# UPLIFTING GREENERY

## PROPOSING LOCATIONS FOR URBAN ROOFTOP GARDENS TO MAXIMISE ACCESSIBILITY TO GREEN SPACES IN DKI JAKARTA AND SINGAPORE

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## INTRODUCTION

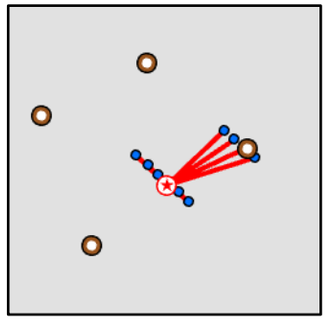
By 2050, more than 2/3 of the world's population will be living in cities. Yet, urbanites are known to have hectic schedules and stressful lives, and studies have shown that they are frequently sufferers of the most severe mental illnesses. Could accessibility to green spaces be improved to improve health outcomes? In alignment with the UNSDG 3 (Good Health and Well Being), 11 (Sustainable Cities and Communities) & 13 (Climate Action) we propose equitably distributed locations of unutilized urban rooftops to be converted to therapy gardens, in the cities of DKI Jakarta and Singapore.

## METHODOLOGY

**Satellite imagery** (Mapbox) → Deep learning/ Computer vision **(Roofpedia)** → **Detected green roofs**

**Example of Roofpedia**

Detected green roof
Building footprint



**Example of Location-allocation**

Chosen sites
Candidate buildings
Demand points
Assignment of candidate buildings to demand points

**Residential buildings inventory** (OpenStreetMap) → Within 500m* of parks?
- No → Within 500m* of detected green roofs?
  - Yes → Improve facilities on the green roof
  - No → Amount of surrounding vegetation**?
    - > 0.2 NDVI → Has relatively adequate access to greenery
    - ≤ 0.2 NDVI → **Demand points** + **Candidate sites for new rooftop gardens**
- Yes → Has relatively adequate access to greenery

**Buildings inventory** (OpenStreetMap) → >100m away from major city roads?
- Yes → Within 500m* of demand points?
  - Yes → Accessible to public?
    - Yes → **Demand points** + **Candidate sites for new rooftop gardens**
    - No → Rejected as a potential candidate site
  - No → Rejected as a potential candidate site
- No → Rejected as a potential candidate site

**Demand points with higher priority:** Sparse surrounding vegetation**

**Candidate sites with higher priority:** Sparse surrounding vegetation** & far from existing parks

**Location-allocation** to recommend sites for construction of new green roofs

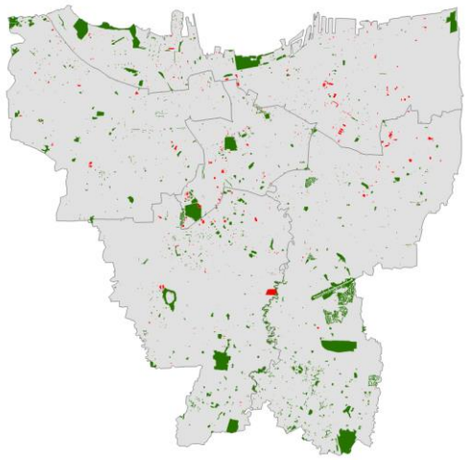
- **Near-term:** Optimal sites within 500m*
- **Long-term:** Optimal sites to serve ≥50% of demand points

*Approximately a 10-minute walk
**Calculated using mean Normalized Difference Vegetation Index (NDVI) in a 500m buffer

## RESULTS

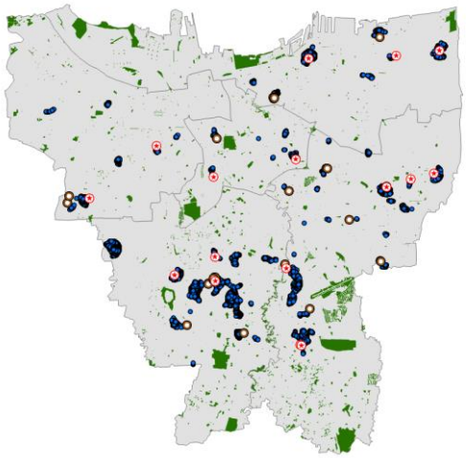
# DKI JAKARTA

**Distribution of green spaces**



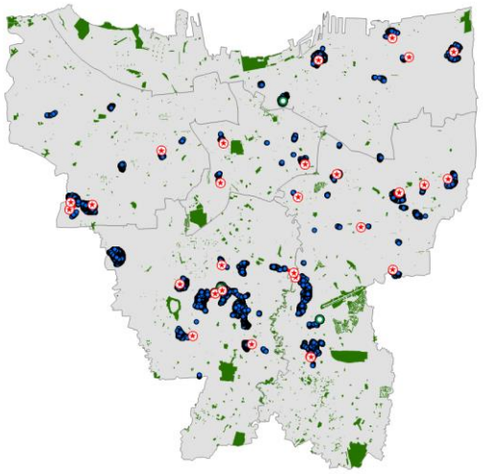
- **Number of green roofs:** 1,513
- **Density of green roofs:** 2.35 roofs per km$^2$
  - Relatively sparse
- **Area of parks:** 28.7km$^2$
- **Park-area ratio:** 0.045
- **86.9%** of residences have either a park or green roof within 500m

**Near-term proposed siting**
*Maximum Coverage, Minimum Facilities*



- **5,761 residences** (out of 29,441) serviced
- Using **16 buildings** (out of 47 candidate buildings)

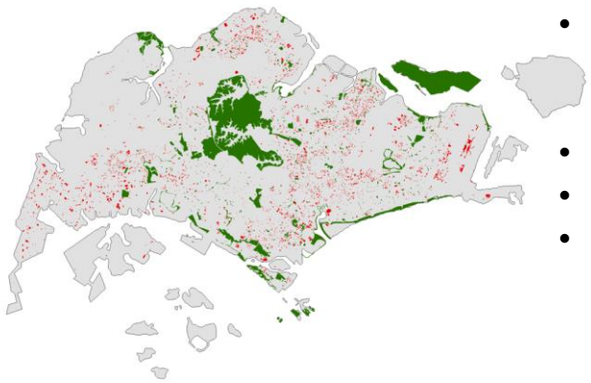
**Long-term proposed siting (≥50% coverage)**
*Maximum coverage (1,100m*)*



- **15,465 residences** (out of 29,441) serviced
- Using **31 buildings** (out of 47 candidate buildings) within 1,100m

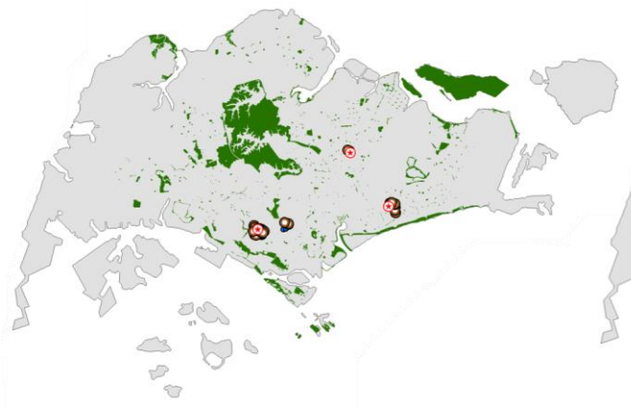
# SINGAPORE

**Distribution of green spaces**



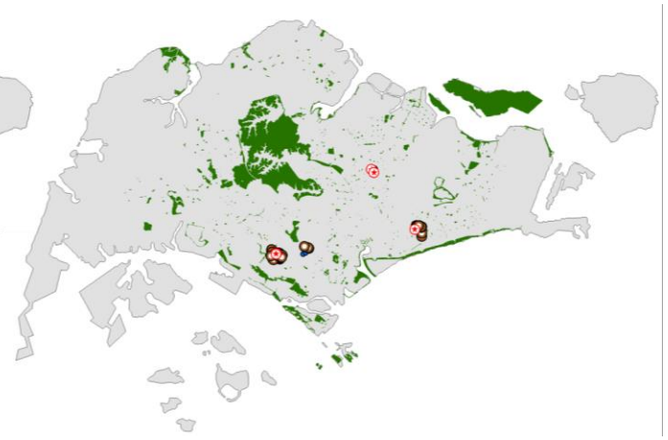
- **Number of green roofs:** 5,690
- **Density of green roofs:** 10.8 roofs per km$^2$
  - Evenly distributed
- **Area of parks:** 77.2 km$^2$
- **Park-area ratio:** 0.147
- **99.3%** of residences have either a park or green roof within 500m

**Near-term proposed siting**
*Maximum Coverage, Minimum Facilities*



- **17 residences** (out of 37) serviced
- Using **3** buildings (out of 120 candidate buildings)

**Long-term proposed siting (≥50% coverage)**
*Maximum coverage (600m*)*



- **35 residences** (out of 37) serviced
- Using **6** buildings (out of 120 candidate buildings) within 600m

**Legend:** Detected green roofs | Parks | Chosen sites | Candidate buildings | Demand points

*Minimum impedance distance required to achieve ≥50% coverage

## CONCLUSION

The potential for the development of rooftop gardens can be achieved through this study's proposed sites of green rooftop construction, which primarily aims to increase the accessibility of green spaces to the urban population, especially in the case of Jakarta, in view of the advantages that urban rooftop gardens offer in attaining sustainable development. However, rooftop gardens cannot be treated as a panacea for the problems tied to growing urbanisation rates. In the long run, alternative solutions to achieve greater sustainable development and reduce inequality in the access to ecosystem services have to be carefully considered as well.