Space based information for health and SDGs

Expectations and needs of decision makers

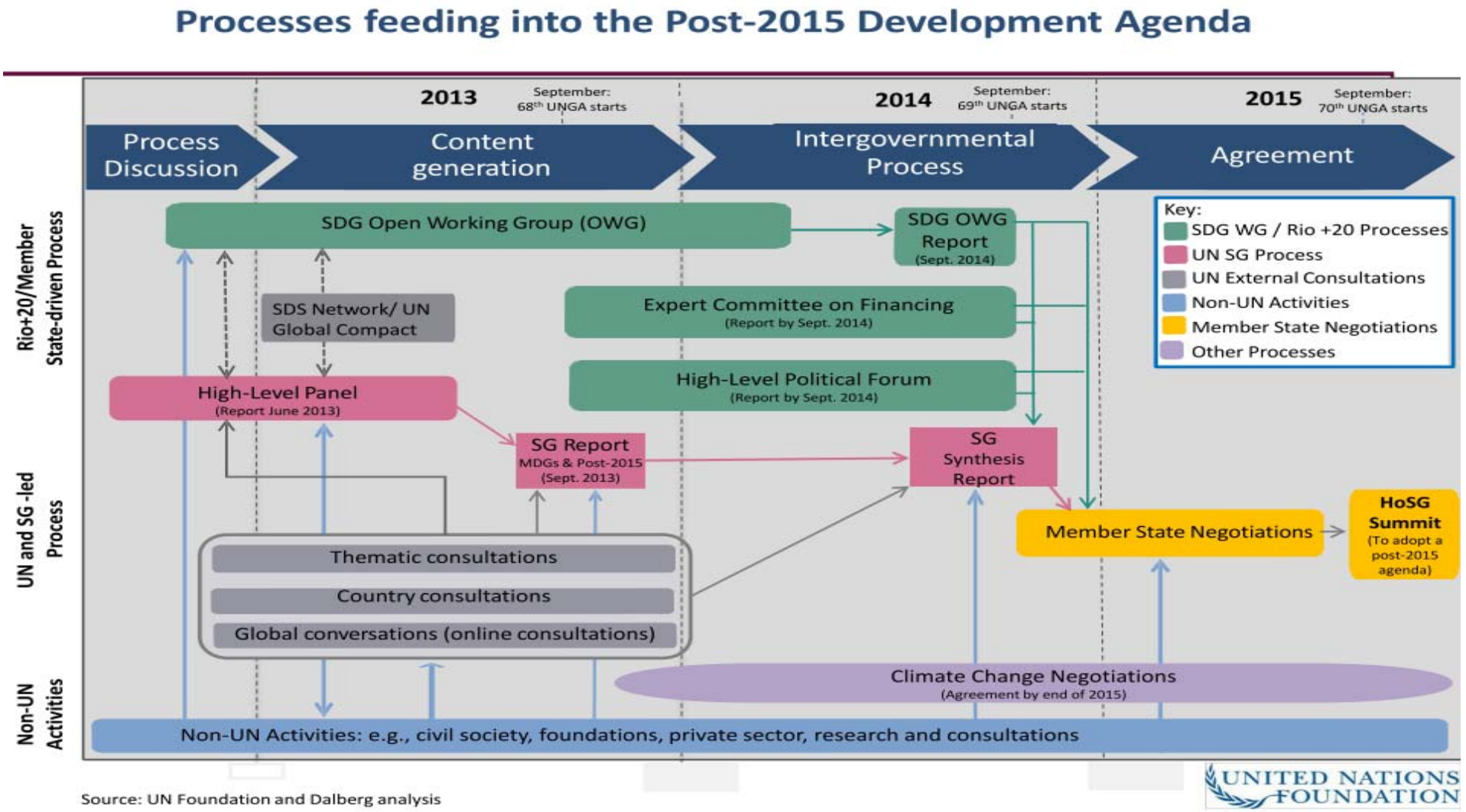
Bettina Menne
with contributions from Marie-Eve Hereux, Pierpaolo Mudu and Tanja Wolf

WHO Regional Office for Europe,
European Centre for Environment and Health

The SDGs

1. End poverty everywhere
2. End hunger, improve nutrition and promote sustainable agriculture
3. Attain healthy lives for all
4. Provide quality education and life-long learning opportunities for all
5. Attain gender equality, empower women and girls everywhere
6. Ensure availability and sustainable use of water and sanitation for all
7. Ensure sustainable energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Promote sustainable infrastructure and industrialization and foster innovation
10. Reduce inequality within and between countries
11. Make cities and human settlements inclusive, safe and sustainable
12. Promote sustainable consumption and production patterns
13. Tackle climate change and its impacts
14. Conserve and promote sustainable use of oceans, seas and marine resources
15. Protect and promote sustainable use of terrestrial ecosystems, halt desertification, land degradation and biodiversity loss
16. Achieve peaceful and inclusive societies, access to justice for all, and effective and capable institutions
17. Strengthen the means of implementation and the global partnership for sustainable development

The process


Processes feeding into the Post-2015 Development Agenda
2013
September: 68th UNGA starts
2014
September: 69th UNGA starts
2015
September: 70th UNGA starts
Process Discussion
Content generation
Intergovernmental Process
Agreement
Rio+20/Member State-driven Process
UN and SG -led Process
Non-UN Activities
SDG Open Working Group (OWG)
SDG OWG Report (Sept. 2014)
SDS Network/ UN Global Compact
Expert Committee on Financing (Report by Sept. 2014)
High-Level Political Forum (Report by Sept. 2014)
High-Level Panel (Report June 2013)
SG Report MDGs & Post-2015 (Sept. 2013)
SG Synthesis Report
Member State Negotiations
HoSG Summit (To adopt a post-2015 agenda)
Thematic consultations
Country consultations
Global conversations (online consultations)
Climate Change Negotiations (Agreement by end of 2015)
Non-UN Activities: e.g., civil society, foundations, private sector, research and consultations
Key:
SDG WG / Rio +20 Processes
UN SG Process
UN External Consultations
Non-UN Activities
Member State Negotiations
Other Processes
Source: UN Foundation and Dalberg analysis
UNITED NATIONS FOUNDATION

Indicator development

List of proposed preliminary indicators

(February 2015)

Description:

The following document contains a compilation of proposed indicators for each Sustainable Development Goal (SDG) target formulated by specialized agencies and entities of the wider United Nations System. The list contains a maximum of two indicators per target with the only exception of target 3.3. Background information with more detailed descriptions of the indicators and in many cases, additional indicators, is available in a separate document.

The need of health decision makers

Decision makers in the health sector have used space based information in regions and for topics when

- **other information is not readily available;**
- **other information is not up to date or areas are not accessible (emergencies, disaster relief);**
- **collection is too time- and resource intense;**
- **further evidence to causal epidemiological links is required.**

Examples of use

1. Satellite data in air pollution health risk assessment
2. Climate change: remote sensing for urban heat island detection
3. Developing indicators for access to green space
4. Monitoring and prediction of disease and their vectors
5. E-Atlas of disaster risks
6. Interventions and post-disaster relief

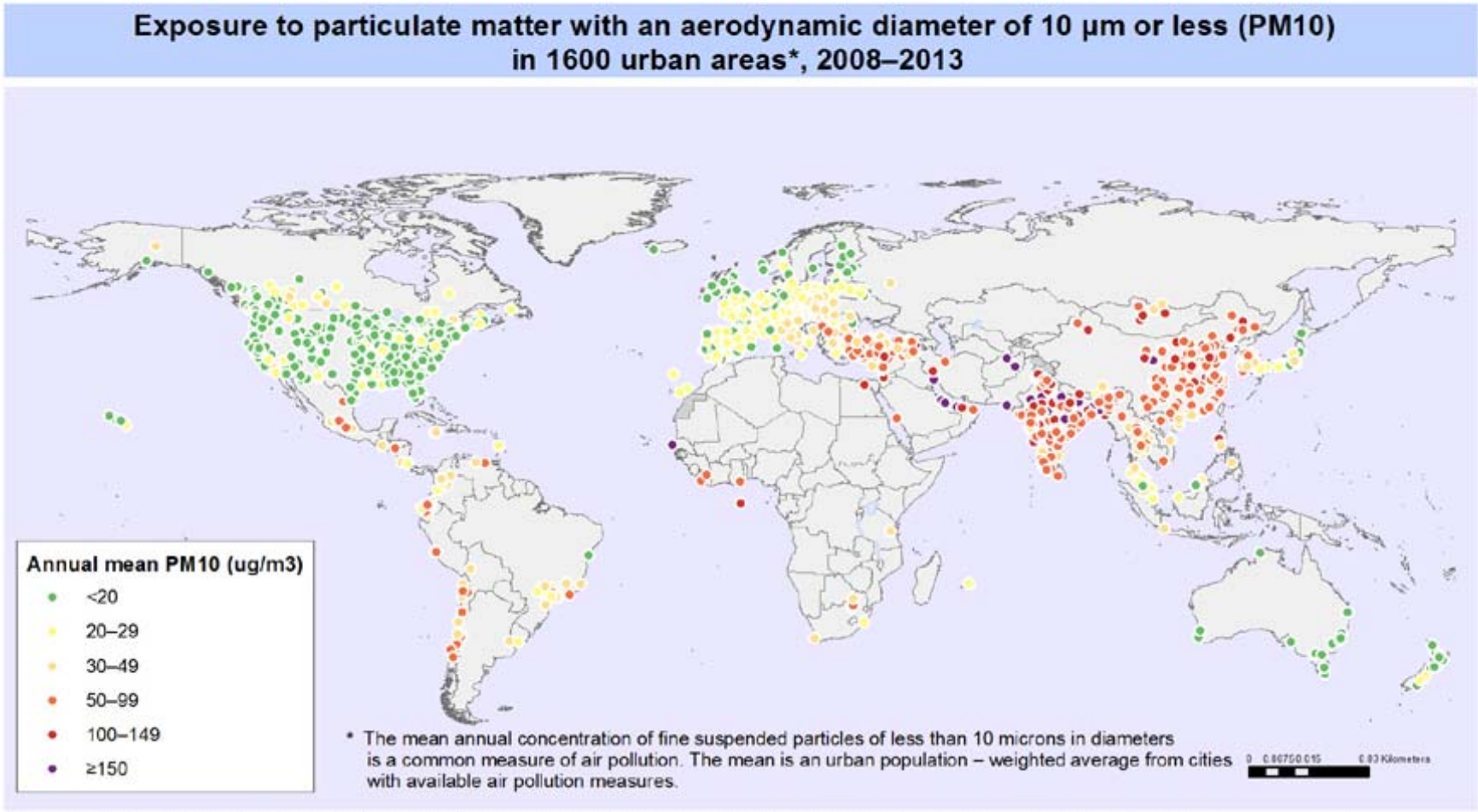
Example 1:

Satellite data in air pollution health risk assessment

Air quality: main issues

1. **Air pollution is a big contributor to the burden of disease from the environment, globally and in European Region**
2. **Ambient air pollution contributes to deaths from causes such as cardiovascular diseases, respiratory diseases, and lung cancer**
3. **For the assessment of population exposure, models, ground monitoring, and satellite information all have their respective strengths.**
4. **Satellite remote sensing of ground level air quality has developed substantially over the last decade.**
5. **Improved estimates of population exposure to air pollution have been used for awareness raising and as critical input to policy decisions.**
6. **Proposed indicator:** *Population in urban areas exposed to outdoor air pollution levels above WHO guideline values (will be adjusted)*

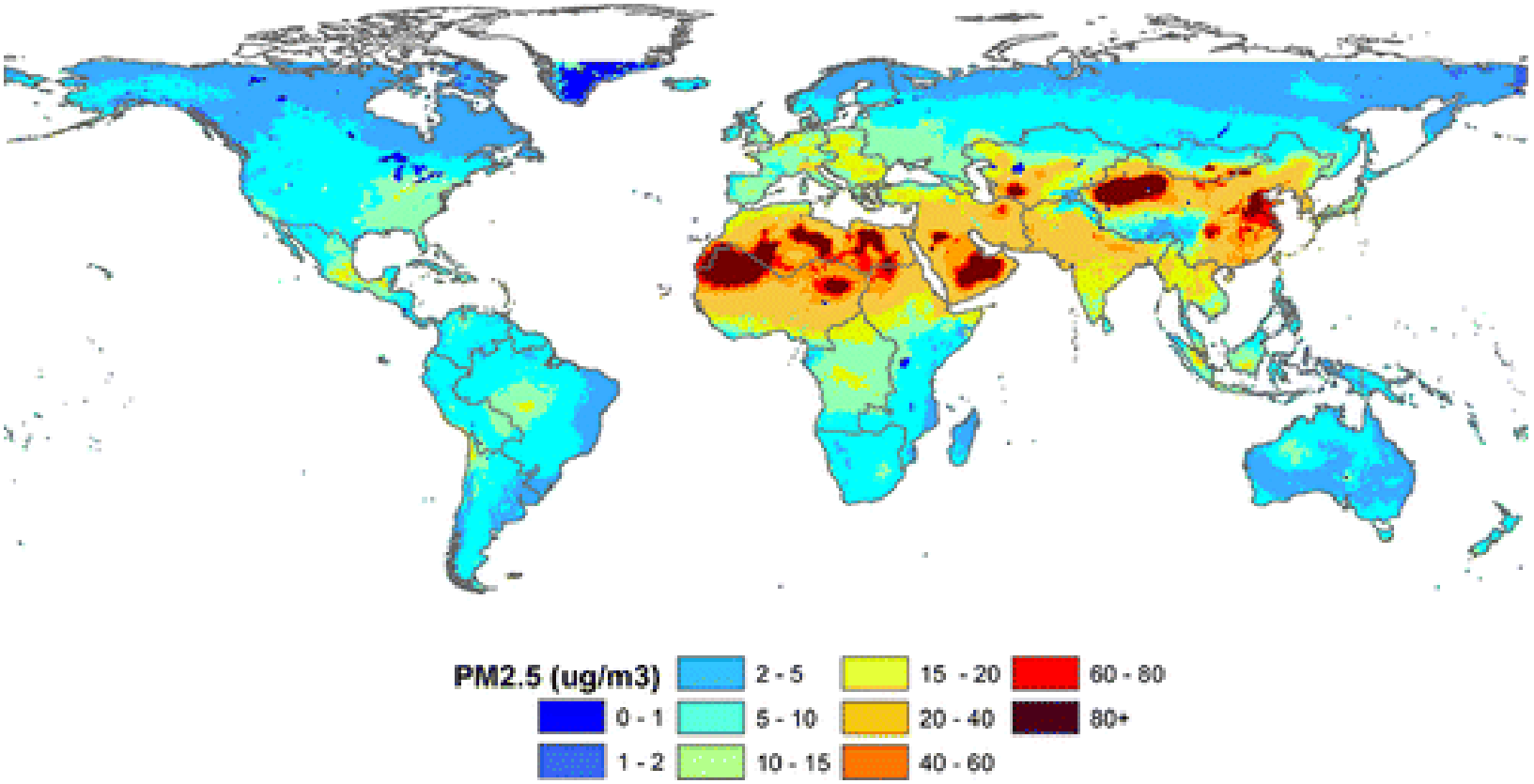
Limited data availability from monitoring



Source: WHO (2014)

Use of satellite-based estimates

- Satellite remote sensing of ground level air quality has developed substantially over the last decade.
- Satellite remote sensing provides valuable information about ground level concentrations and has been applied in epidemiologic studies.



$PM_{2.5}$ annual exposure estimates for 2005 – GBD2010

Brauer et al. EST (2012)

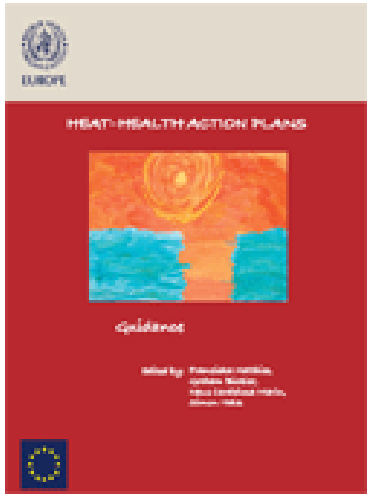
Example 2:

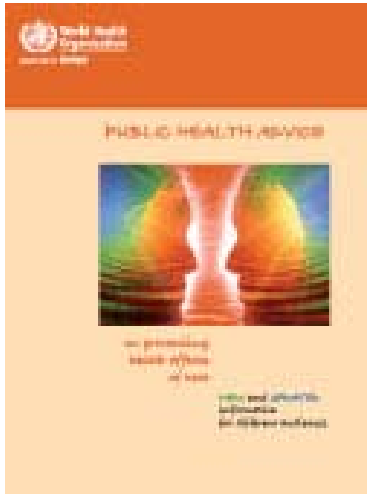
Climate change: Remote sensing data for urban heat island detection

Detecting urban heat islands

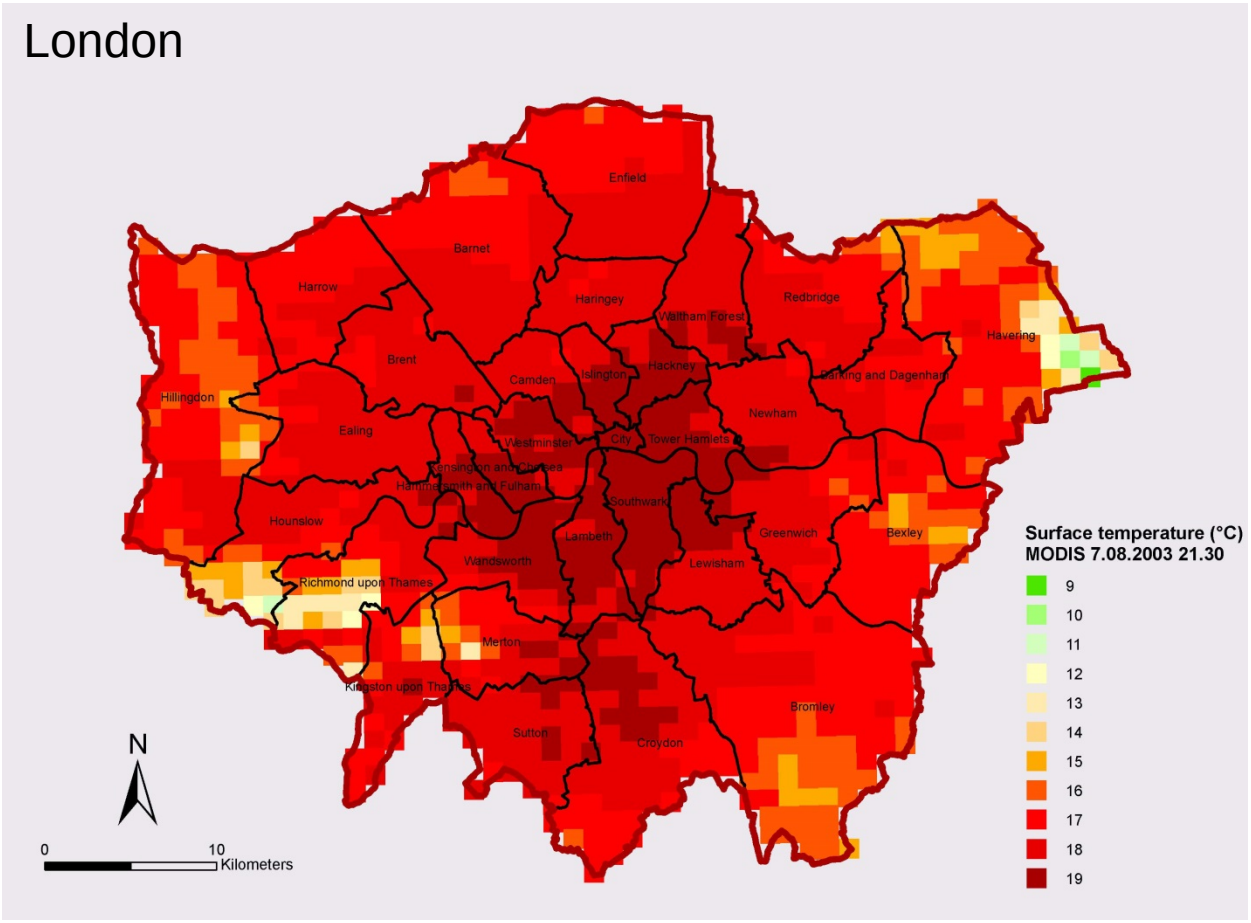
Decision support on where to take action first!

Identifying vulnerable areas and areas with higher heat exposure through thermal satellite imagery:





London



Wolf & McGregor Weather and Climate Extremes 2013, 1:59-68

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Example 3

Developing indicators for access to green space

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Indicators of access to green spaces

SDG: Proposed indicator 11.7: Proposed Indicator 1: Area of public space as a proportion of total city space; Proposed Indicator 2: Proportion of residents within 0.5 km of accessible green and public space

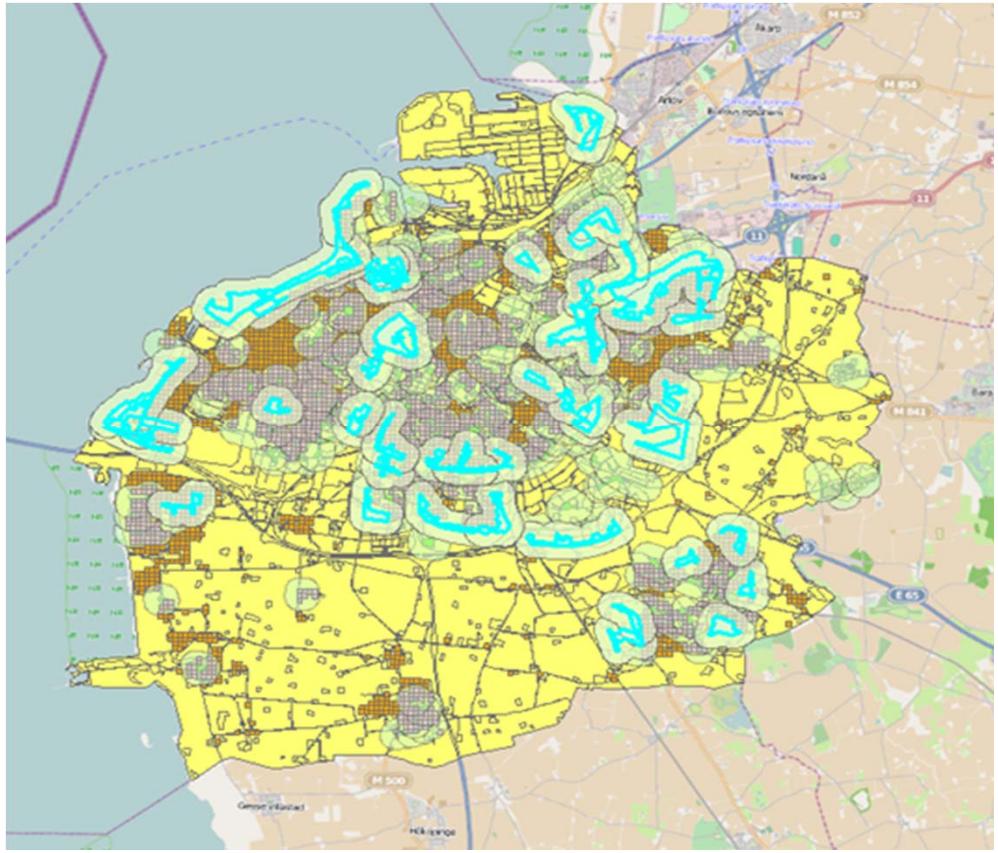
- **WHO's Action Plan for the implementation of the European Strategy for the Prevention and Control of NCDs 2012–2016 (WHO 2012) includes a call to create health-supporting urban environments.**
- **the Member States of the WHO European Region committed themselves "…to provide each child by 2020 with access to health and safe environments and settings of daily life in which they can walk and cycle to kindergartens and schools, and to green spaces in which to play and undertake physical activity" (WHO, 2010).**
- **In order to monitor progress towards this commitment there is a need for developing indicator tools that can be applied on a municipality level.**

Urban Atlas in Malmö, Utrecht and Kaunas

WHO is testing in the cities of Malmö, Utrecht and Kaunas a method for a GIS-based indicator of available green spaces to urban citizens, by combining population data with land use data from Urban Atlas:

Urban Atlas four major units:

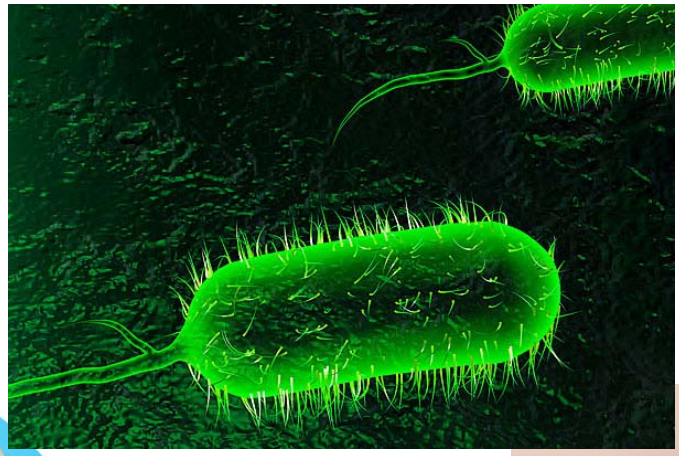
- **artificial surfaces (including "Green urban areas" and "Sports and leisure facilities")**
- **agricultural areas, semi-natural areas and wetlands;**
- **forests**
- **water.**

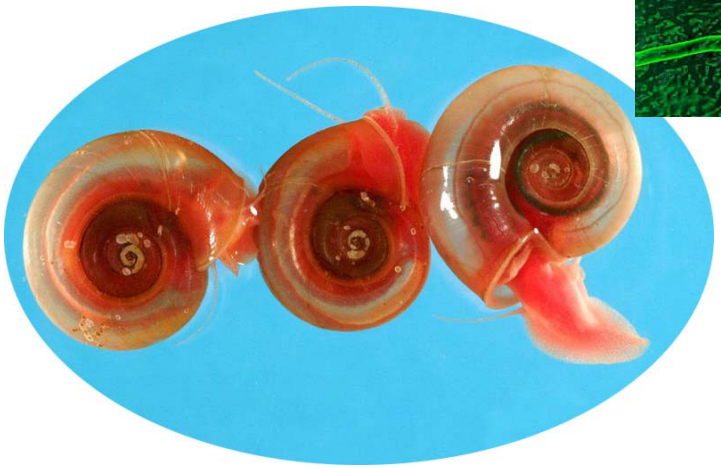


GIS-map of Malmö, population living with 300 m buffer zones around green areas of 5 ha minimum size

Example 4

Monitoring and prediction of disease and their vectors





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Target 3.3.

Proposed Indicator 1: HIV incidence per 100 susceptible person years (adults, key populations, children, adolescents)

Proposed Indicator 2: HIV/AIDS deaths per 100,000 population

Proposed Indicator 3: TB incidence per 1,000 person years

Proposed Indicator 4: Number of TB deaths

Proposed Indicator 5: Malaria incident cases per 1,000 person years

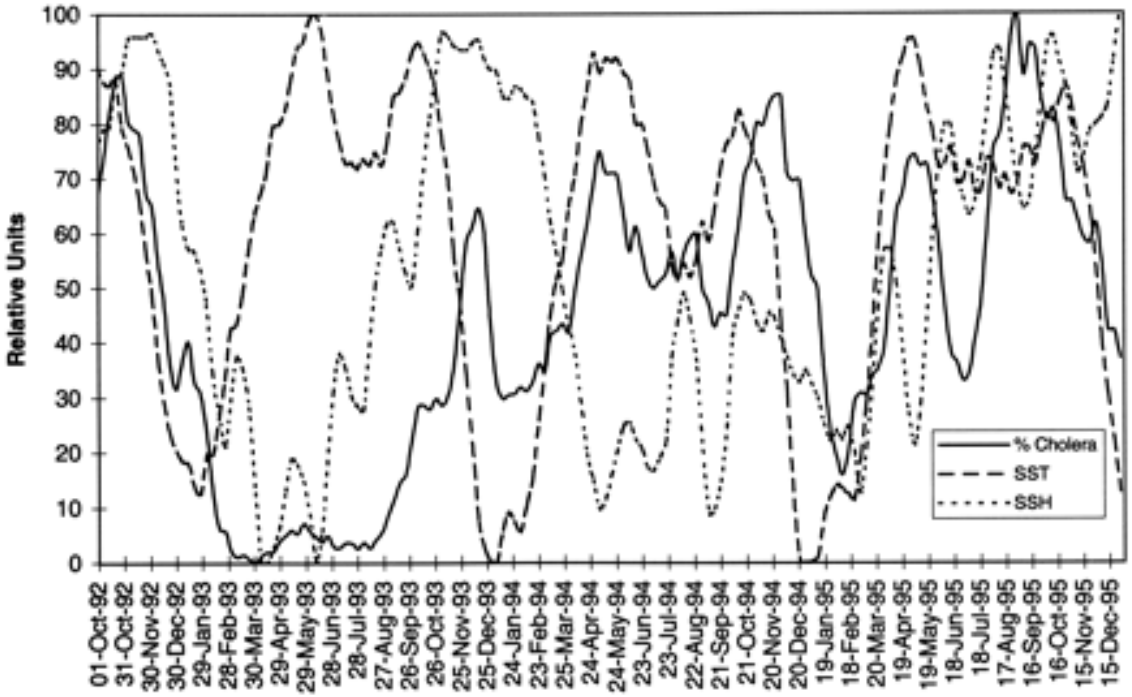
Proposed Indicator 6: Malaria deaths per 100,000 population

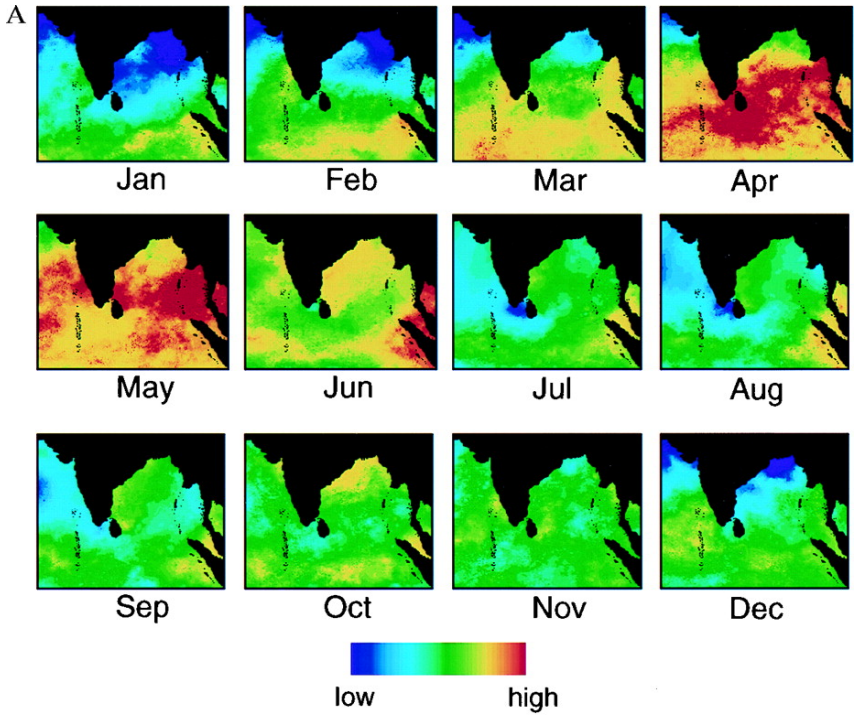
Proposed Indicator 7: Prevalence of hepatitis B surface antigen in children under 5

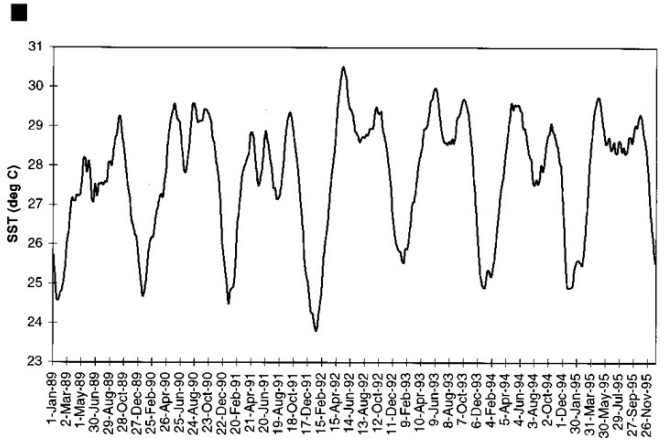
Proposed Indicator 8: Presence of 13 IHR core capacities for surveillance and response

Forecasting Cholera

with chlorophyll concentration based on sea-surface temperature anomalies (Golf of Bengal)







Brad Lobitz et al. PNAS 2000;97:1438-1443

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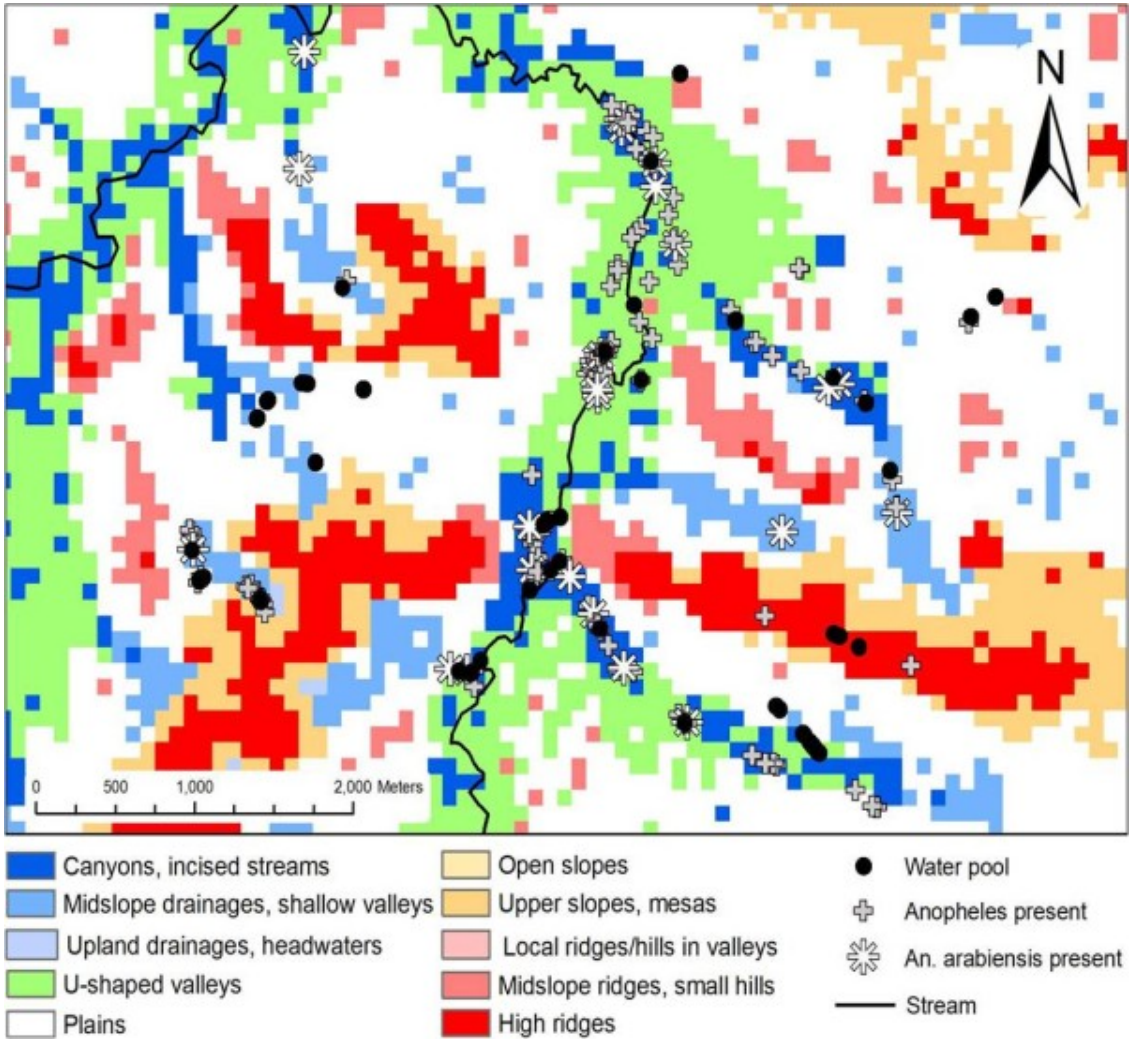
Identifying malaria vector breeding habitats

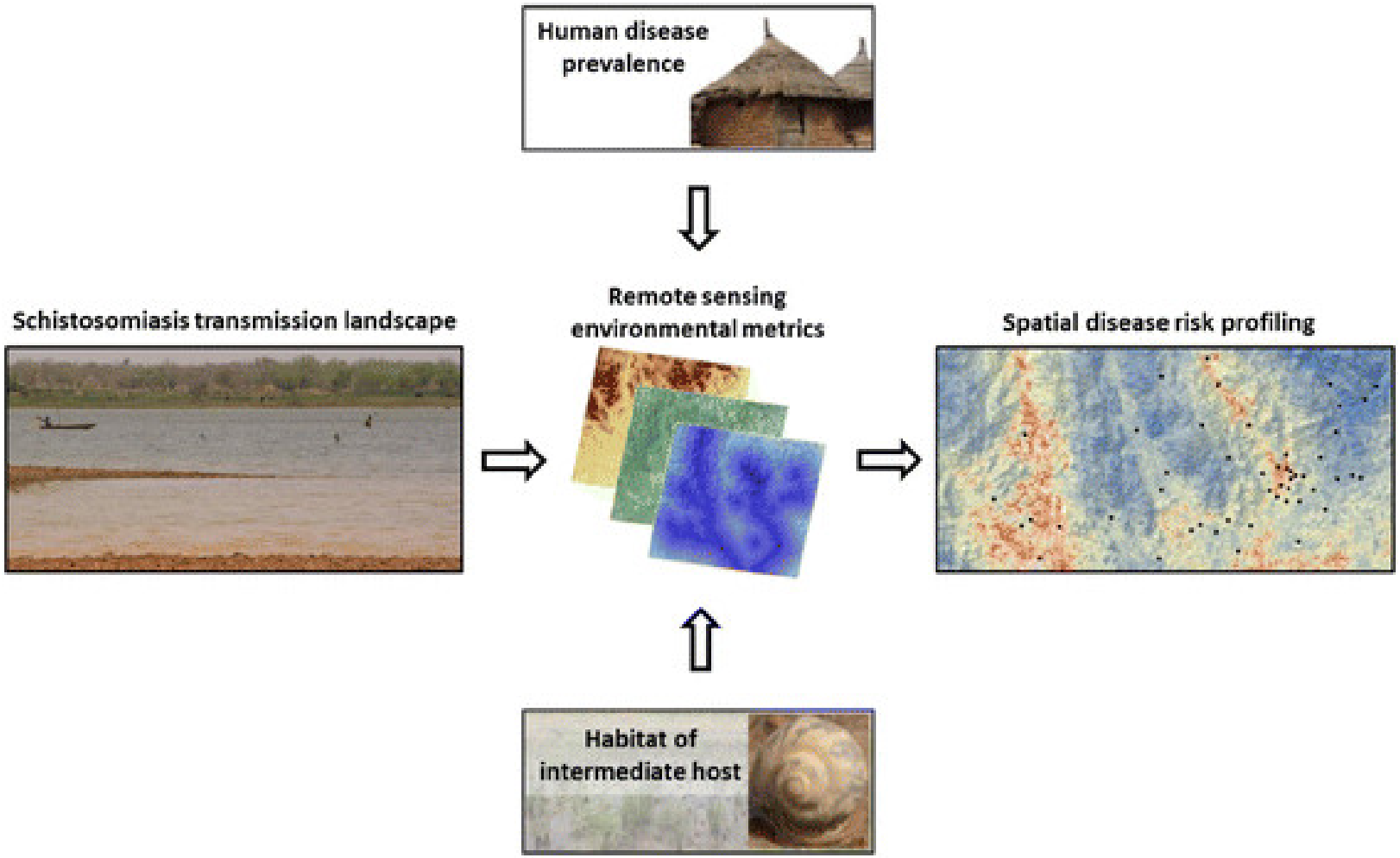
with remote sensing data and terrain-based landscape indices (in Zambia)

Locations of water sites with anopheline larvae overlaid on landform types derived from SRTM Imagery.



Clennon *et al. International Journal of Health Geographics* 2010 9:58

Risk profiling of schistosomiasis using remote sensing



Yvonne Walz et al Parasites & Vectors 2015, 8: 163

Example 5: E-Atlas of disaster risks

- Contains Geographical Information Systems and disaster models to support decision-makers in **reducing health risks** amongst populations vulnerable to health emergencies or crises.
- Can be used to **predict the magnitude** of a disaster (earthquakes, floods, heat waves, winds and landslides) on a specific population,
- Can assess the areas where damage can be more significant and anticipate specific resources which will be needed.

El Morjani Z et al. Modelling the spatial distribution of five natural hazards in the context of the WHO/EMRO Atlas of Disaster Risk as a step towards the reduction of the health impact related to disasters. *International Journal of Health Geographics*, 2007, 6:8 [English]

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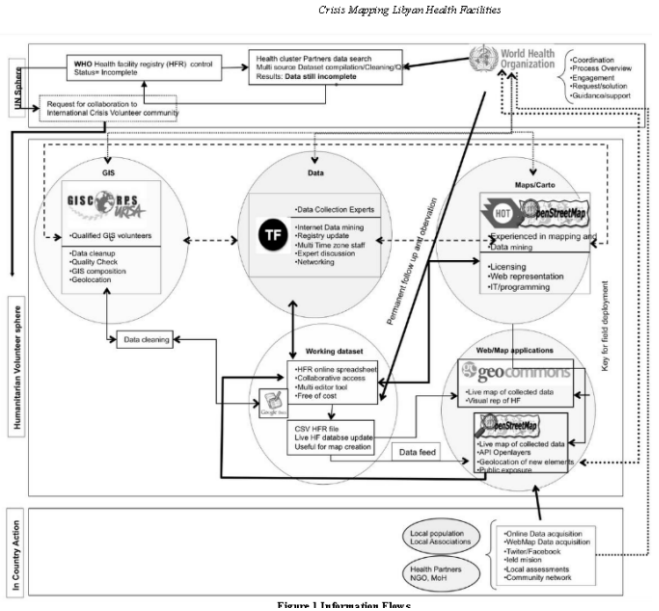
Example 6: Interventions (Libya crisis)

- WHO partnered with volunteer crisis mappers (GISCorps, The Standby Task Force (SBTF), and Humanitarian OpenStreetMap (HOT)) to quickly collect information and map over 600 health facilities after the 2011 Libya Crisis.

- This new collaboration between WHO staff, volunteers, technologists, GIS specialists, health cluster partners and a researcher helped provide health and geographic information to support the planning phases of an in-depth countrywide health facility assessment.

- Outcomes of this collaboration (identification of 683 health facilities) aid recovery and reconstructions efforts for the Libyan health system.

(Chan, Colombo, & Musani, 2012)



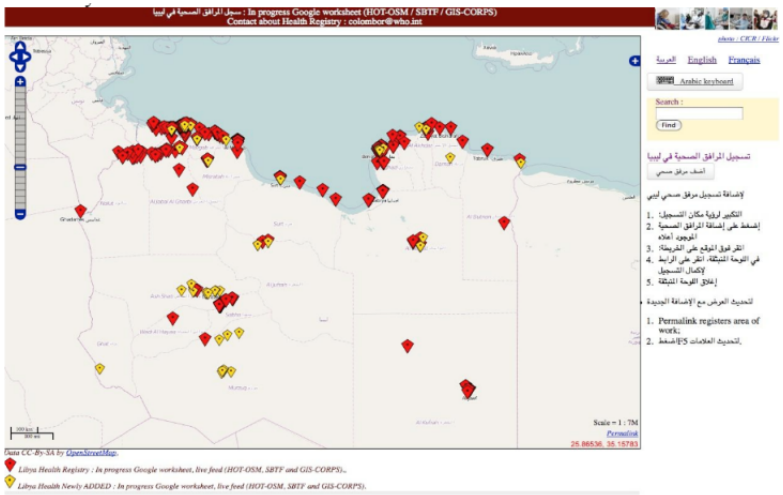


Figure 3 Online Map

Example 6: Damage maps to faciliate interventions

Example damage maps of parts of Port-au-Prince (Haiti) following the 2010 earthquake

a- SERTIT,

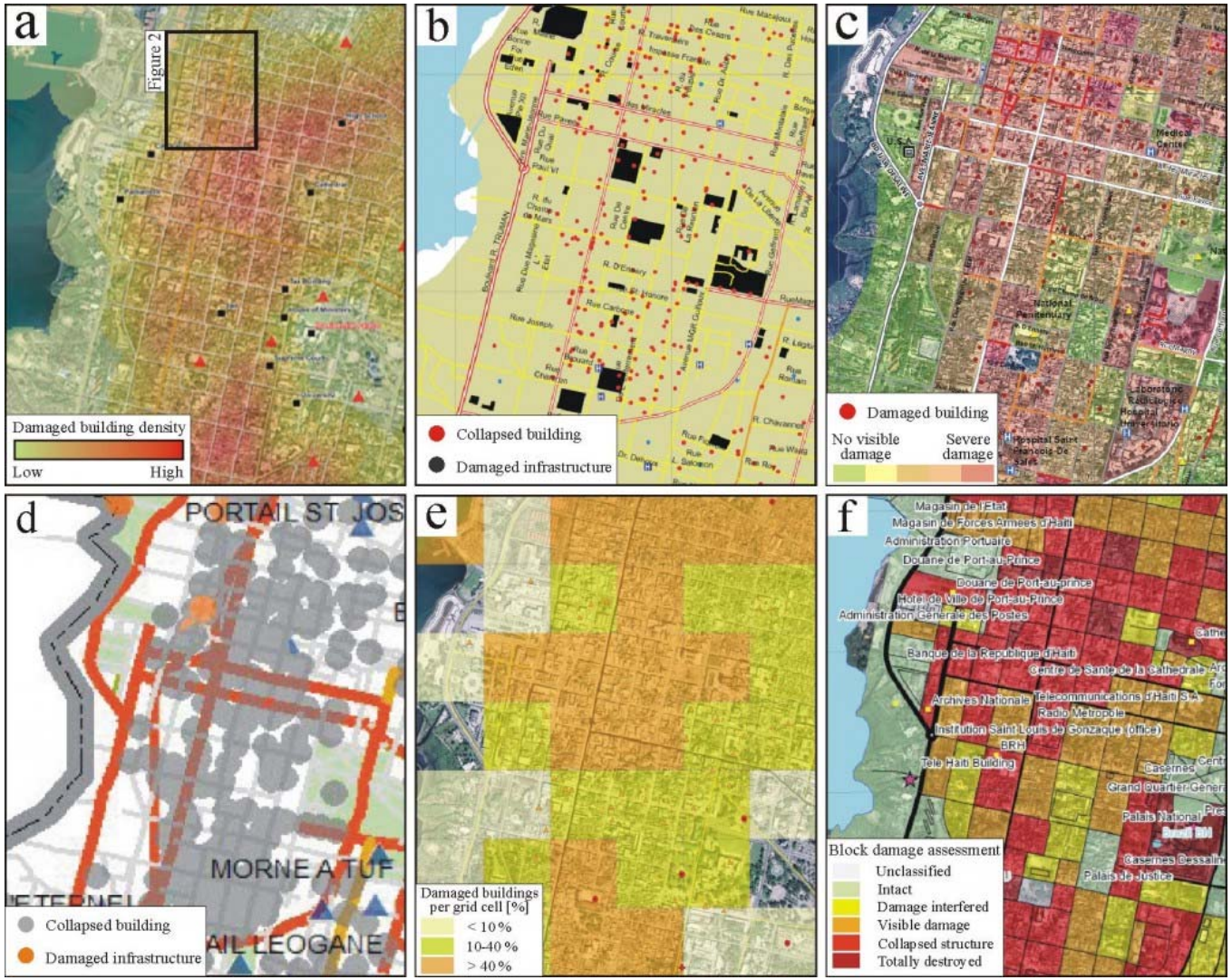
b- ITHACA,

c- UNSC,

d- iMMAP,

e- DLR-ZKI,

f- e-GEOS;



WHO work on using space based information is in progress

- Standardization of collection of geographical data
- Reporting and monitoring
- Technological challenges: big data

- Integration of data
- Spatial analysis and modelling
- Combination of topics and with qualitative data
- Development of tools (for example indicators)

How reliable is space based information?

- Scientific work includes information about the limits of space based data
- Overall, the scientific reliability and accuracy is impressive and lack of policy action cannot be justified by lack of knowledge or insufficient reliability of data
- However, continuous ground-proofing is necessary- space based data will not substitute classic data collection, especially under global change and climate change.

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Examples show: Space based information is useful

- For local decision makers: Rapid adhoc-short term information
- For national decision makers: Long term monitoring at large geographic scales to guide local interventions
- For environmental health researchers: to make a case and create evidence on causal links, generate decision-support, help setting priorities

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www.euro.who.int

wolft@who.int

mudup@who.int

menneb@who.int

Extra slides

Air quality and health

- Air pollution is an important determinant of health and convincing evidence links air pollutants with the risk of disease, including premature death, even at relatively low pollutant concentrations.
- Quantitative estimates of air pollution health impacts have become an increasingly critical input to policy decisions.
- Several large projects have recently estimated the burden of disease of exposure to air pollution in various populations and for a variety of policy scenarios of different spatial and temporal scales.
- Satellite information has been used to improve the estimation of the population exposure to air pollution in areas where no monitoring is conducted

Burden of disease from air pollution

عربي 中文 English Français Русский Español

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Public health, environmental and social determinants of health (PHE)

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7 million deaths annually linked to air pollution

In new estimates released, WHO reports that in 2012 around 7 million people died - one in eight of total global deaths – as a result of air pollution exposure. This finding more than doubles previous estimates and confirms that air pollution is now the world's largest single environmental health risk. Reducing air pollution could save millions of lives.

Read the news release on air pollution attributable deaths

Read the feature story on air pollution

FAQs on air pollution and health
pdf, 169kb

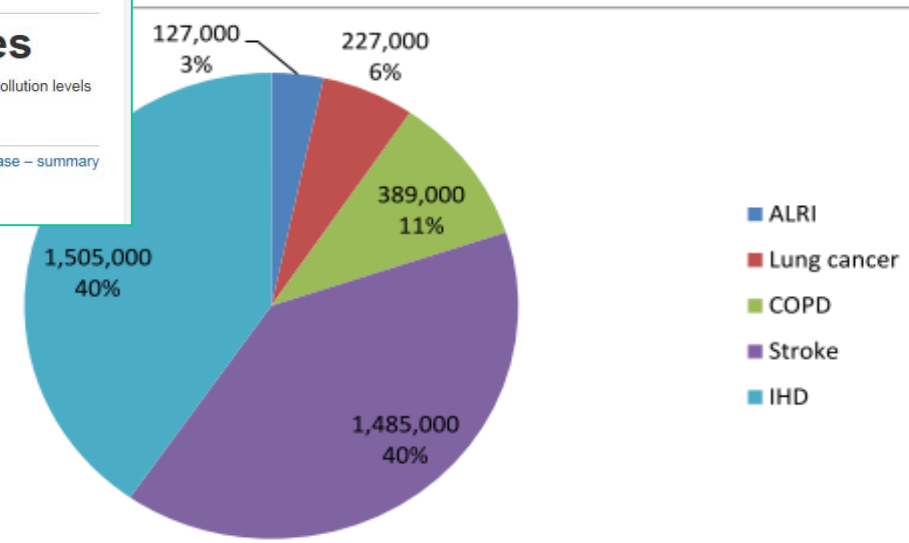
Air pollution estimates
pdf, 1.16Mb
Summary of results and method descriptions

3.7 million deaths
attributable to ambient air pollution
Mortality from ambient air pollution for 2012 - summary of results
pdf, 293kb

4.3 million deaths
attributable to household air pollution
Mortality from household air pollution 2012 - summary of results.
pdf, 558kb

1600 cities
worldwide are reporting air pollution levels
Air quality in cities database – summary of results
pdf, 304kb

le to AAP in 2012, by disease



Percentage represents percent of total AAP burden (add up to 100%).
AAP: Ambient air pollution; ALRI: Acute lower respiratory disease; COPD: Chronic obstructive pulmonary disease; IHD: Ischaemic heart disease.

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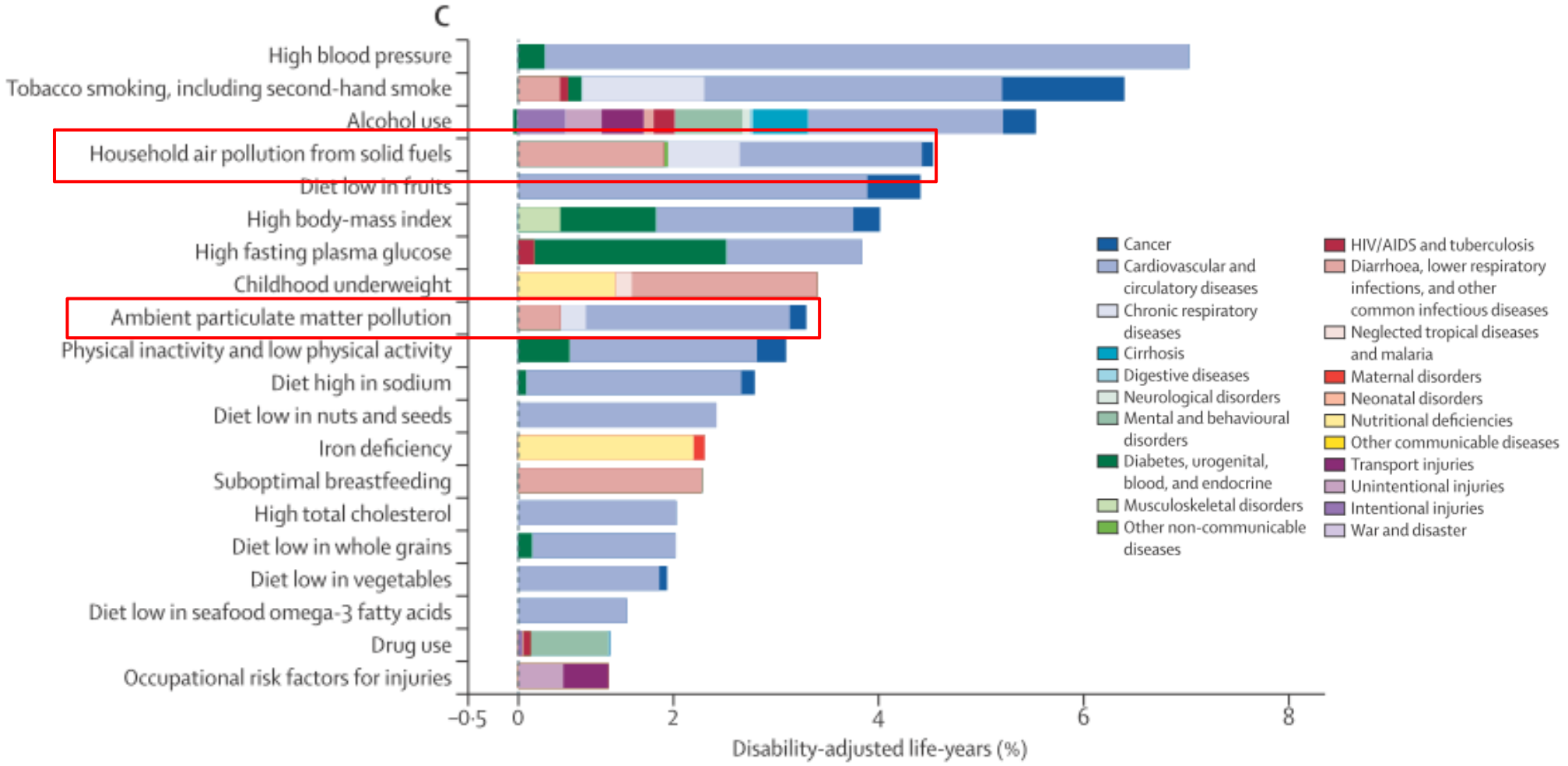
Air pollution is a leading cause of death and disease (data for 2010)



Lim et al. LANCET (2012)

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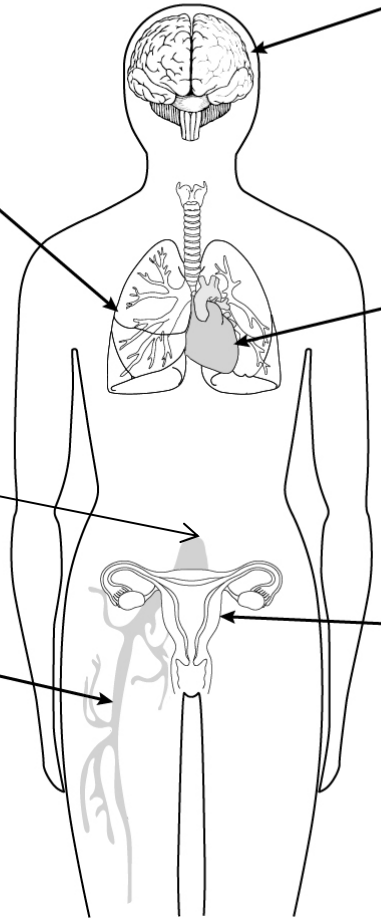
Several organs of the human body are affected by particulate air pollution

- Respiratory mortality
- Respiratory symptoms
- Rhinitis/Pneumonia
- Airway inflammation
- Decreased lung function
- Decreased lung growth
- Lung cancer

- Stroke
- Diseases of the central nervous system



- Cardiovascular mortality
- Cardiovascular hospital admission
- Changes in heart rate variability
- ST-segment depression

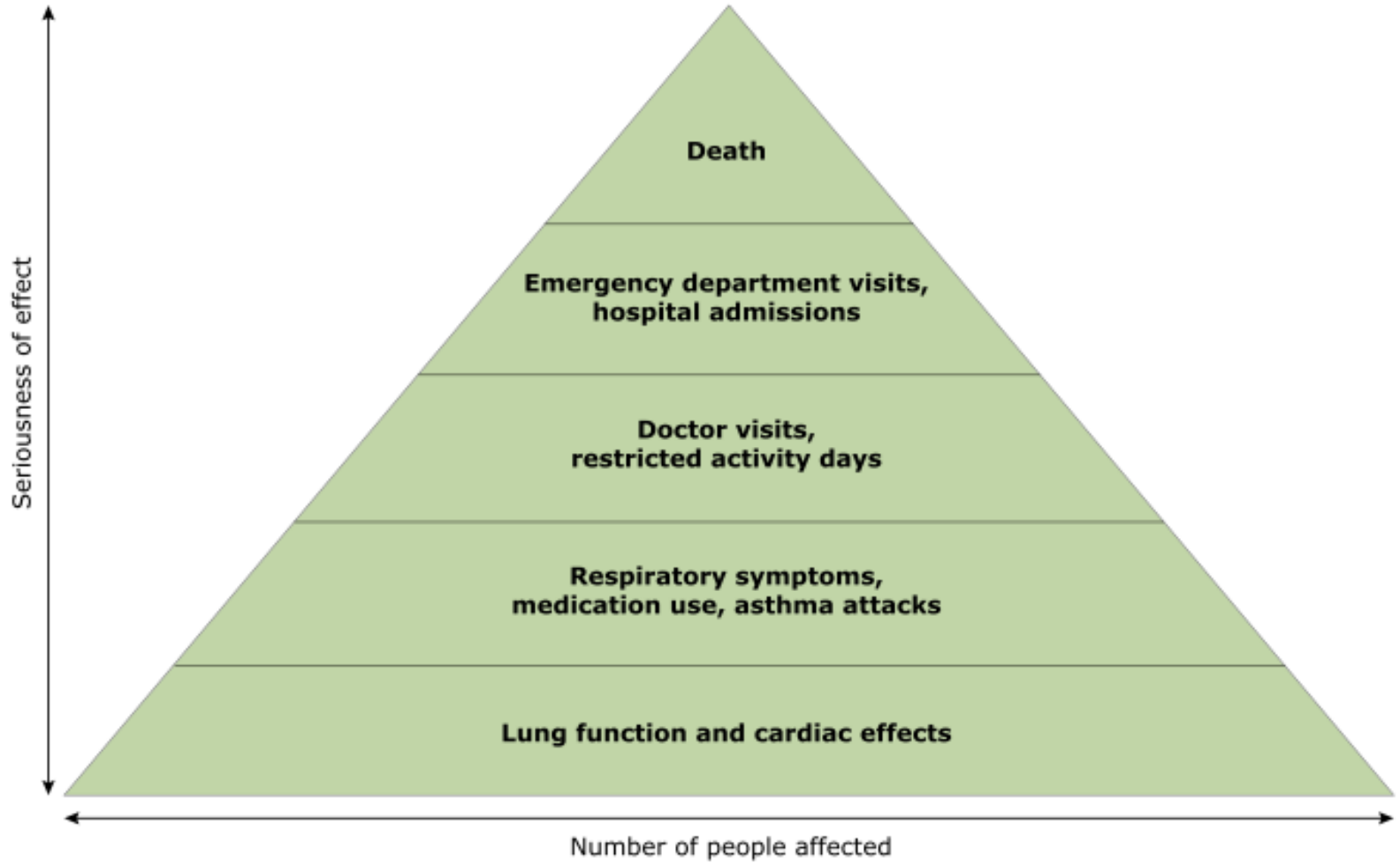
- Metabolic disorders
- Diabetes
- Liver disorders

- Changes in blood pressure
- Endothelial function
- Increased blood coagulation
- Systemic inflammation

- Premature birth
- Decreased birth weight
- Decreased foetal growth
- Intrauterine growth retardation
- Decreased sperm quality

Source: updated from Peters et al. (2011)

Air pollution causes a wide range of health effects and varying number of people are affected



Source: EEA, 2014 (Based on US EPA)

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Population exposure and health risk assessment of air pollution

- A core component of health risk assessment for air pollution is the assessment of exposure.
- While measurements of ambient air pollutants are the foundation for air pollution epidemiology, the applicability of measurements to health risk assessment is often limited by their temporal and spatial coverage.
- Very few measurements are available in some highly-polluted regions of the world.
- Further, measurements are typically only available in urban areas, despite the fact that approximately 50% of the global population resides in rural areas.
- In addition, measurements conducted in different locations often follow different procedures and use different technologies, making it difficult to harmonize data.
- Recent progress in methods based on remote sensing and (global) chemical transport and local land use regression models and other estimation approaches, combined with existing surface monitoring, has led to an increase in availability of information on key air pollutants, including the most highly-polluted and data-poor regions.
    - These approaches allow for improvement of air pollution health risk assessment.
    - Models, ground monitoring, and satellite information all have their respective strengths.

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