The Challenges of Restoring Urban Biodiversity

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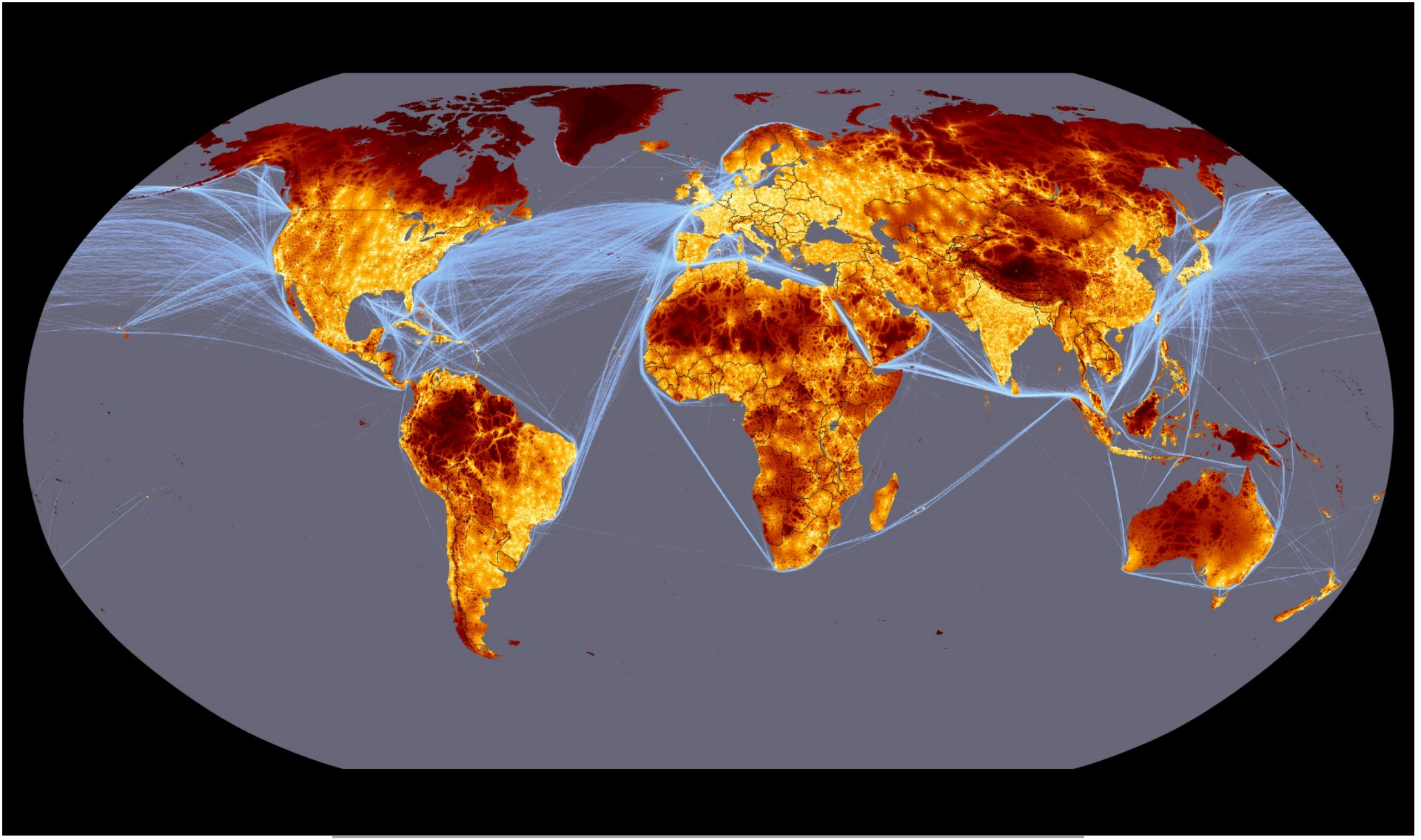
Our Urbanizing World




CB SUSSEX
MAGTECH

The city as an environment:

- Climate
- Air
- Soil
- Hydrology
- Habitats
- Disturbance

The Urban Climate

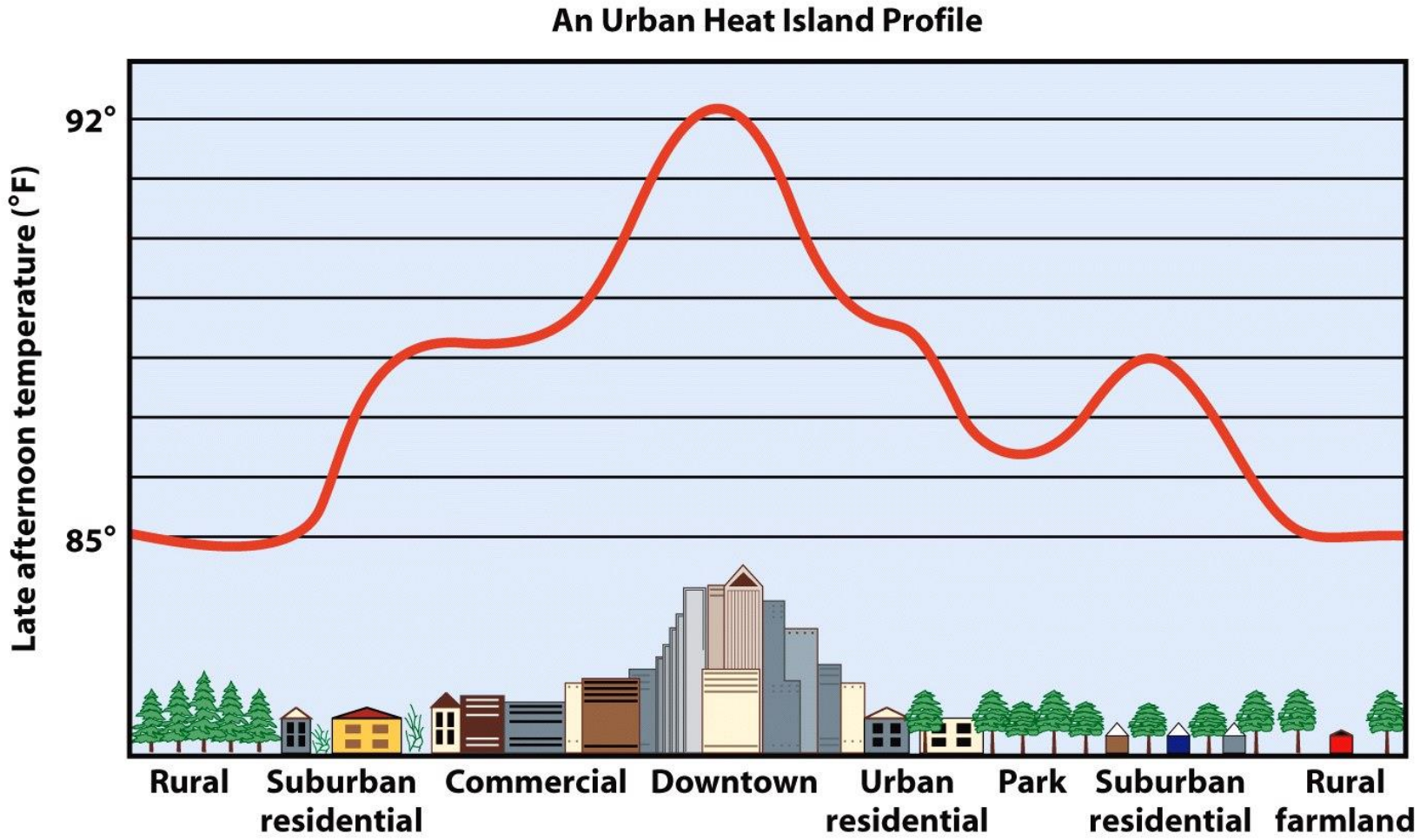


Figure 29-11 Botkin - Env. Sci. 6/e

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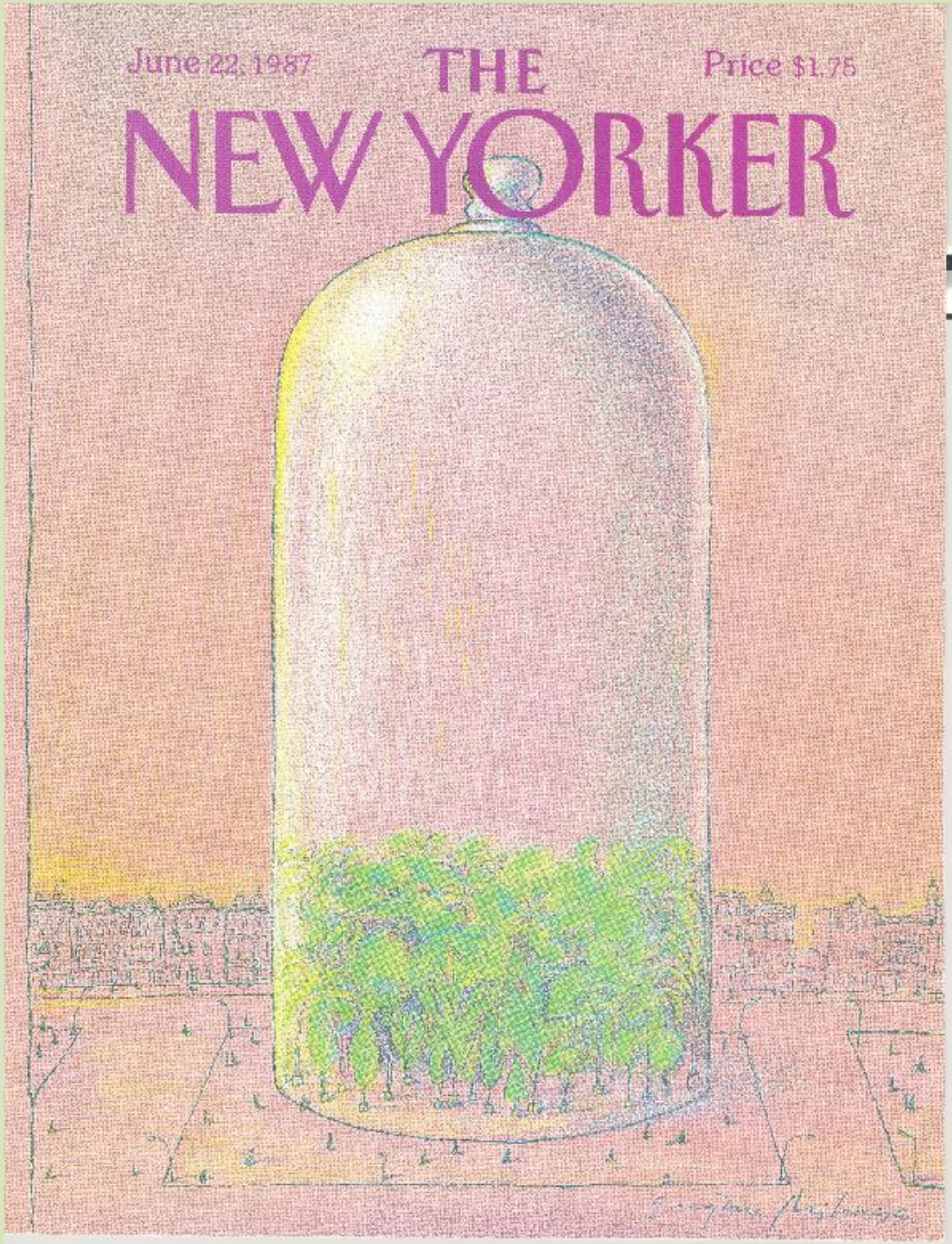
Urban problems: Heat island effect & climate change



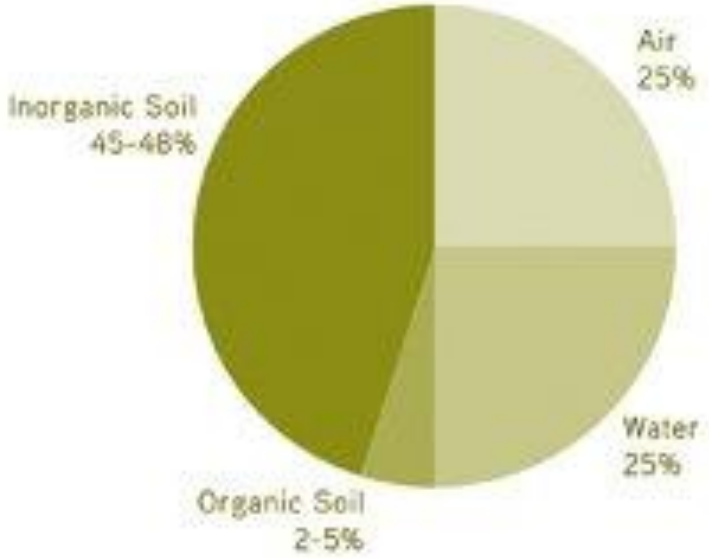
The Urban Atmosphere

- Dust (particulates)
  - Soot, cement, tiny particles formed from emissions of sulfur dioxide and others from coal burning.
  - Natural sources (soil particles from denuded land)

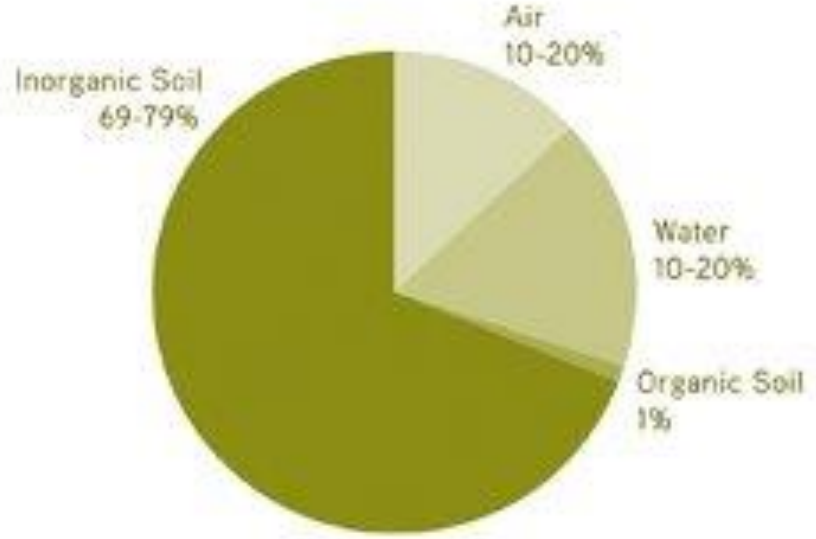
Urban Soils

- Lack of leaf litter/organic layer
- Compaction
- Low water holding capacity - due to loss of organic matter and compaction
- Chemical pollution, heavy metals, pH change
- Lack soil biodiversity
- Erosion
- Heat
- Fill

Urban Soils



FOREST SOILS



URBAN SOILS

Existing Urban Habitats, a Mosaic

- Managed parks
- Backyards
- Gardens
- Green roofs
- Riparian corridors
- Vacant lots
- Remnant vegetation
- Roadsides, medians

Plants in Cities

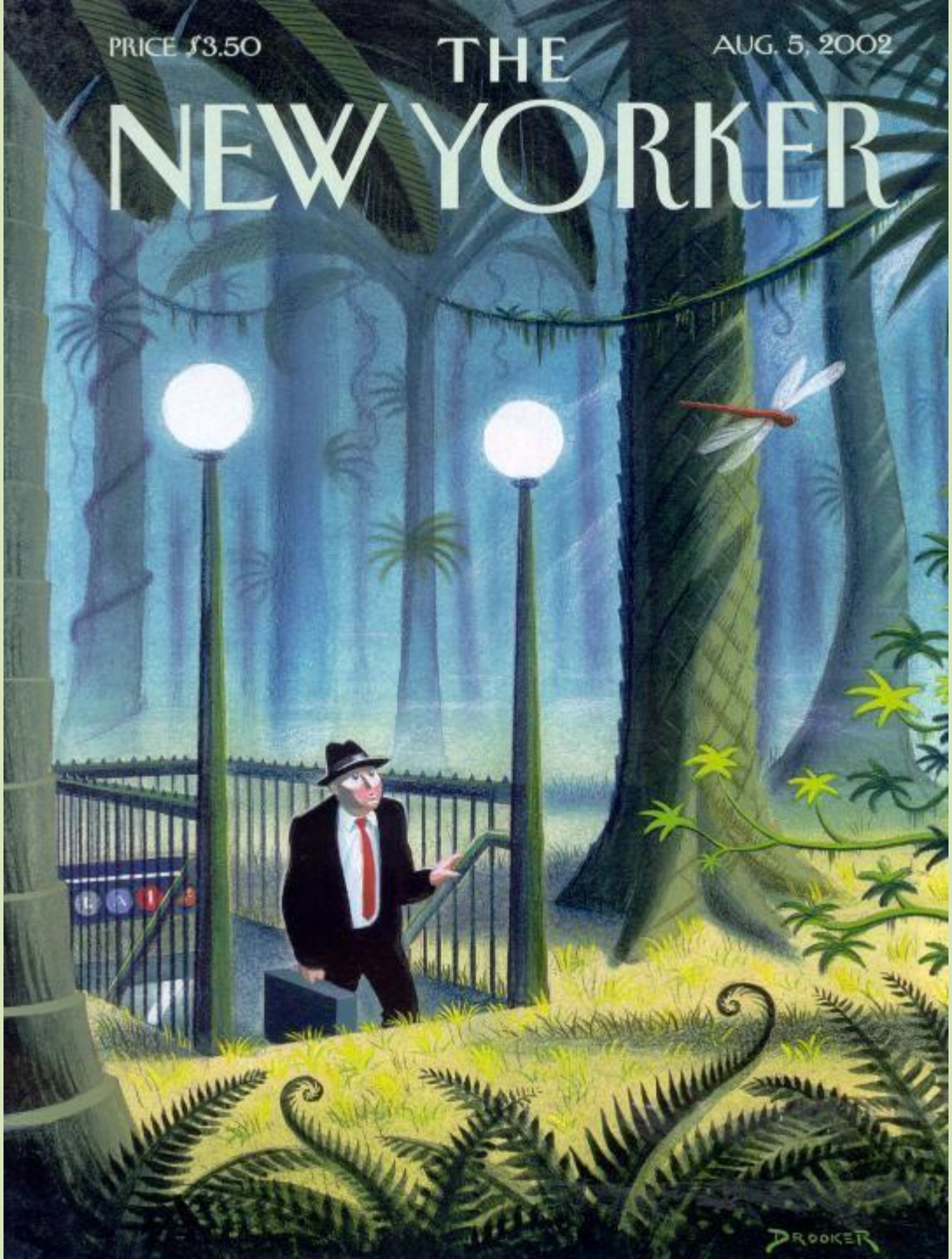
- Cultivated
- Naturalized
- Remnant

Ecosystem Functions of Urban Plants

- Temperature reduction
- Food/habitat for wildlife
- Erosion control
- Nutrient absorption in wetlands
- Aesthetics

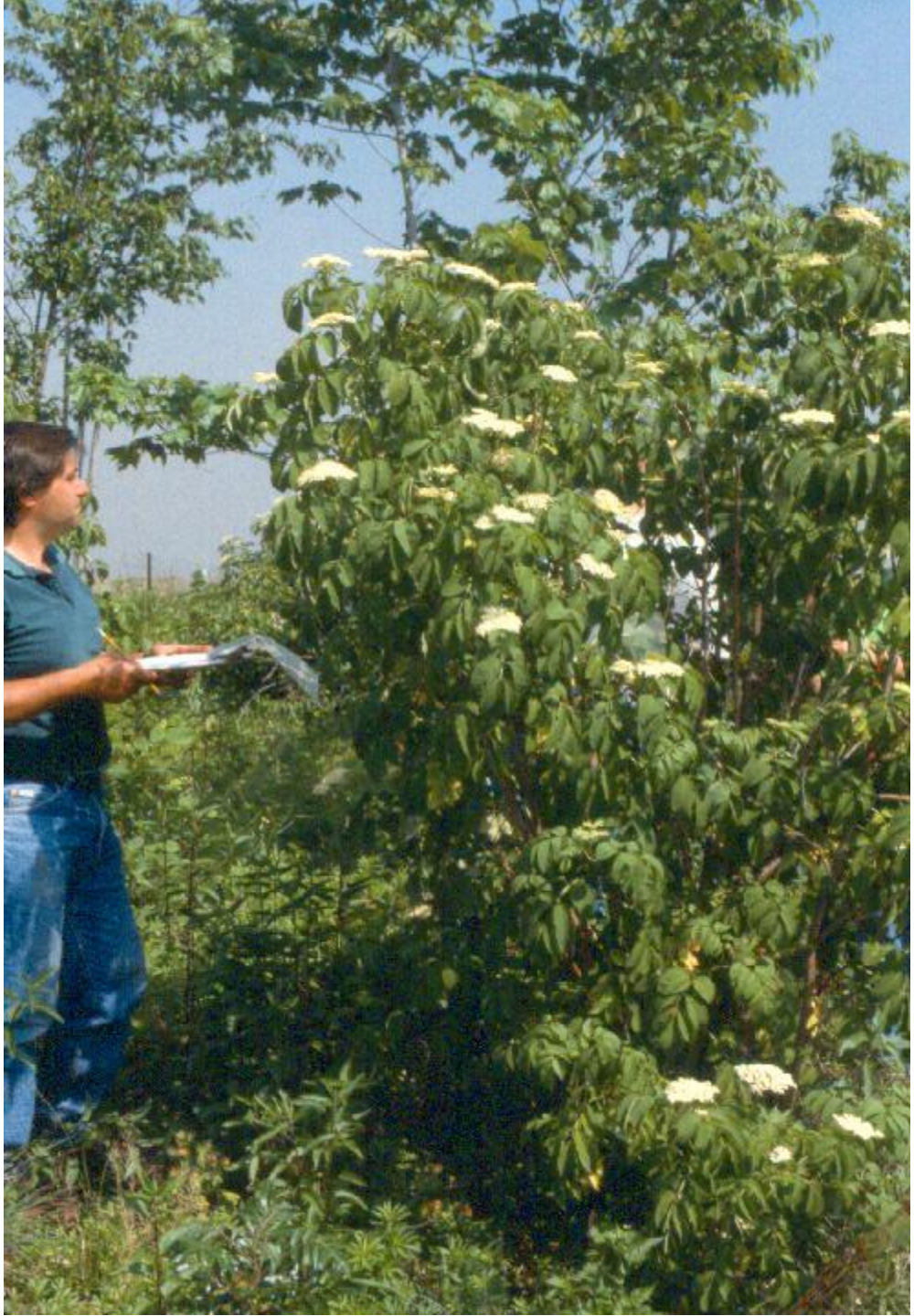
- Soil building on degraded land
- Colonization of bare ground
- Carbon sequestration
- Oxygen production

In urban conditions:
what is the ecological target?



Much area, little money: try ecological links

Is lack of pollinators a limitation to restoration?



Agapostemon texanus

Melissodes sp.

Hylaeus sp.

Megachile sp.

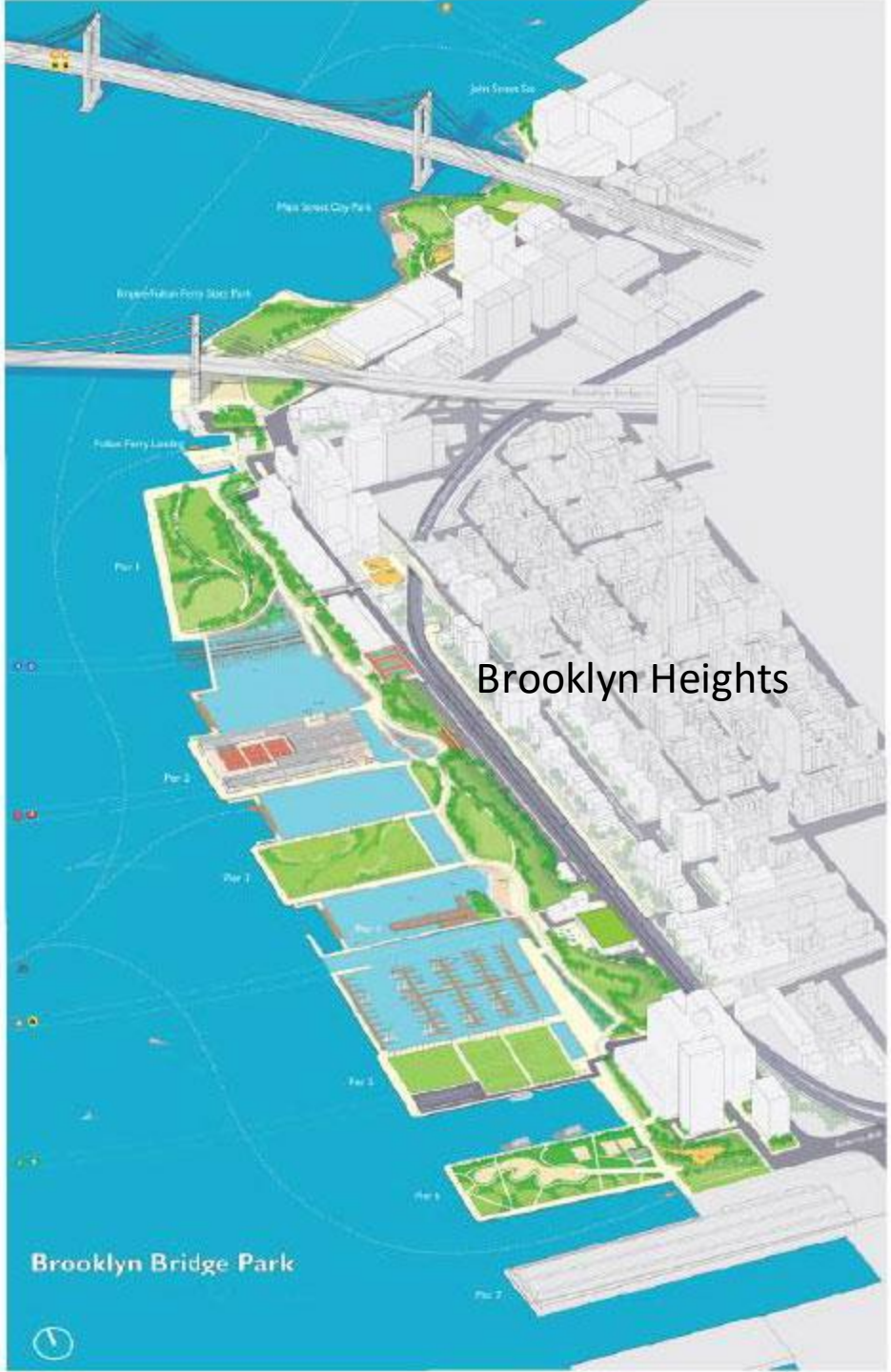
Ecological restoration of habitats requires a partnership between ecologists and the design professions

City of New York

Former Brooklyn Waterfront

Brooklyn Bridge Park

Michael Van Valkenburgh Associates



Proposed Habitat Types

- **Woodlands and shrublands**
- **Freshwater wetlands and swales**
- **Meadows**
- **Marine zones - uplands**
  - salt marsh
  - submarine habitat

Promenade, Brooklyn Bridge Park

Michael Van Valkenburgh Associates

The Orange County Great Park: Before

The Orange County Great Park: After L..A. leads: Ken Smith and Mia Lehrer

Great Park Canyon

The Canyon

Beijing 2008 Olympics

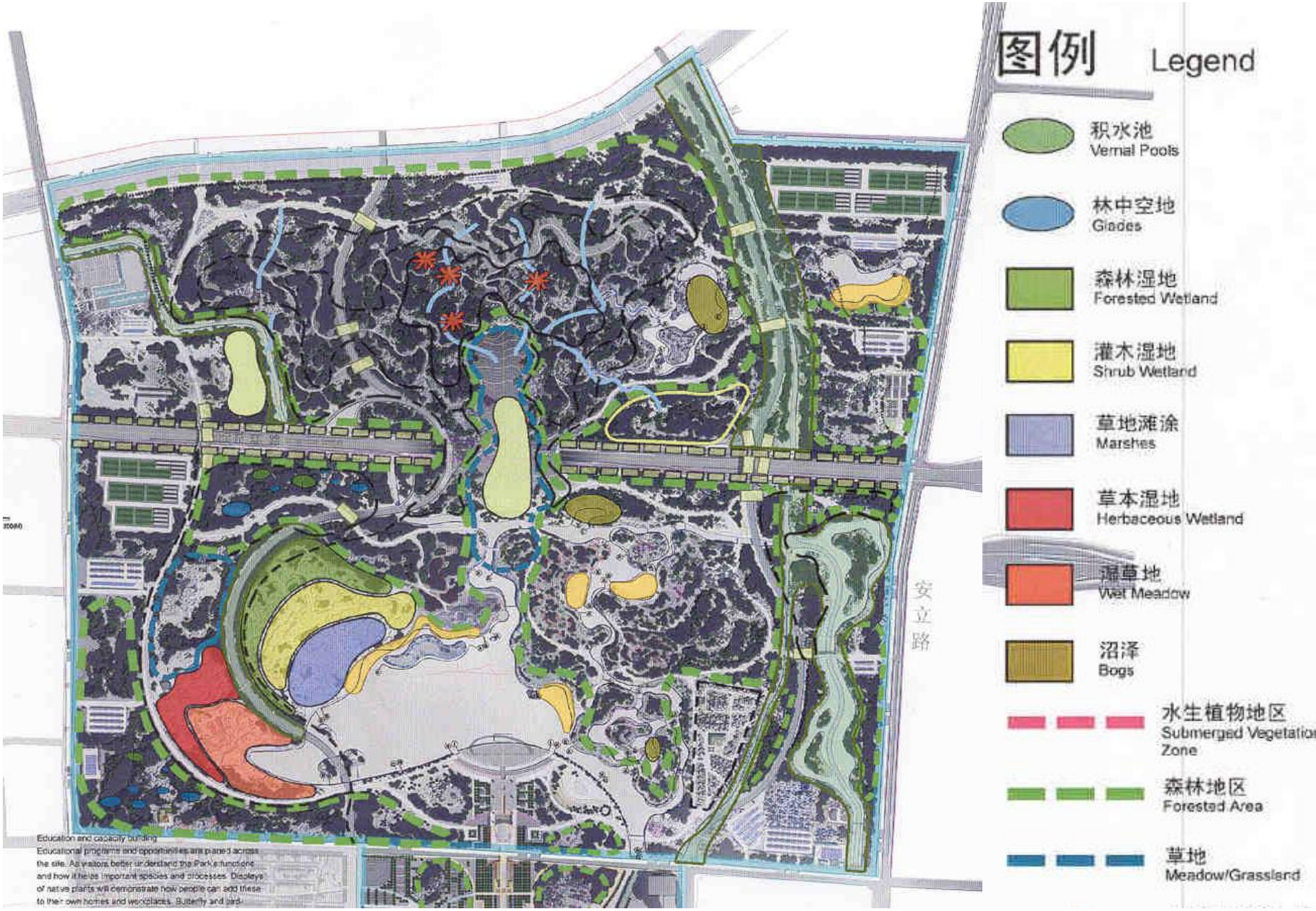
Sasaki Associates

←1500 acre Forest Park

←700 acre athletic zone

Beijing 2008 Olympics Forest Park

Beijing 2008


图例 Legend
积水池
Vernal Pools
林中空地
Glades
森林湿地
Forested Wetland
灌木湿地
Shrub Wetland
草地滩涂
Marshes
草本湿地
Herbaceous Wetland
湿草地
Wet Meadow
沼泽
Bogs
水生植物地区
Submerged Vegetation Zone
森林地区
Forested Area
草地
Meadow/Grassland
安立路
Education and capacity building
Educational programs and opportunities are placed across the site. As visitors better understand the Park's functions and how it helps important species and processes. Displays of native plants will demonstrate how people can add these to their own homes and workplaces. Butterfly and bird-

Art by Mike McCann

Ecological Constraints

- Dispersal
- Degraded plant and animal communities
- Soil quality and biota
- Successional processes (natural disturbances)
- Invasive species are lurking
- Proper varieties of planting material needed

Ecological Opportunities

- Restore natural heritage of the land
- Restore ecological functions
- Minimize, but not eliminate, management needs and costs
- Improve biodiversity in surrounding areas
- Add ecological resiliency for the future

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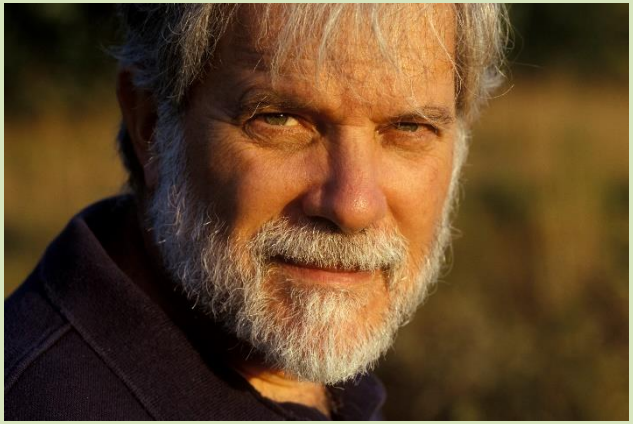

Recommended Readings

Handel, S. N. 2013. Ecological restoration foundations to designing habitats in urban areas. Pages 169-186 in: Designing Wildlife Habitats. J. Beardsley, ed. Harvard Univ. Press, Cambridge.

Handel, S. N. et al. 2013. Restoration ecology in an urbanizing world. Pages 665-698 In: Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities. T. Elmqvist, M. Fragkias, et al., editors. Springer, Dordrecht.

Nilon, C.H., Aronson, M.F., et al. 2017. Planning for the future of urban biodiversity: a global review of city-scale initiatives. BioScience 67:332-342.

Handel, S.N. 2018. The digital and the organic. Ecological Restoration 36(3):167-168.

Piana, M.R., Aronson, M.F.J., Pickett, S.A., and Handel, S.N. 2019. Plants in the city: understanding plant recruitment dynamics in the urban landscape. Frontiers in Ecology and the Environment. 17(8):455-463.