HEALTHY TREES
HEALTHY PEOPLE

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People in the centre…

The determinants of health and well-being in our neighbourhoods
PLANETARY HEALTH

THE HEALTH OF HUMAN CIVILISATION AND THE NATURAL SYSTEMS ON WHICH IT DEPENDS

THE HUMAN POPULATION IS HEALTHIER THAN EVER BEFORE

Source: Rockefeller Foundation, The Lancet
BUT TO ACHIEVE THIS WE’VE EXPLOITED THE PLANET AT AN UNPRECEDENTED RATE

Source: Rockefeller Foundation, The Lancet
Healthy trees…?
Healthy ecosystems…?
Healthy planet…?
“UK government plans for more extreme rainfall”, The Guardian, Sep 8, 2016

Photo: Catriona Webster/PA
“Humans have destroyed 1/10 of Earth’s remaining wilderness in the last 25 years and there may be none left within a century if trends continue”
The Guardian, Sep 8, 2016 (Watson et al. 2016)
“Toxic air pollution particles found in human brains”

“But they haven't proven the link to Alzheimer's yet, so we don't want to rush off and clean up the air. That would just be making the world a better place for no reason”
Human behaviour...

1. Stress
2. Physical inactivity
3. Social isolation
4. Socioeconomic inequalities
## THE GLOBAL DISEASE SCENARIO

**Ten leading causes of burden of disease, world, 2004 and 2030**

<table>
<thead>
<tr>
<th>Disease or injury</th>
<th>2004</th>
<th>Rank</th>
<th>2030</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower respiratory infections</td>
<td>6.2</td>
<td>1</td>
<td>6.2</td>
<td>1</td>
</tr>
<tr>
<td>Diarrhoeal diseases</td>
<td>4.8</td>
<td>2</td>
<td>5.5</td>
<td>2</td>
</tr>
<tr>
<td>Unipolar depressive disorders</td>
<td>4.3</td>
<td>3</td>
<td>4.9</td>
<td>3</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>4.1</td>
<td>4</td>
<td>4.3</td>
<td>4</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>3.8</td>
<td>5</td>
<td>3.8</td>
<td>5</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>3.1</td>
<td>6</td>
<td>3.2</td>
<td>6</td>
</tr>
<tr>
<td>Prematurity and low birth weight</td>
<td>2.9</td>
<td>7</td>
<td>2.9</td>
<td>7</td>
</tr>
<tr>
<td>Birth asphyxia and birth trauma</td>
<td>2.7</td>
<td>8</td>
<td>2.7</td>
<td>8</td>
</tr>
<tr>
<td>Road traffic accidents</td>
<td>2.7</td>
<td>9</td>
<td>2.5</td>
<td>9</td>
</tr>
<tr>
<td>Neonatal infections and other&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.7</td>
<td>10</td>
<td>2.3</td>
<td>10</td>
</tr>
<tr>
<td>COPD</td>
<td>2.0</td>
<td>13</td>
<td>1.9</td>
<td>11</td>
</tr>
<tr>
<td>Refractive errors</td>
<td>1.8</td>
<td>14</td>
<td>1.9</td>
<td>12</td>
</tr>
<tr>
<td>Hearing loss, adult onset</td>
<td>1.8</td>
<td>15</td>
<td>1.9</td>
<td>15</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1.3</td>
<td>19</td>
<td>1.6</td>
<td>18</td>
</tr>
</tbody>
</table>

<sup>a</sup> Other causes include: maternal conditions, tuberculosis, lower respiratory infections, accidents and violence, mental and neurological disorders.
Cities, the primary drivers and likeliest victims of climate change, hold the antidote as well.

MIKE BLOOMBERG
PUBLIC HEALTH – URBAN ENVIRONMENT
ISSUES AND SOLUTIONS

• Non-communicable diseases
• Health inequalities
• Autoimmune diseases – e.g. allergies
• Lifestyle (physical inactivity, stress, social & environmental isolation)
Natural environment
• Type (e.g., urban park)
• Quality (e.g., species diversity)
• Amount (e.g., tree canopy near home)

Contact with nature:
• Frequency of contact
• Duration of contact
• Activity affordance (e.g., for viewing, for walking)

Ecosystem Services
• Cooling of cities
• Storm-water runoff
• Reduced air pollution
• Providing microbiota

Physical activity

Social contacts

Stress reduction

Health and well-being
• Performance (e.g., academic, occupational)
• Subjective well-being (e.g., happiness)
• Persistent physiological changes (e.g., high cortisol levels)
• Morbidity (e.g., CHD, depression)
• Mortality (e.g., CVD, all cause)
• Longevity

Effect modifiers 1. Examples:
Distance, weather, societal context

Effect modifiers 2. Examples:
Gender, age, SES, context

Adapted from Hartig et al. 2014
Physical inactivity is a big problem. Inactive people have higher healthcare costs.

Cost of additional healthcare due to inactivity.

Source: CDC / National Centre for Chronic Disease Prevention
Prevalence of obesity*, ages 18+, 2014 (age standardized estimate)
Both sexes

Prevalence (%)
- <10.0
- 10.0–19.9
- 20.0–29.9
- ≥30.0
- Data not available
- Not applicable

* Body Mass Index ≥30 kg/m²

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization
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PHYSICAL ACTIVITY IN RELATION TO URBAN ENVIRONMENTS

14 cities, n=6822 adults

- Residential density (19%)
- Intersection density (21%)
- Transit density (21%)
- Number of parks (14% difference in PAG)

STRESS REDUCTION

Cortisol - a biomarker for stress

Figure 2. (a) Differences in mean cortisol slope in women living in high versus low green space areas. (b) Differences in mean cortisol slope in men living in high versus low green space areas.
MENTAL HEALTH

2a

T0: Move to a **greener** area

![Graph showing the change in GHQ (Change from baseline T2) over years relative to the move (T-2 to T+3).]

2b

T0: Move to a **less green** area

![Graph showing the change in GHQ (Change from baseline T2) over years relative to the move (T-2 to T+3).]

*Alcock et al. 2014. Env Sci & Tech. 48(2):1247-1255*
Bratman et al. 2015. Nature experience reduces rumination and subgenual prefrontal cortex activation. PNAS. 112(28):8567-8572
GREEN SPACES AND SOCIAL ISOLATION

Social isolation: Same risk factor level as smoking (WHO, 2016)

\[\text{Elands et al. In press}\]
# GREEN SPACE CHARACTERISTICS FACILITATING SOCIAL INTERACTION

<table>
<thead>
<tr>
<th>Factor</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Proximity, size</td>
</tr>
</tbody>
</table>
| Type     | Urban parks (varying from neighbourhood parks to city parks)  
Community gardens                                                                 |
| Quality  | Design: good physical access, aesthetics, safety  
Plants: presence of trees and grass, variety of plant species (both native and exotic)  
Choreography of spaces: multi-functionality and multi-user groups  
Management: well-managed and room for self-organisation |
Health inequalities


![Bar chart showing incidence rate ratio for different levels of green exposure and income groups.](chart.png)

- **Exposure to Green**
  - No green
  - Little green
  - Some green
  - More green
  - Very green

- **Income Groups**
  - Highest Income
  - Middle Income
  - Lowest Income

- **Incidence Rate Ratio**

**Graph Key**
- Linjär (Highest Income)
- Linjär (Middle Income)
- Linjär (Lowest Income)
Health “is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”

Biodiversity (biodiversity) is “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.”

Biodiversity underpins ecosystem functioning and the provision of goods and services that are essential to human health and well being.

The links between biodiversity and health are manifested at various spatial and temporal scales. Biodiversity and human health, and the respective policies and activities, are interlinked in various ways.

Direct drivers of biodiversity loss include land-use change, habitat loss, over-exploitation, pollution, invasive species and climate change. Many of these drivers affect human health directly and through their impacts on biodiversity.

Women and men have different roles in the conservation and use of biodiversity and varying health impacts.

Human population health is determined, to a large extent, by social, economic and environmental factors.

The social and natural sciences are important contributors to biodiversity and health research and policy. Integrative approaches such as the Ecosystem Approach, Ecohealth and One Health unite different fields and require the development of mutual understanding and cooperation across disciplines.

van den Bosch et al. Healthy Planet Healthy People. In: UNEP/UNECE 2016. GEO-6 Assessment for the pan-European region. UNEP, Nairobi, Kenya

REGULATING ECOSYSTEM SERVICES

Brack, 2002; Escobedo et al., 2011; Escobedo and Nowak, 2009; Livesley et al., 2014, 2015, 2016; McPherson et al., 2011; Norton et al. 2015; Sugawara et al. 2016; Scharenbroch et al. 2016; Denman et al. 2016
URBAN FORESTS AND ECOSYSTEM SERVICES

- Cooling of cities (decrease heat stress and related morbidity and mortality)

Exhausted worker in Dubai, 2015, photo: Kamran Jebreili
The Urban Heat Island (UHI)

http://www.cleanairpartnership.org/files/urbanheatisland.jpg
All buildings covered with vegetation (roofs and walls): average air temperature would decrease by 9.1°C in Riyadh (Alexandri & Jones, 2008)
Natural environment

- Type (e.g., urban park)
- Quality (e.g., species diversity)
- Amount (e.g., tree canopy near home)
Ownership

- Distinction public vs. private (hinterland, region, city, neighbourhood)
- Communal/collective/ private vs. shared

Nine key variables
(Roderick Lawrence & Joris Zufferey)

Slide courtesy of PHENOTYPE, www.phenotype.eu
Blue and Green Spaces

- Classification of parks by size and shape

Slide courtesy of PHENOTYPE, www.phenotype.eu
Blue and Green Spaces

Biological Characteristics

- Land cover, biodiversity, presence of water, vegetation structure and type

Slide courtesy of PHENOTYPE, www.phenotype.eu
• Distance to blue and green spaces, accessibility, connection with other blue and green spaces

Slide courtesy of PHENOTYPE,  www.phenotype.eu
Management

• Maintenance (cleanliness, horticultural and landscape management), sense of security, time of opening/closing, entrance fees, codes of conduct (rules)
Urban Forest Benefits

The ecological and social benefits of urban forests can help reduce health risks and enhance health promotion.

Ecological Factors
- Food and nutrition security
- Exposure to biodiversity (e.g., other animals, microorganisms)
- Ecosystem resilience

Social and Environmental Factors
- Increased social activities
- Enhanced social cohesion
- Improved air quality
- Improved thermal comfort
- Reduced heat-health risks
- Reduced flood risks
- Reduced risks of skin cancer

Individual Factors
- Increased physical activity
- Reduced stress
- Cognitive restoration
- Increased perceived health
- Reduced aggression
- Enhanced immune function

Health Outcomes

Positive health outcomes associated with urban forests:

- Reduced risks of cardiovascular diseases, cancer, diabetes, respiratory diseases
- Lower prevalence of allergies and asthma
- Decreased rates of general mortality and premature deaths
- Improved birth outcomes, especially birth weights
- Reduced symptoms of anxiety disorders, depression and attention deficit disorders

*Climate Change* can impact both urban forests and human health. Impacts on urban forests can affect the provision of health benefits by urban forests which may lead to further detrimental impacts on health.
“NO TIME TO LOSE – GREEN THE CITIES NOW”

Obstacles:
  
• cognitive bias,

• poor translation of science into policy,

• academic traditions

• inadequate standards for evidence-based decisions

“We conclude that the probability of net-benefits [...] by natural spaces is very high and that increased efforts are required to translate this knowledge into policy and practice, especially in developing parts of the world.”

“The assessment of risks to human health from [...] disruptions [...] of the Earth system is necessarily of a **qualitative or modelled semi-quantitative** kind.

If that frustrates [...] the conventional needs of policy-makers it is because we carry a **simplified, inadequate, model of ‘science’** in our heads.

That mental model is the legacy of over three centuries of primarily **experimental and reductionist** research [...].

The **ghosts** of Francis Bacon, René Descartes, Robert Hooke, and Isaac Newton still pervade our laboratories and journal editorial offices.”

Tony McMichael, 2015
THANK YOU FOR YOUR ATTENTION!
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