HEALTHY TREES HEALTHY PEOPLE

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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







The period of environmental changes induced by human exploitation of the planet defines a new geological era: the Anthropocene epoch



Source: Rockefeller Foundation, The Lancet

Healthy trees...? Healthy ecosystems...? Healthy planet...?



"UK government plans for more extreme rainfall", The Guardian, Sep 8, 2016

INON

Photo: Catriona Webster/PA



Globally significant wilderness areas

Change in the distribution of wilderness areas since the early 1990s Remaining Loss Protected areas



"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)





Guardian graphic

Source: Current Biology

"Toxic air pollution particles found in human brains" The Guardian, Sep 5, 2016, (Maher et al. 2016)

"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"

Photo: Manuel Velasquez/Getty Images

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

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









PUBLIC HEALTH – URBAN ENVIRONMENT ISSUES AND SOLUTIONS

- Non-communicable diseases
- Health inequalities
- Autoimmune diseases e.g. allergies
- Lifestyle (physical inactivity, stress, social & environmental isolation)









Source: CDC / National Centre for Chronic Disease Prevention

Prevalence of obesity*, ages 18+, 2014 (age standardized estimate) Both sexes



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

Differences in estimated MVPA between participants with low and high values for significant environmental correlates

SEV	5% lowest values of environmental features	5% highest values of environmental features	Differences in weekly minutes of MVPA between lowest 5% and highest 5% values of environmental correlate (95% CI)	Lowest average study-city value for environmental features	Highest average study-city value for environmental features
Net residential density—1·0 km buffer	710	21 078	29 (12–46) 19% of PAG	1658·0	57 322·0
Intersection density—1·0 km buffer	16	198	31 (5–60) 21% of PAG	27.0	227.0
Public transport density—1·0 km buffer	0	35	32 (17–52) 21% of PAG	2.2	29.1
Number of parks contained or intersected by 0.5 km buffer	0	6	21 (5–37) 14% of PAG	0.6	7-4

Sallis et al. 2016. The Lancet. 387(10034):2207-2217

14 cities, n=6822 adults

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





STRESS REDUCTION



Annerstedt et al. 2013. Physiology and Behavior 118:240-50; "Your Brain on Nature", National Geographic, 2016





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





Alcock et al. 2014. Env Sci & Tech. 48(2):1247-1255

DEPRESSION

Bratman et al. 2015. Nature experience reduces rumination and subgenual prefrontal cortex activation. PNAS. 112(28):8567-8572



Urban

A 0.0

Mean change in rumation

-2.5

-5.0

Nature

Fig. 1. The impact of nature experience on self-reported rumination and blood perfusion to the sgPFC. (A) Change in self-reported rumination (postwalk minus prevalk) for participants randomly assigned to take a 90-min walk either in a natural setting or in an urban setting. (B) A time-by-environment interaction in blood perfusion was evident in the sgPFC. F map of significant interactions at a threshold of P < 0.05, FWE corrected for multiple comparisons. (C) Change in blood perfusion (postwalk) for participants randomly assigned to take a 90-min walk either in a natural setting or in an urban setting. For bars represent 5E within subjects: P < 0.05, **P < 0.001.</p>

GREEN SPACES AND SOCIAL ISOLATION



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



Elands et al. In press

GREEN SPACE CHARACTERISTICS FACILITATING SOCIAL INTERACTION



Factor	Examples
Availability	Proximity, size
Туре	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

Mitchell & Popham (2008), The Lancet, 372(9650):1655-1660







Health "is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

Biological diversity

(biodiversity) is "the variability among living organisms from all sources including, interalia, 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.

Biodiversity

Nutrition

Disaster

risk

Health

Outcomes

biodiversity

quality

Climate

change

Infectious

diseases

Water

quality

Ecosystem

ROP

Microbial

diversity

Agricultural

biodiversity

Sustainable

development

Traditional

nedicin

Mental

Health

Biomedical/

pharmacutica

discoverv

Food & Wate

security

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

BIODIVERSITY



Rook, G. 2013. *Regulation of the immune system by biodiversity from the natural environment: An ecosystem service essential to health*. PNAS, 110(46):18360-67 Pakarainen et al. 2008. Environmental Microbiology. 10(12):3317-3325



REGULATING ECOSYSTEM SERVICES

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URBAN FORESTS AND ECOSYSTEM SERVICES

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

The Urban Heat Island (UHI)

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)

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

Nine key variables (Roderick Lawrence & Joris Zufferey)

Classification of parks by size and shape

Slide courtesy of PHENOTYPE, www.phenotype.eu

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

Slide courtesy of PHENOTYPE, <u>www.phenotype.eu</u>

• Distance to blue and green spaces, accessibility, connection with other blue and green spaces

©LeTemps

Maillage des espaces publics du centre ville (dessin ar-ter) ©Ar-ter

Slide courtesy of PHENOTYPE, <u>www.phenotype.eu</u>

Blue and Green Spaces

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

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Slide courtesy of PHENOTYPE, <u>www.phenotype.eu</u>

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Urban Forest Benefits Health Promoting Factors

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

Lam, 2016. Climate Change and Innovation Bureau, Health Canada

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 in to 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."

van den Bosch & Nieuwenhuijsen, 2016. Environment International. Under review.

THE BIGGER PICTURE

"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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