018). Effects of Horticultural Therapy on Asian Older Adults: A Randomized Controlled Trial. *Int. J. Environ. Res. Public Health* 15, 1705.

Sia, A., Ng, K. S. T., Ng, M. K. W., Chan, H. Y. Tan, C. H., Rawtaer, I., Feng, L., Mahendran, R., Kua, E. H., Ho, R. C. M. (2018). The Effect of Therapeutic Horticulture on the Psychological Wellbeing of Elderly in Singapore. *Journal of Therapeutic Horticulture* 28(1).

Chan, H. Y., Ho, R. C., Mahendran, R., Ng, K. S., Tam, W. W., Rawtaer, I., Tan, C. H., Larbi, A., Feng, L., Sia, A., Ng, M. K. W., Gan, G. L., Kua, E. H. (2017). Effects of horticultural therapy on elderly' health: protocol of a randomized controlled trial. *BMC Geriatrics* 17(1). doi: 10.1186/s12877-017-0588-z

# Therapeutic Horticulture

Design Guidelines for Therapeutic Gardens

Network of Therapeutic Gardens  
implemented and being planned





# Viewing Landscapes

# Viewing Landscapes

Well-documented benefits

Reported improvements in stress and fatigue  
recovery and relaxation effects

Induced decreased oxy-Hb concentrations in  
the right prefrontal cortex.



# Viewing Landscapes

Pilot study to examine the health-promoting benefits of passive exposure to sites with different landscape features through in-situ scanning of participants' brain activity



Beta (14-30Hz)



Alpha (8-13Hz)



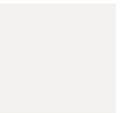
Theta (4-7Hz)

# Viewing Landscapes

Landscapes with features like far distance views,  
character of peace and silence induce higher valence

Healthy participants and patients with depression  
experienced the benefits of landscapes through  
slightly different pathways





3.

## Summary

# Summary

- People will experience benefits when they are in contact with nature in Singapore
- Parks are effective in promoting PA
- People with higher needs can benefit more from therapeutic gardens and horticulture programmes
- Landscapes may be designed to enhance restorative experience of users, and potentially provide therapeutic effects to those who are depressed



# Thank You