# Stedelijk groen

## Een wondermiddel voor meer leefbare steden?

**Matthias Demuzere**



RUB

B-Kode

# Toestand van ons klimaat


In het Verenigd Koninkrijk werd het hitterecord verbroken.


# Extreme hittegolf trekt noordwaarts: heetste dag ooit in Verenigd Koninkrijk, zware branden in Bretagne en Toscane

De hittegolf die de laatste dagen grote delen van Europa in zijn greep houdt, trekt langzaamaan verder richting het noordoosten. Vandaag kunnen de temperaturen in België, Duitsland en Nederland daardoor oplopen tot 40 graden. In het Verenigd Koninkrijk werd de warmste temperatuur ooit gemeten. Intussen woeden in Spanje en Frankrijk tientallen bosbranden. Tienduizenden mensen werden gedwongen om hun woning te verlaten, honderden kwamen om van de hitte.

**Lukas Lecluyse**
Update di 19 jul 20:20
di 19 jul 12:22


In het Verenigd Koninkrijk werd het hitterecord verbroken.


# Extreme hittegolf trekt noordwaarts: heetste dag ooit in Verenigd Koninkrijk, zware branden in Bretagne en Toscane

De hittegolf die de laatste dagen grote delen van Europa in zijn greep houdt, trekt langzaamaan verder richting het noordoosten. Vandaag kunnen de temperaturen in België, Duitsland en Nederland daardoor oplopen tot 40 graden. In het Verenigd Koninkrijk werd de warmste temperatuur ooit gemeten. Intussen woeden in Spanje en Frankrijk tientallen bosbranden. Tienduizenden mensen werden gedwongen om hun woning te verlaten, honderden kwamen om van de hitte.

**Lukas Lecluyse**
Update di 19 jul 20:20
di 19 jul 12:22




James Arthur Photography

# Neerslagtekort in Vlaanderen ligt opnieuw historisch hoog: "Veel meer aan de hand dan te weinig regenval"

Het neerslagtekort sinds 1 april is in Vlaanderen opgelopen tot 250 millimeter, of 250 liter water per vierkante meter. Dat blijkt uit cijfers die VRT NWS heeft opgevraagd bij hydroloog Patrick Willems (KU Leuven) en het KMI. Daarmee komen we in de buurt van de droge zomer van 1976, en zitten we in de 5 procent droogste zomers ooit. Er is veel meer aan de hand dan te weinig regenval: de verdamping was erg groot, wat de droogte en warmte in de hand werkte. "Dat effect riskeert de volgende jaren verder door te hollen", weet weerman Frank Deboosere.

**Michaël Torfs**
za 30 jul 05:55


Radio2

# Vier bermbranden op één dag in regio Ieper, grootste langs A19 autosnelweg

Op de A19, de autosnelweg richting Ieper, is ter hoogte van Zonnebeke een berm beginnen branden door de droogte. Het vuur verspreidde zich razendsnel. De brandweer kon voorkomen dat de brand zou overslaan naar het Polygoonbos in de buurt.


Radio2

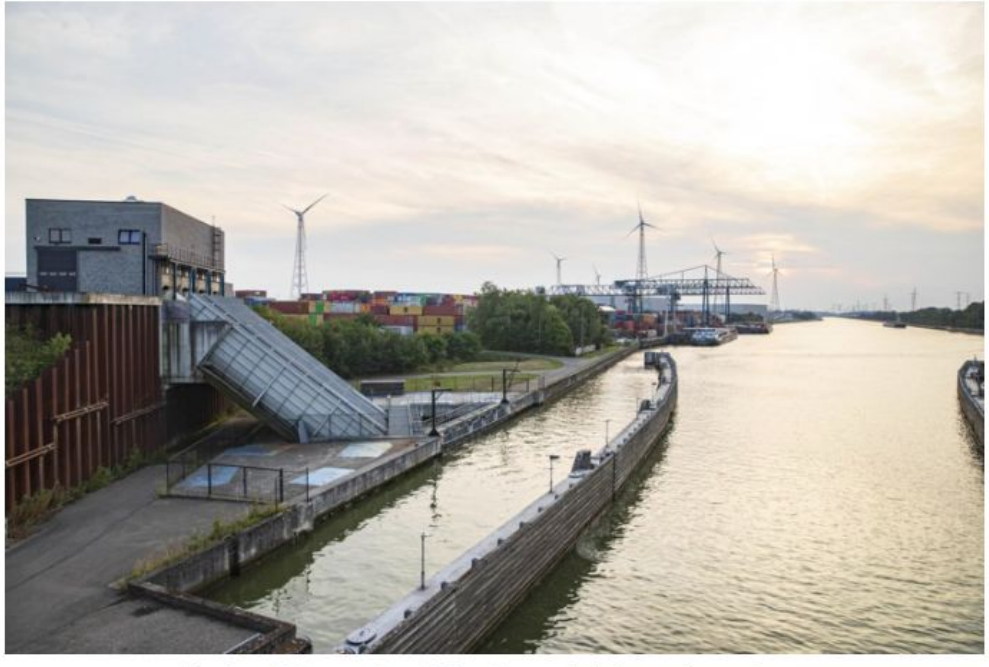
## Vier bermbranden op één dag in grootste langs A19 autosnelweg

Op de A19, de autosnelweg richting Ieper, is ter hoo
berm beginnen branden door de droogte. Het vuur
razendsnel. De brandweer kon voorkomen dat de br
het Polygoonbos in de buurt.

# Als de Maas nog verder opdroogt, komt Vlaanderen in de problemen

**Het debiet van de Maas zakt naar een crisisniveau. Als het de komende weken niet veel gaat regenen, worden tekorten voor de industrie en de gezinnen onvermijdelijk.**

Ine Renson
Vrijdag 26 augustus 2022 om 3.25 uur



Het Albertkanaal, dat gevoed wordt door de Maas, is de levensader van de Vlaamse economie. © Sebastian Steveniers

Drought, Po (Italy)
Photograph: Cruciatti/AFP/Getty

Drought, Yangtze River Wuhan (China)
Photograph: AFP/Getty Images

Drought in the Horn of Africa, Somalia
Photograph: Feisal Omar/Reuters


Floods in the Sylhet district, Bangladesh
Photograph: Anadolu Agency/Getty

# Toestand van ons huidig klimaat

## IPCC AR6

> Klimaatverandering vindt hier en nu plaats.

“De klimaatverandering heeft nu al een impact op verschillende types van weerextremen in alle delen van de wereld.

# Climate change is already affecting every inhabited region across the globe with human influence contributing to many observed changes in weather and climate extremes

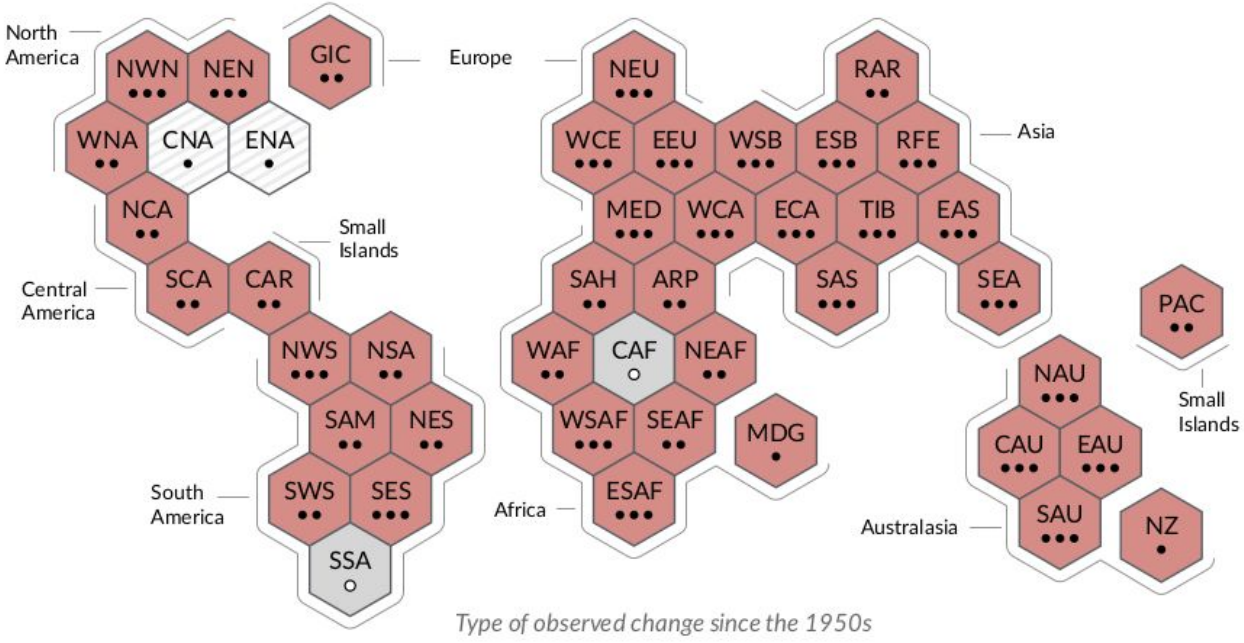
a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions

**Type of observed change**
in hot extremes

- Increase (41)
- Decrease (0)
- Low agreement in the type of change (2)
- Limited data and/or literature (2)

**Confidence in human contribution**
to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence



# Climate change is already affecting every inhabited region across the globe with human influence contributing to many observed changes in weather and climate extremes

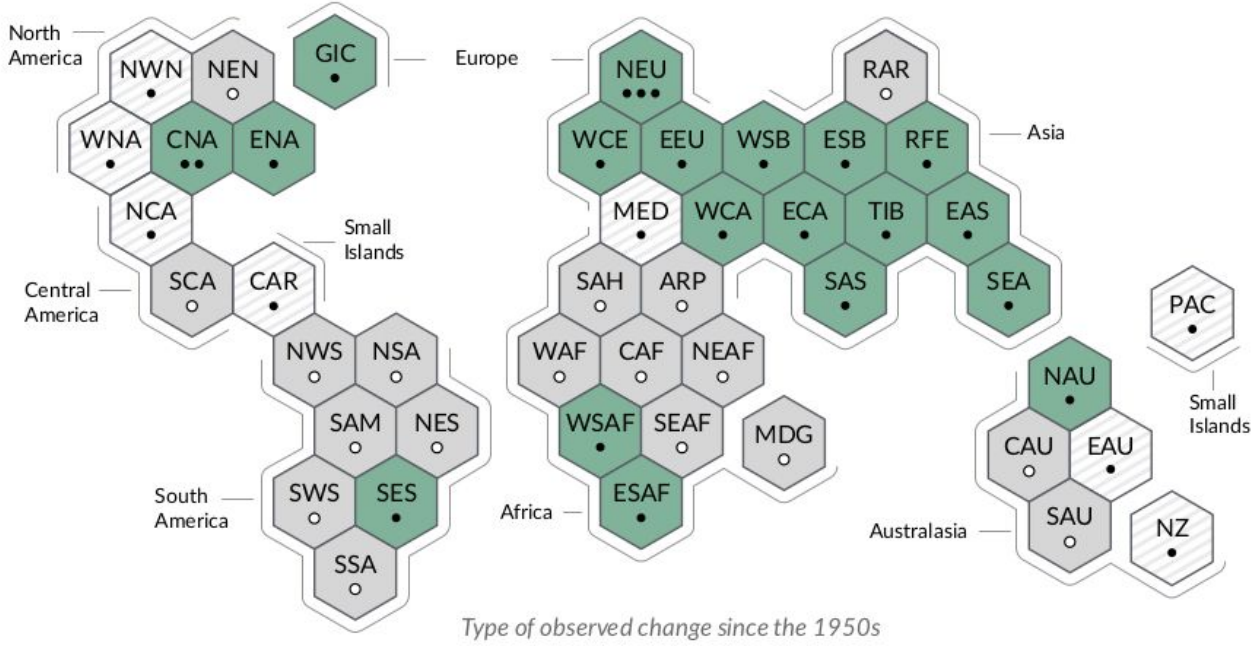
b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions

**Type of observed change**
in heavy precipitation

- Increase (19)
- Decrease (0)
- Low agreement in the type of change (8)
- Limited data and/or literature (18)

**Confidence in human contribution**
to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence




*Type of observed change since the 1950s*

# Toestand van ons toekomstig klimaat?

## IPCC AR6

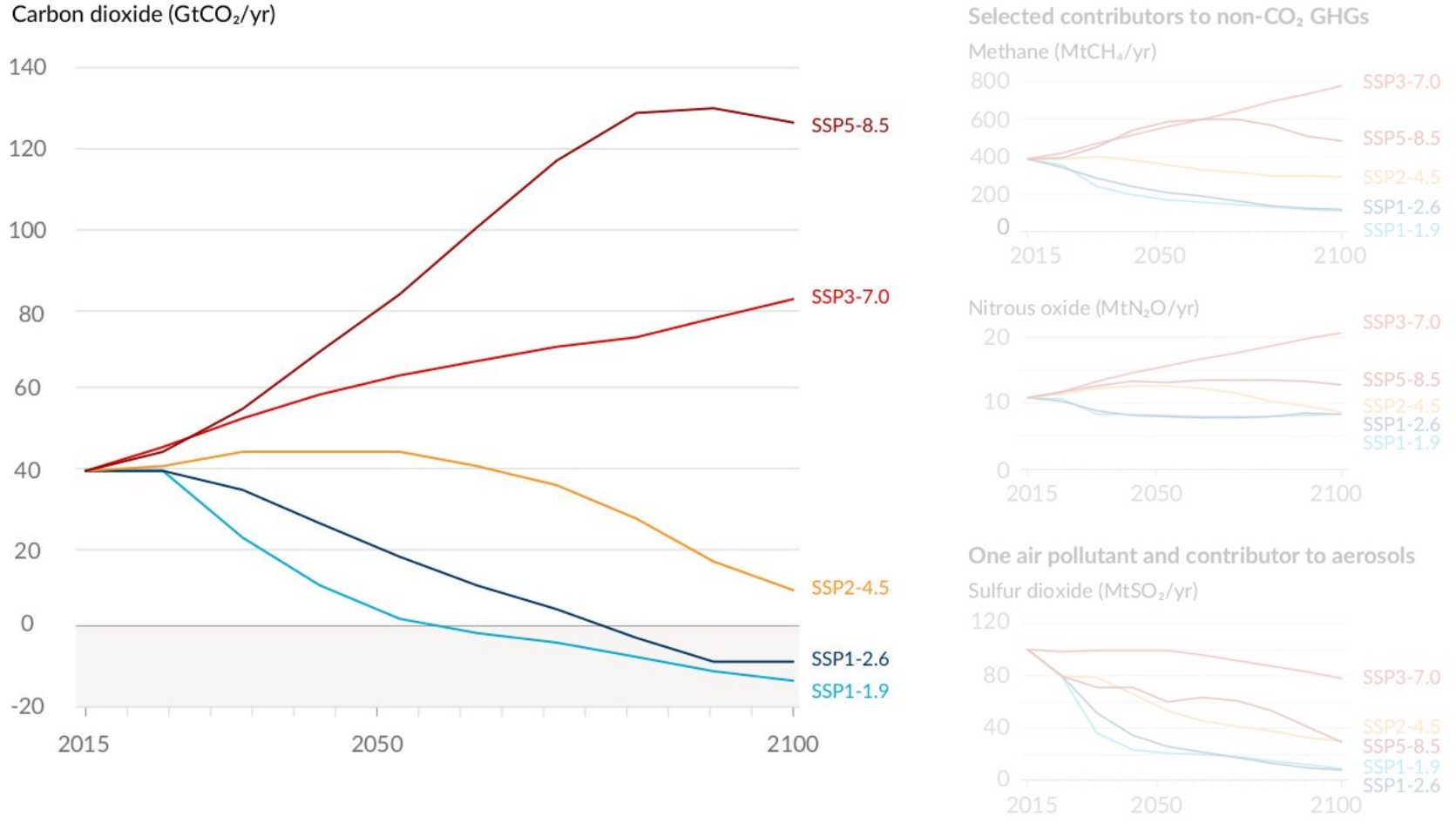
“De globale temperatuur zal minstens tot het midden van deze eeuw blijven stijgen volgens alle emissie-scenario’s.

“De opwarming van de aarde van 1,5 °C en 2 °C zal in de 21e eeuw worden overschreden, tenzij de uitstoot van $CO_2$ en andere broeikasgassen de komende decennia zeer sterk wordt verminderd.

| | Near term, 2021–2040 | | Mid-term, 2041–2060 | | Long term, 2081–2100 | |
|---|---|---|---|---|---|---|
| **Scenario** | Best estimate (°C) | *Very likely* range (°C) | Best estimate (°C) | *Very likely* range (°C) | Best estimate (°C) | *Very likely* range (°C) |
| **SSP1-1.9** | 1.5 | 1.2 to 1.7 | 1.6 | 1.2 to 2.0 | 1.4 | 1.0 to 1.8 |
| **SSP1-2.6** | 1.5 | 1.2 to 1.8 | 1.7 | 1.3 to 2.2 | 1.8 | 1.3 to 2.4 |
| **SSP2-4.5** | 1.5 | 1.2 to 1.8 | 2.0 | 1.6 to 2.5 | 2.7 | 2.1 to 3.5 |
| **SSP3-7.0** | 1.5 | 1.2 to 1.8 | 2.1 | 1.7 to 2.6 | 3.6 | 2.8 to 4.6 |
| **SSP5-8.5** | 1.6 | 1.3 to 1.9 | 2.4 | 1.9 to 3.0 | 4.4 | 3.3 to 5.7 |

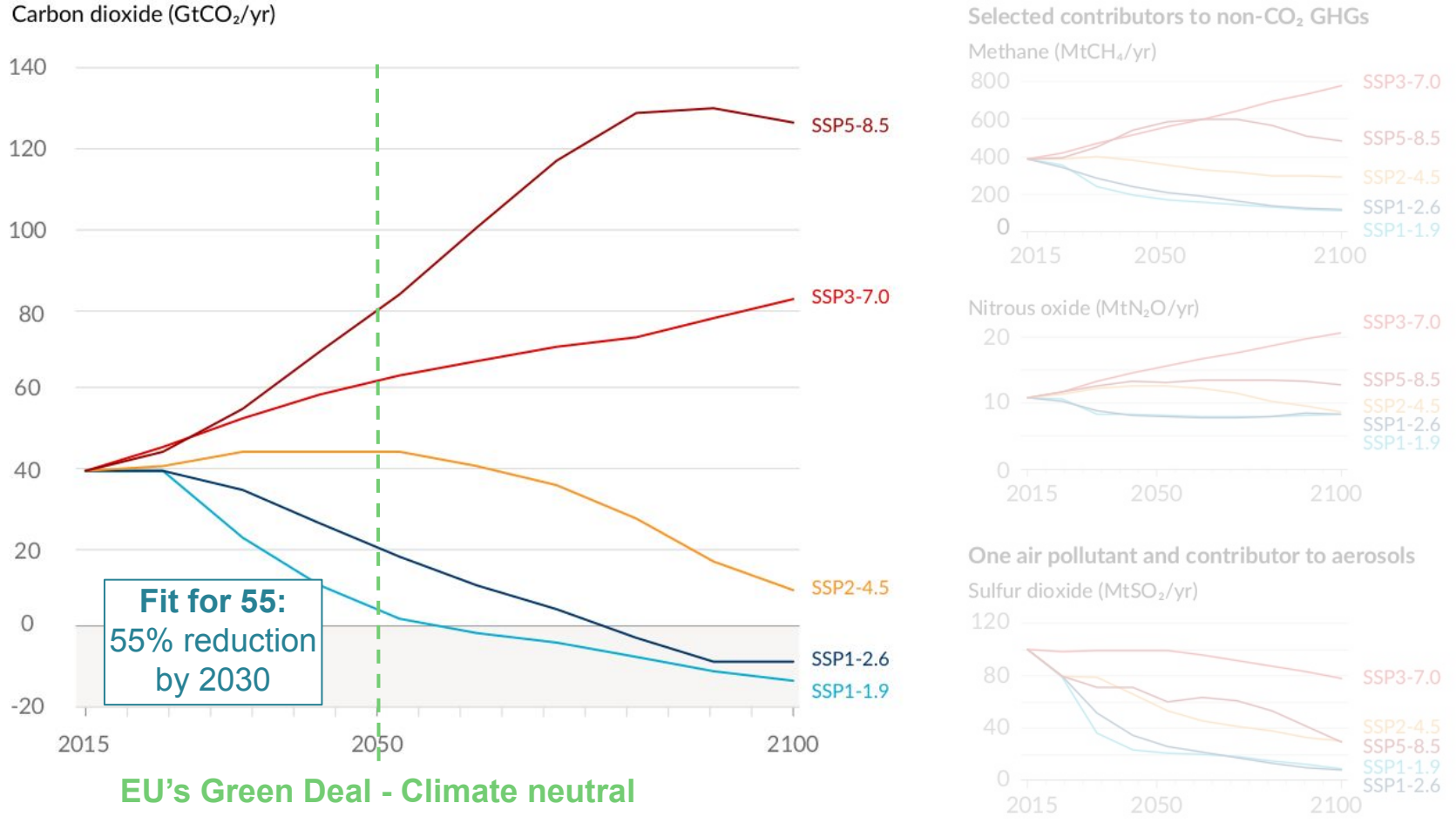
# Future emissions cause future additional warming, with total warming dominated by past and future $CO_2$ emissions

**a) Future annual emissions of $CO_2$ (left) and of a subset of key non-$CO_2$ drivers (right), across five illustrative scenarios**



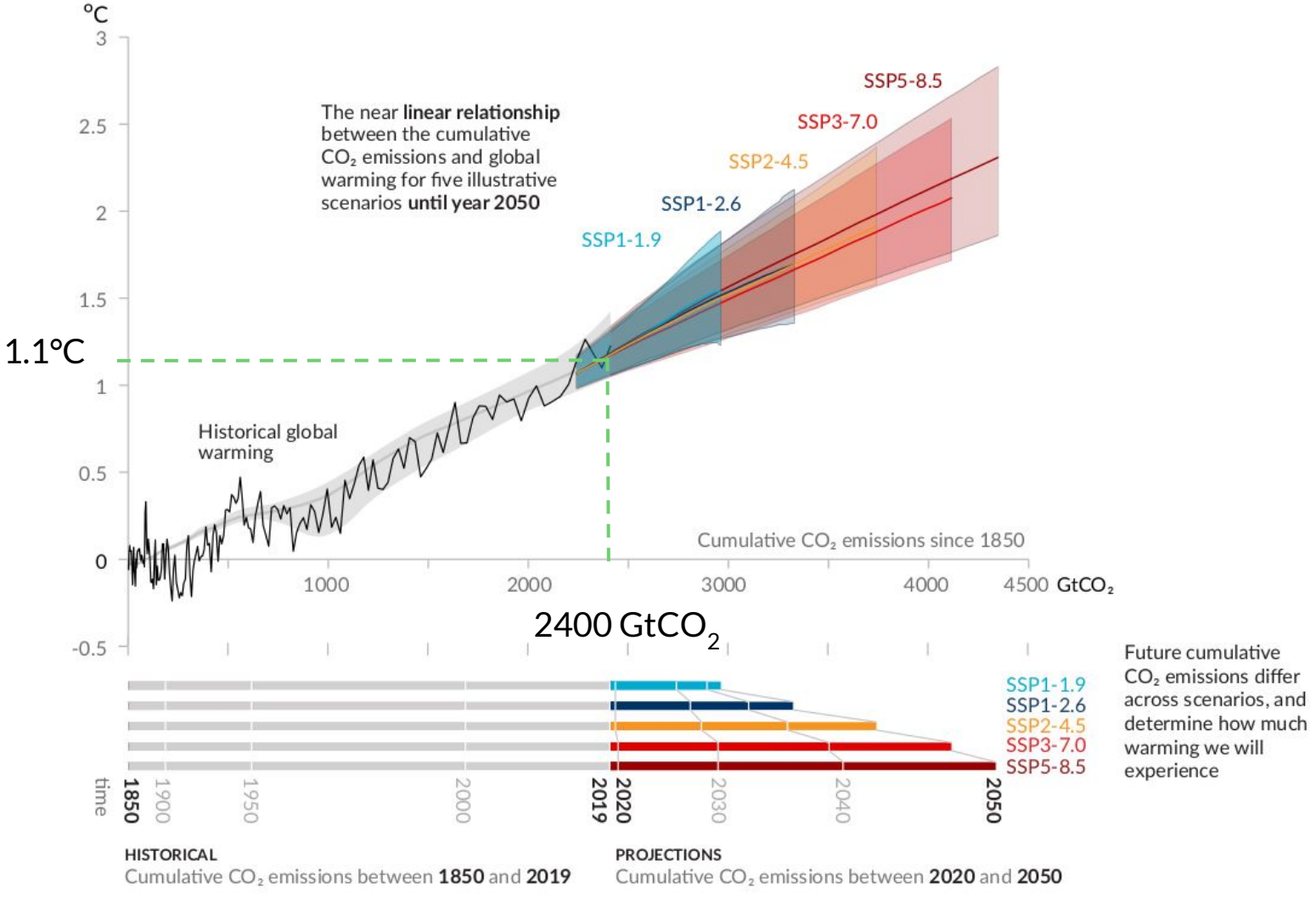
# Future emissions cause future additional warming, with total warming dominated by past and future $CO_2$ emissions

**a) Future annual emissions of $CO_2$ (left) and of a subset of key non-$CO_2$ drivers (right), across five illustrative scenarios**



# Every tonne of $CO_2$ emissions adds to global warming

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative $CO_2$ emissions ($GtCO_2$)

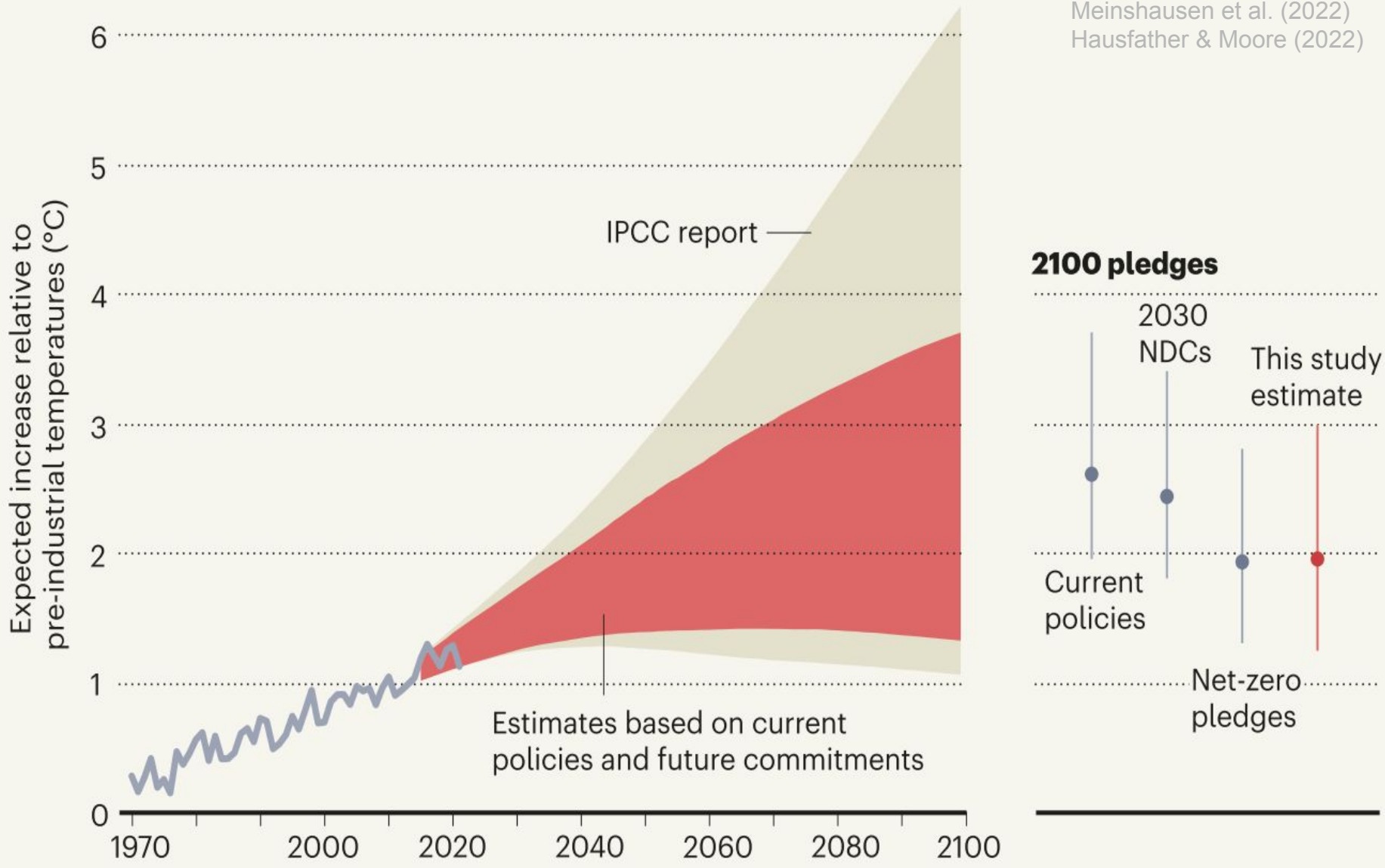


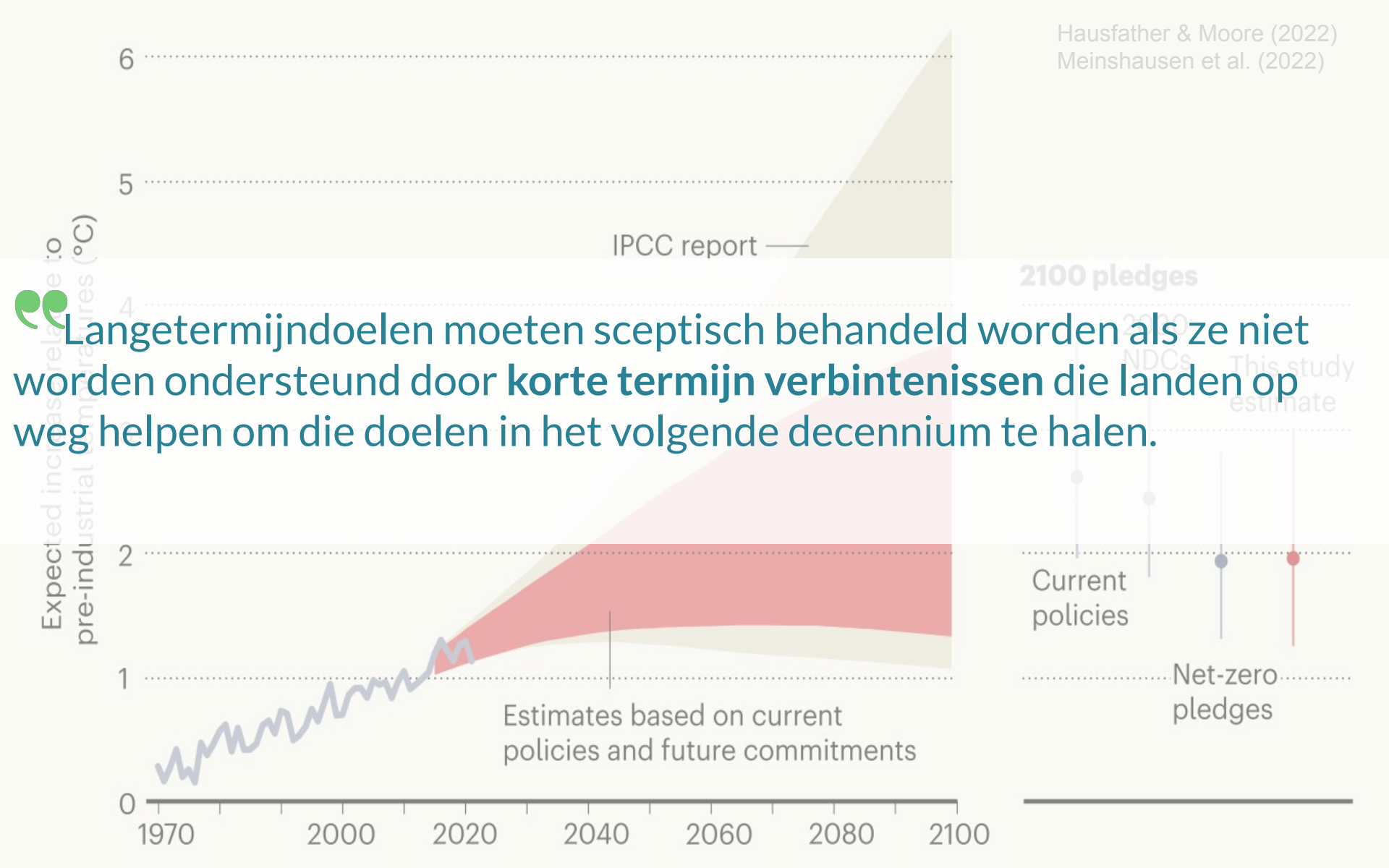

Future cumulative $CO_2$ emissions differ across scenarios, and determine how much warming we will experience

| Global warming between 1850–1900 and 2010–2019 *(°C)* | Historical cumulative $CO_2$ emissions from 1850 to 2019 *($GtCO_2$)* |
|---|---|
| 1.07 (0.8–1.3; *likely* range) | 2390 (± 240; *likely* range) |

| Approximate global warming relative to 1850–1900 until temperature limit *(°C)**(1) | Additional global warming relative to 2010–2019 until temperature limit *(°C)* | Estimated remaining carbon budgets from the beginning of 2020 *($GtCO_2$)* *Likelihood of limiting global warming to temperature limit*(2)* | | | | | Variations in reductions in non-$CO_2$ emissions*(3) |
|---|---|---|---|---|---|---|---|
| | | *17%* | *33%* | *50%* | *67%* | *83%* | |
| 1.5 | 0.43 | 900 | 650 | 500 | 400 | 300 | Higher or lower reductions in accompanying non-$CO_2$ emissions can increase or decrease the values on the left by 220 $GtCO_2$ or more |
| 1.7 | 0.63 | 1450 | 1050 | 850 | 700 | 550 | |
| 2.0 | 0.93 | 2300 | 1700 | 1350 | 1150 | 900 | |

Meinshausen et al. (2022)
Hausfather & Moore (2022)

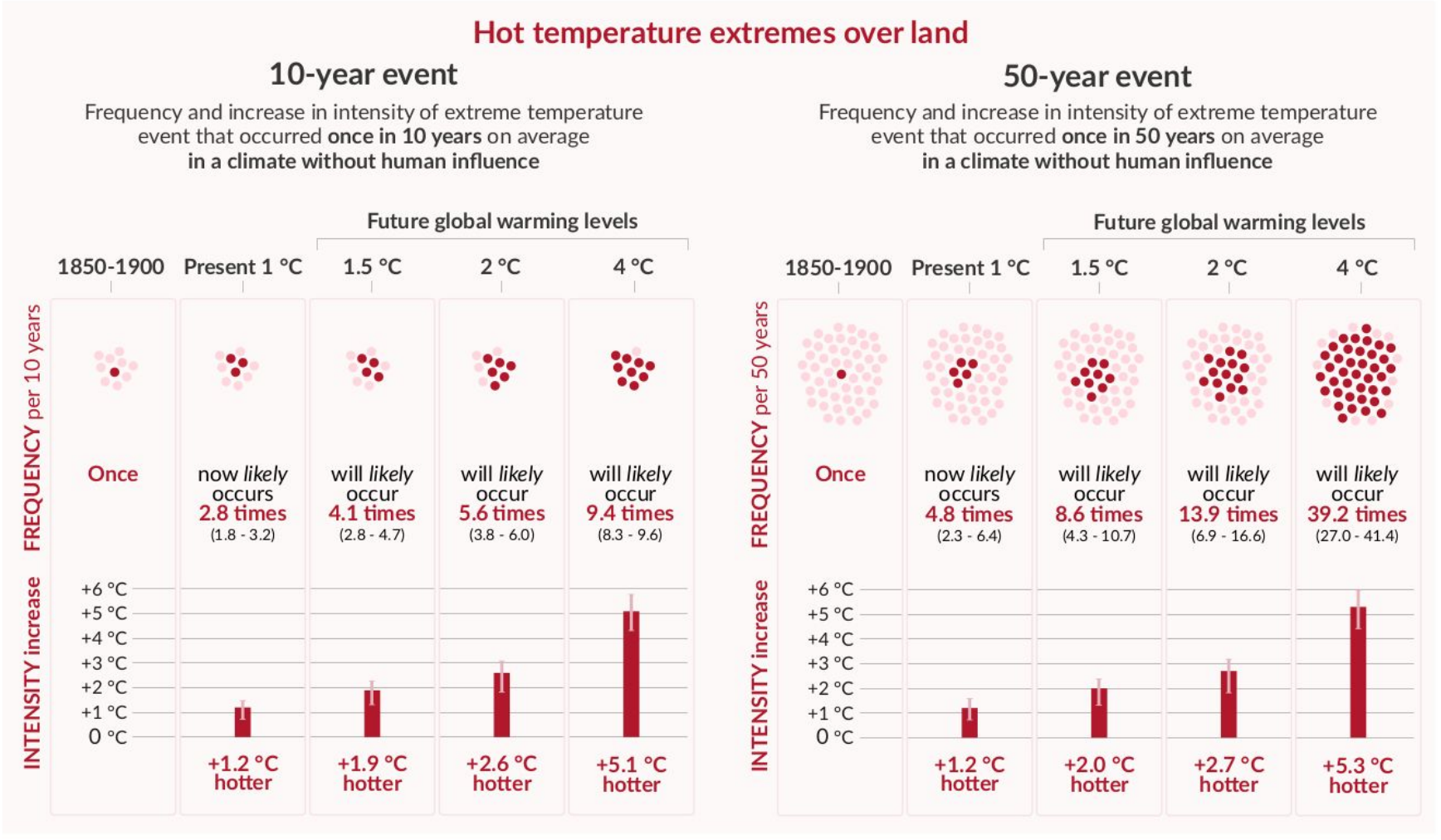




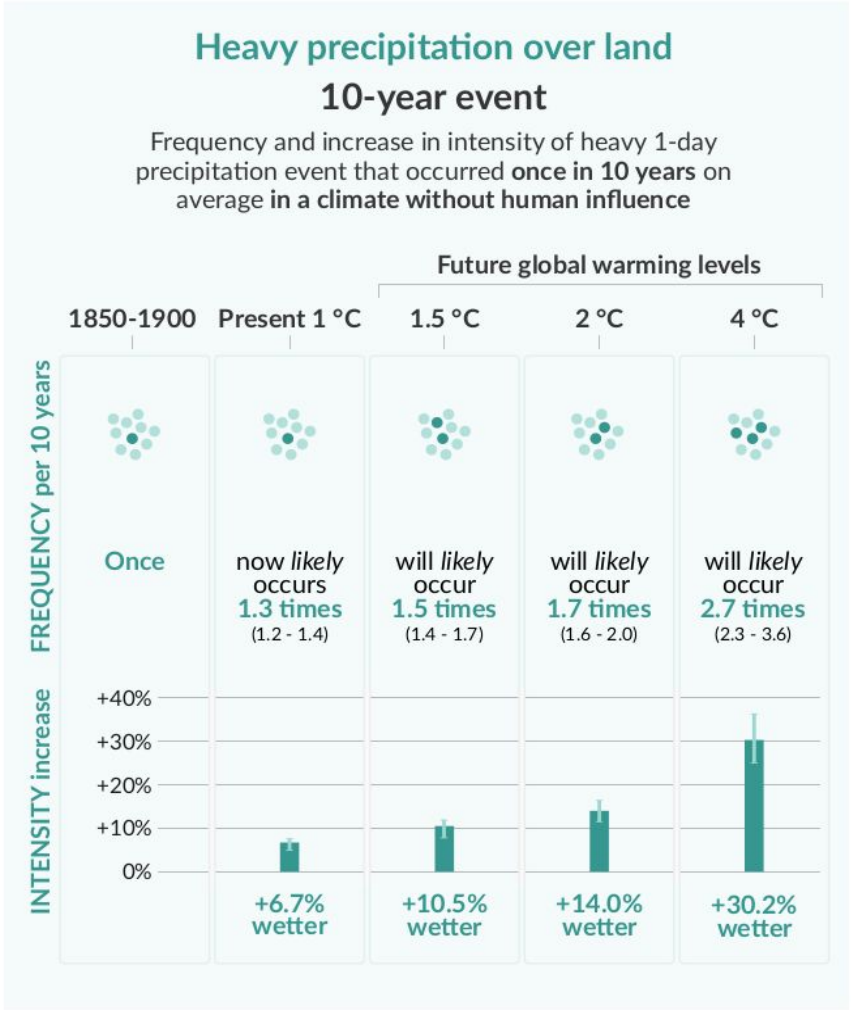

Langetermijndoelen moeten sceptisch behandeld worden als ze niet worden ondersteund door **korte termijn verbintenissen** die landen op weg helpen om die doelen in het volgende decennium te halen.

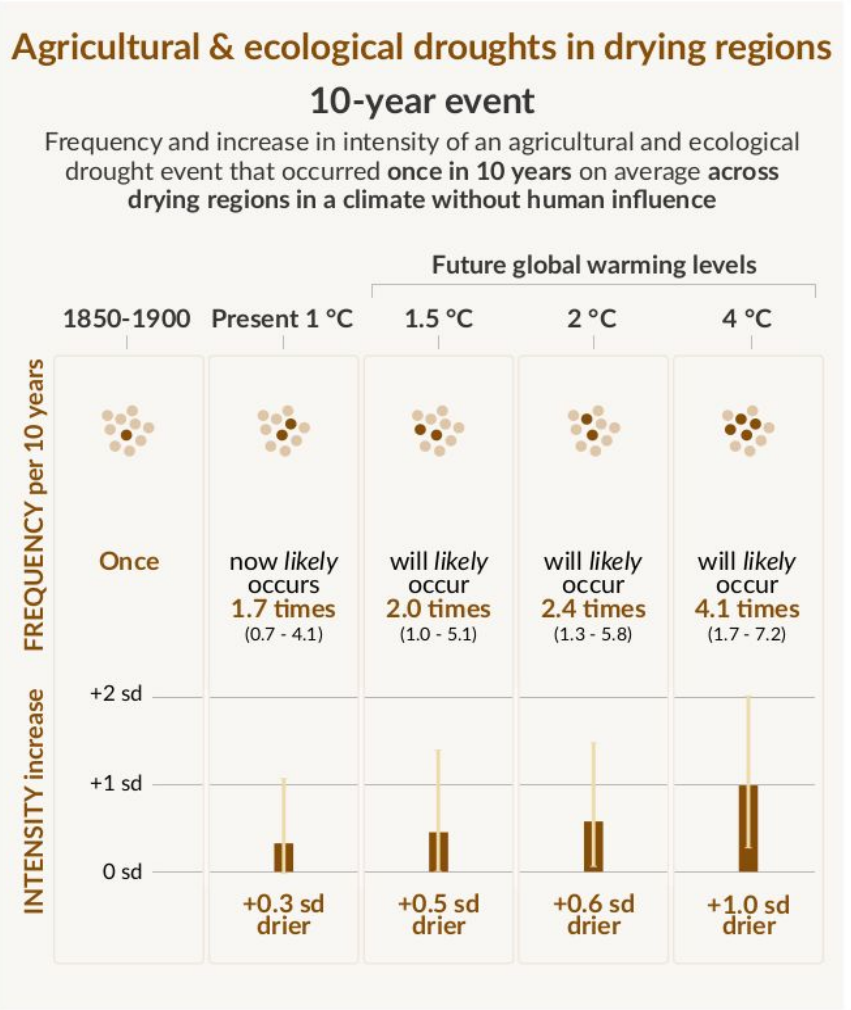
Bij elke extra toename in globale opwarming worden extremer **meer frequent** én **meer intens**.

# Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming



# Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming



# Staat van het klimaat

- Klimaatverandering vindt hier en nu plaats
- Waargenomen extremen bij +1.1°C zijn nu al extremer dan vroeger
- Extremen zullen nog extremer worden in de toekomst, zowel in frequentie als in intensiteit.
- Enkel via een snelle en zeer sterke daling van broeikasgassen kan de globale temperatuurstoename < 2°C blijven

# BUT CITIES ARE AS VULNERABLE AS THEY ARE POWERFUL.

70% of cities are already dealing with the effects of climate change, and nearly all are at risk. Over 90% of all urban areas are coastal, putting most cities on Earth at risk of flooding from rising sea levels and powerful storms.

Key Findings from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5)

**Cities account for 37–49% of global GHG emissions**

**Urban infrastructure accounts for over 70% of global energy use**

**Over 64% of the world population to live in cities by 2050, significantly increasing energy use for infrastructure**

# IMPACTS

## Climate change is expected to affect numerous aspects of urban life.

### Sea-Level Rise

Two-thirds of cities with populations above 5 million are located in the Low Elevation Coastal Zone. Rising sea levels and storm surge flooding could have widespread effects on populations, property, and ecosystems, presenting threats to commerce, business and livelihoods.


**ADAPTATIONS**

Responses include: **(A)** improving early warning systems, **(B)** strengthening coastal infrastructure, a significant degree of rezoning (including relocation of critical services), **(C)** and evacuation and crisis response management.

### Food Insecurity

All aspects of food security are potentially affected by climate change, including access to food, food utilisation and price stability. Climate change is likely to cause food production in some regions (including the ocean due to warming and acidification) to decline.


**ADAPTATIONS**

Local responses include support for urban and peri-urban agriculture, **(D)** green roofs, local markets and enhanced social (food) safety nets. **(E)** Develop alternative food sources, including inland aquaculture, to replace ocean-based resources under threat.

### Freshwater Availability

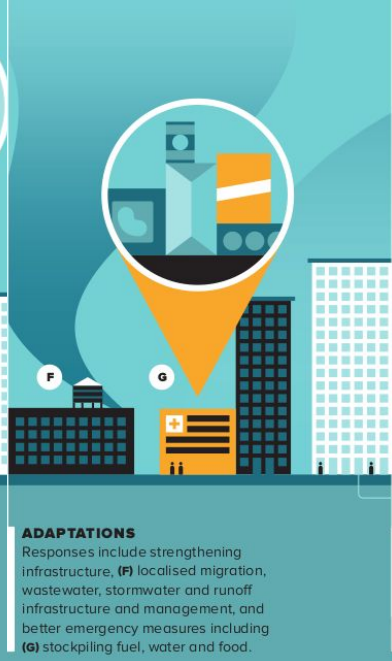
Risks to freshwater resources, such as drought, can cause shortages of drinking water, electricity outages, water-related diseases (through use of contaminated water), higher food prices and increased food insecurity from reduced agricultural supplies.


**ADAPTATIONS**

Options include **(J)** encouraging water recycling and grey water use, improving runoff management and developing new/alternative water sources, **(K)** storage facilities and autonomously powered water management and treatment infrastructure.

### Extreme Weather Events

Changes in extreme rainfall could cause the amount of sewage released to the environment from combined sewage overflow spills and flooding to increase by 40% in some cities. Inland flooding is often made worse by uncontrolled city development.




**ADAPTATIONS**

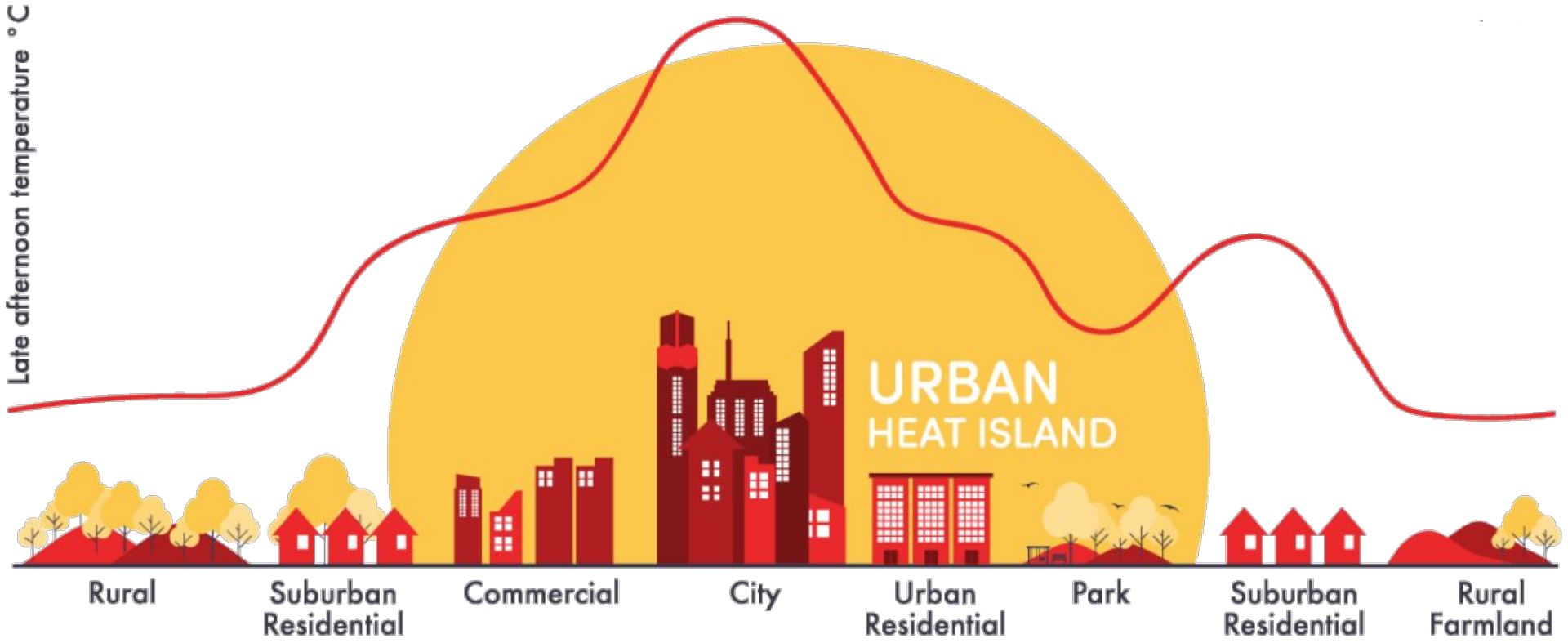
Responses include strengthening infrastructure, **(F)** localised migration, wastewater, stormwater and runoff infrastructure and management, and better emergency measures including **(G)** stockpiling fuel, water and food.

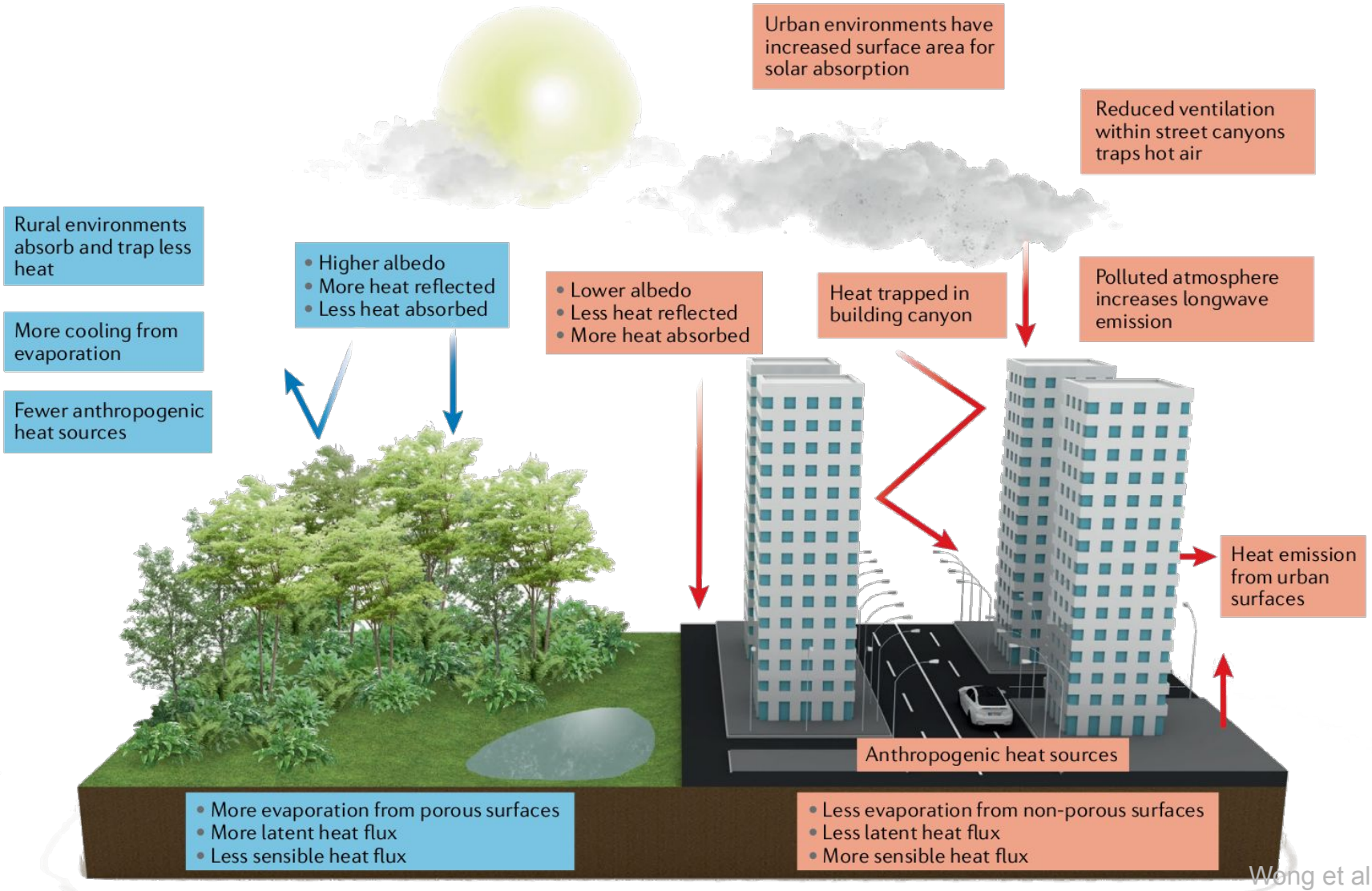
### Increased Temperatures

The mean temperature rise in some cities could be over 4°C by 2100, with peak seasonal temperatures even higher. More hot days will exacerbate urban heat island effects, resulting in more heat-related health problems and, possibly, air pollution.

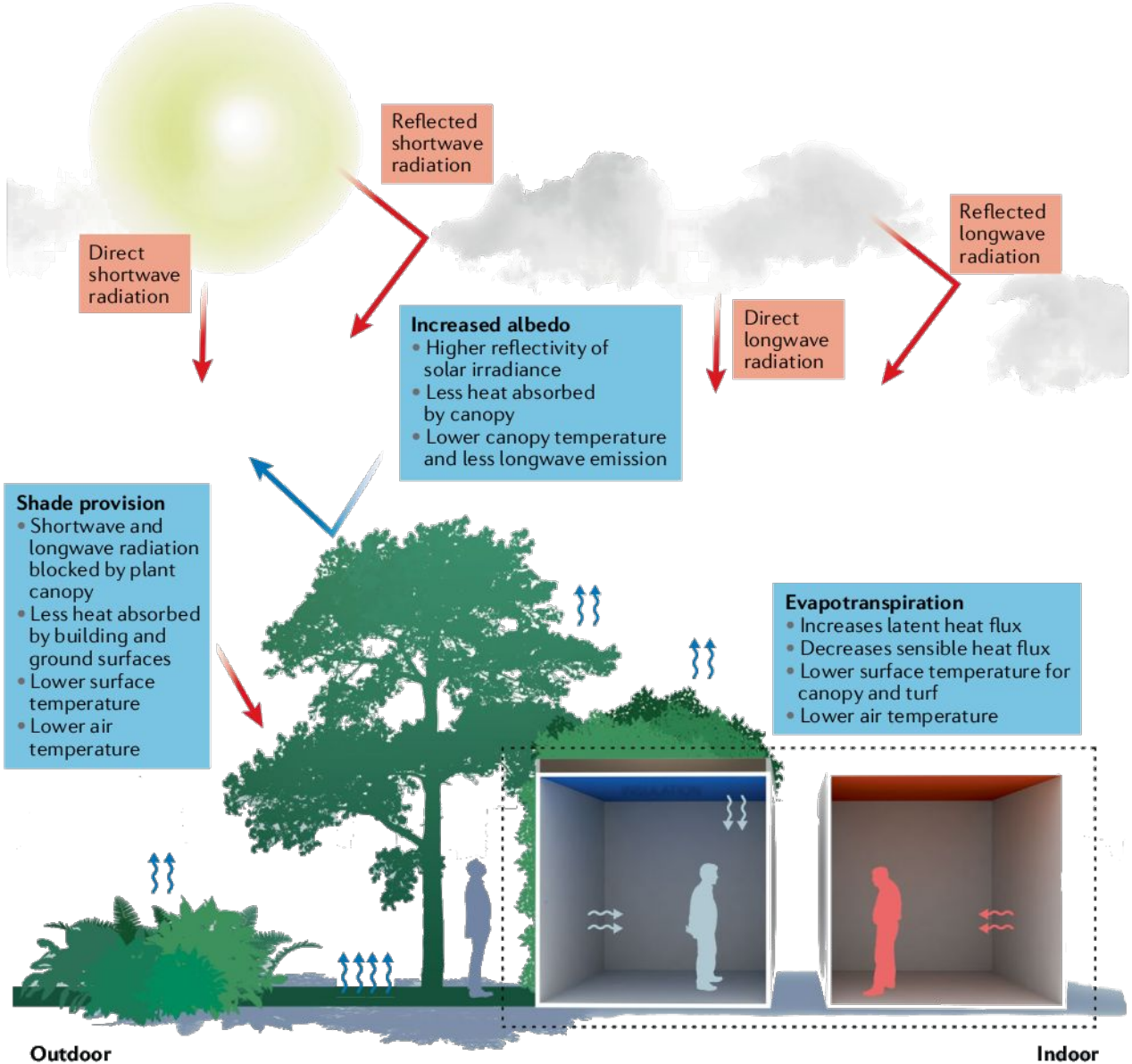

**ADAPTATIONS**

Development of urban planning heat management strategies, **(H)** including green zones, wind corridors, green roofs and water features. **(I)** Building codes will need to be improved, and the infrastructure used by vulnerable parts of the population will need to be made more resilient.





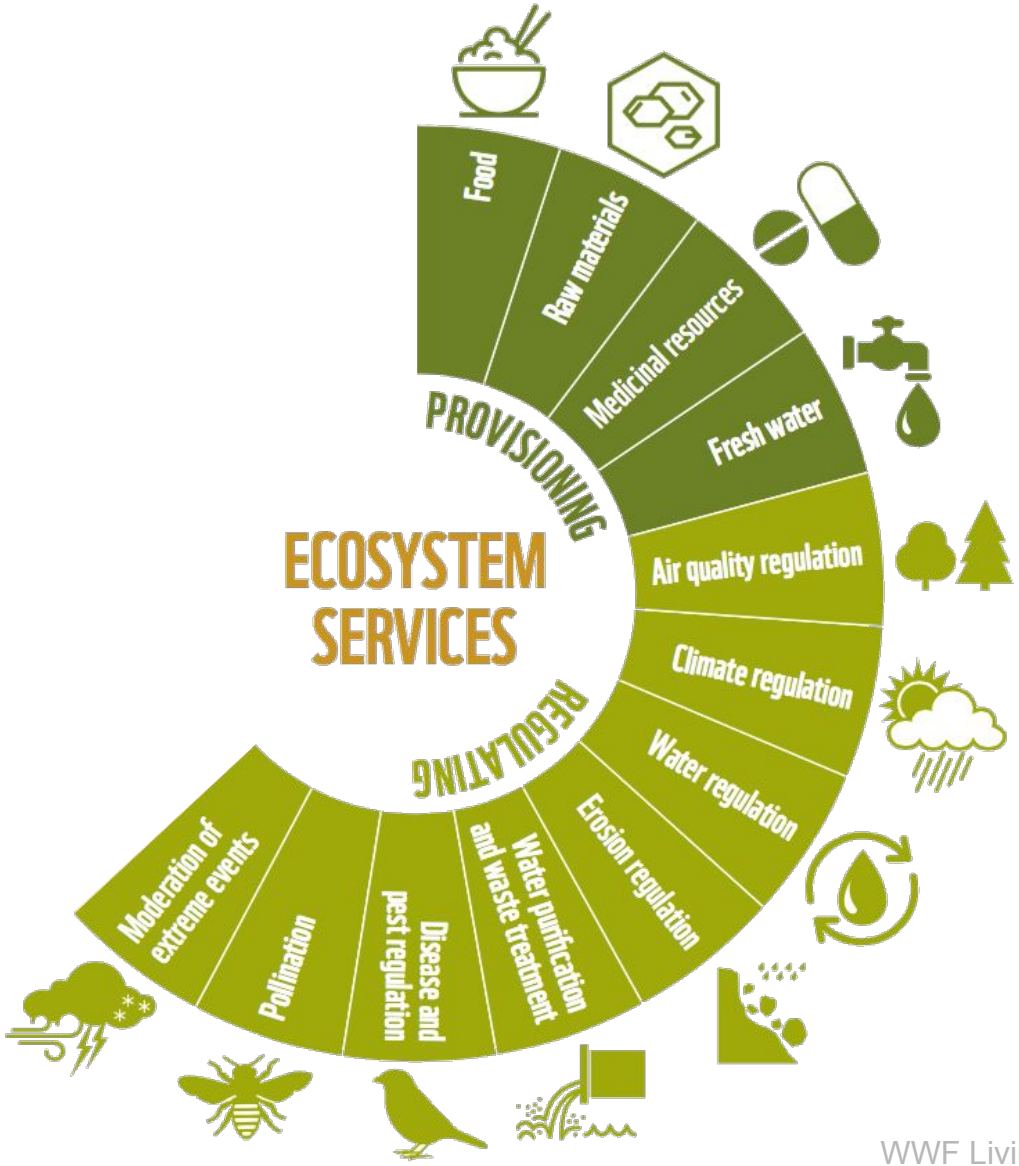

Wong et al. (2021)




Wong et al. (2021)

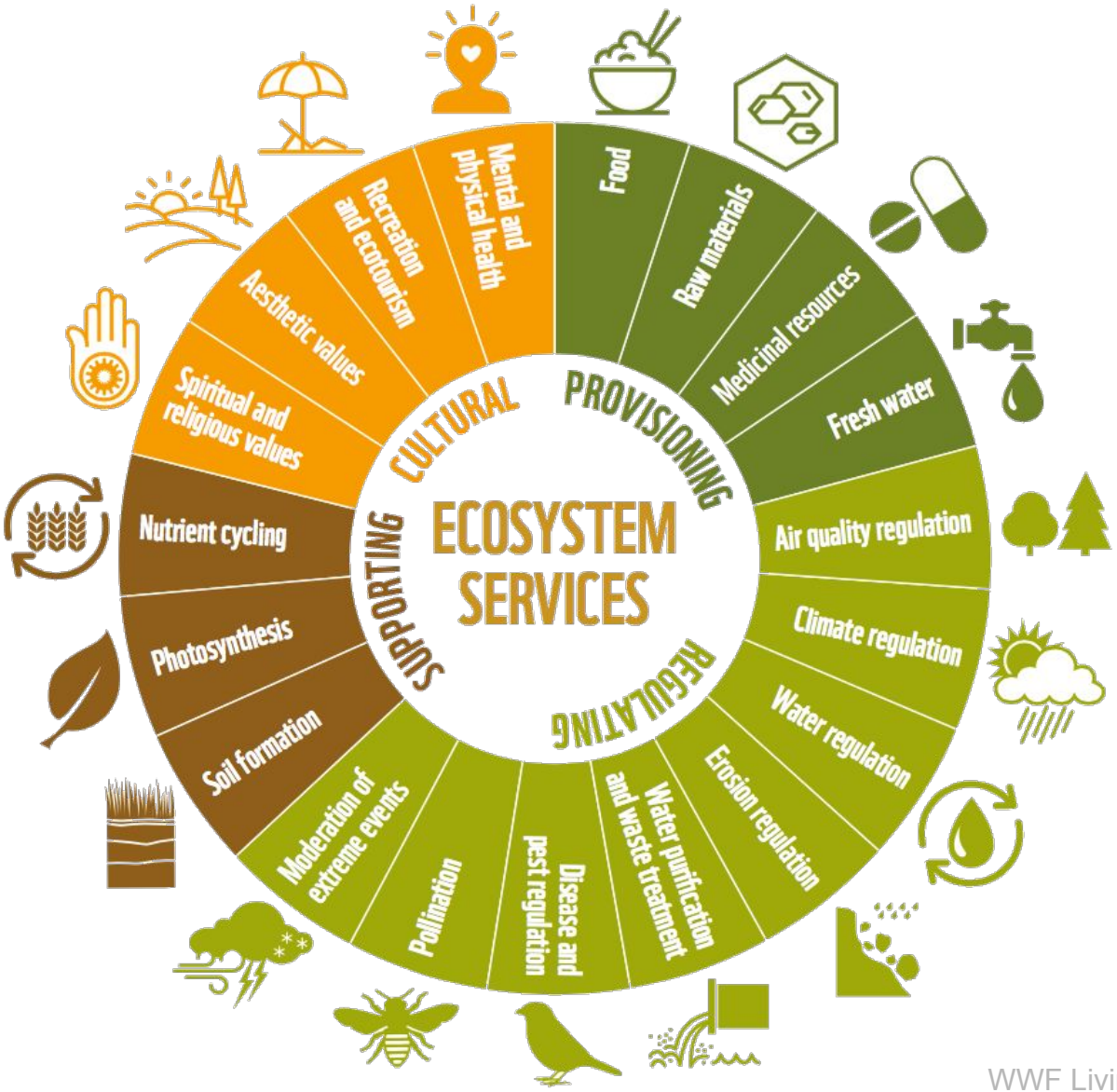
# ECOSYSTEM SERVICES


WWF Living Planet Report (2016)




WWF Living Planet Report (2016)


WWF Living Planet Report (2016)




WWF Living Planet Report (2016)

# Esthetisch

# Recreatie

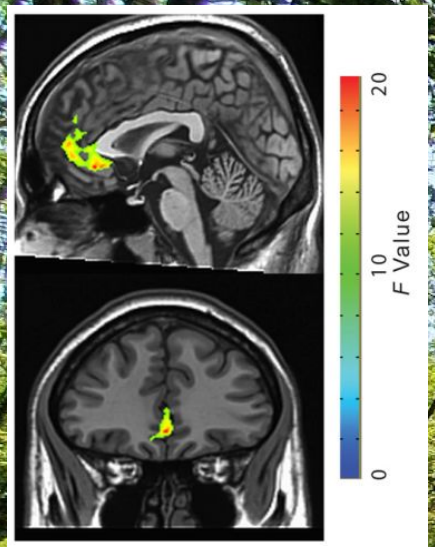
# Fys. gezondheid

2022-08-14


2022-08-24

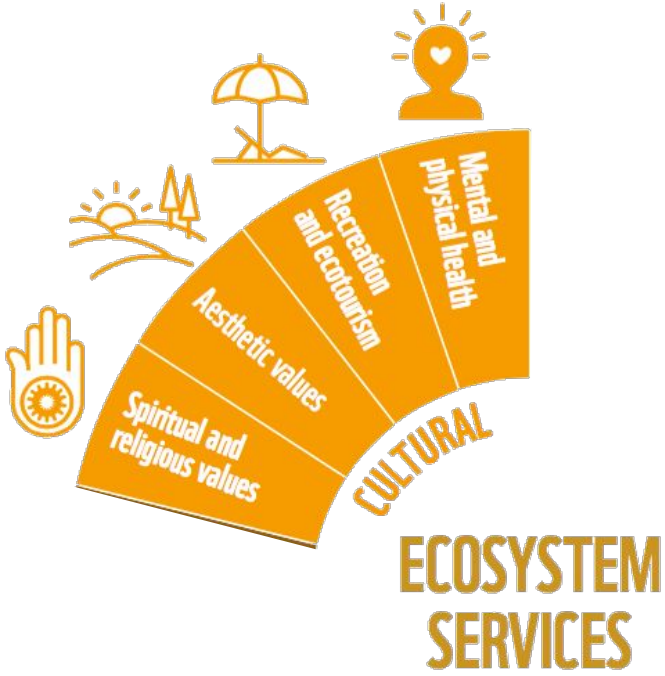
# Ment. gezondheid

# Ment. gezondheid

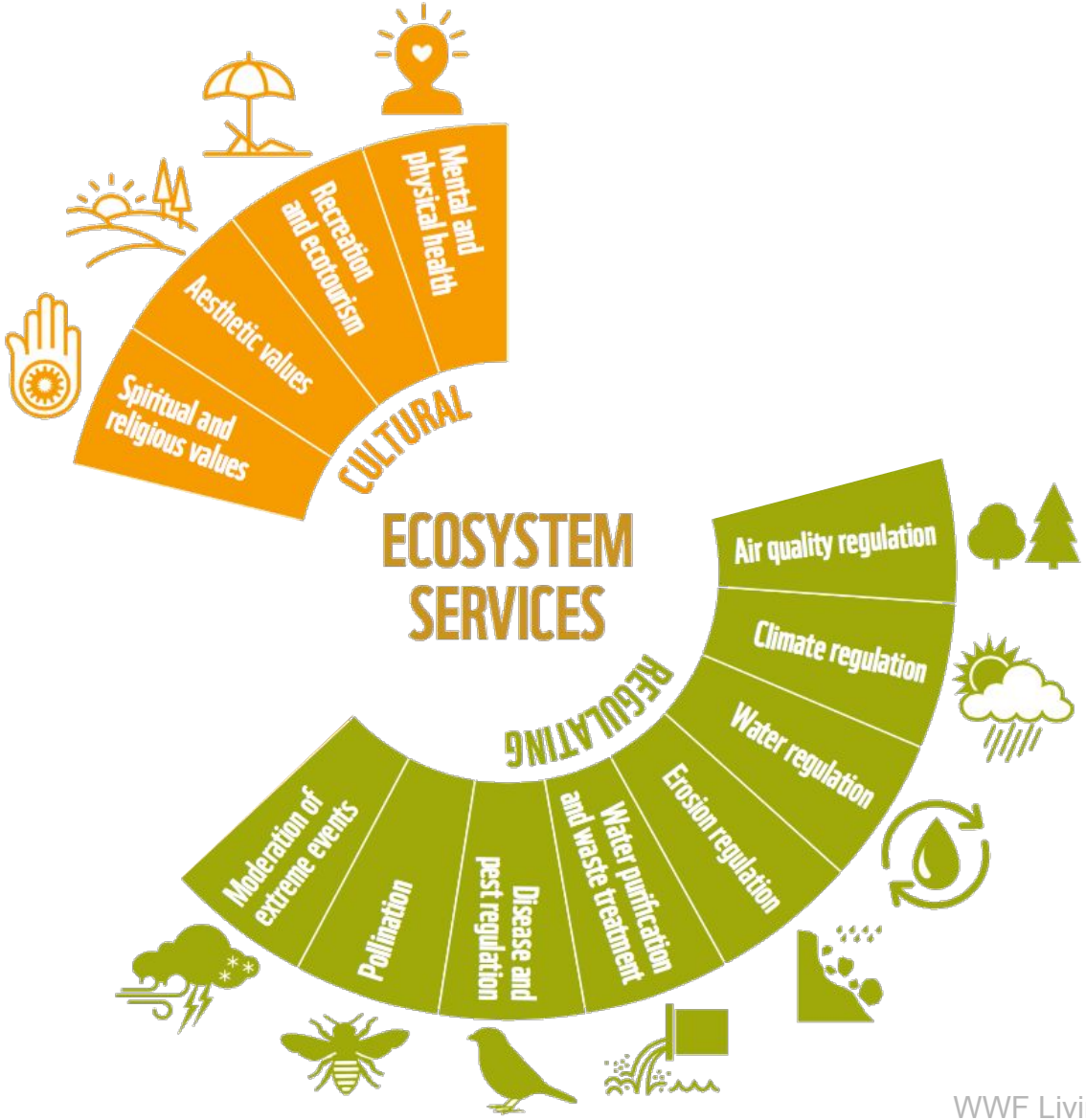



Bratman et al. (2015)

# Community life




WWF Living Planet Report (2016)




WWF Living Planet Report (2016)

# Luchtkwaliteit

BVOCs

Pollen

Dispersion

Gas Deposition

PM Deposition

AIR QUALITY

**Human Health**

e.g., asthma, COPD, cancer

***URBAN ECOSYSTEM FUNCTIONS***

primary expertise

NATURAL SCIENCE

***URBAN ECOSYSTEM SERVICES & DISSERVICES***

primary expertise

EPIDEMIOLOGY

KEY

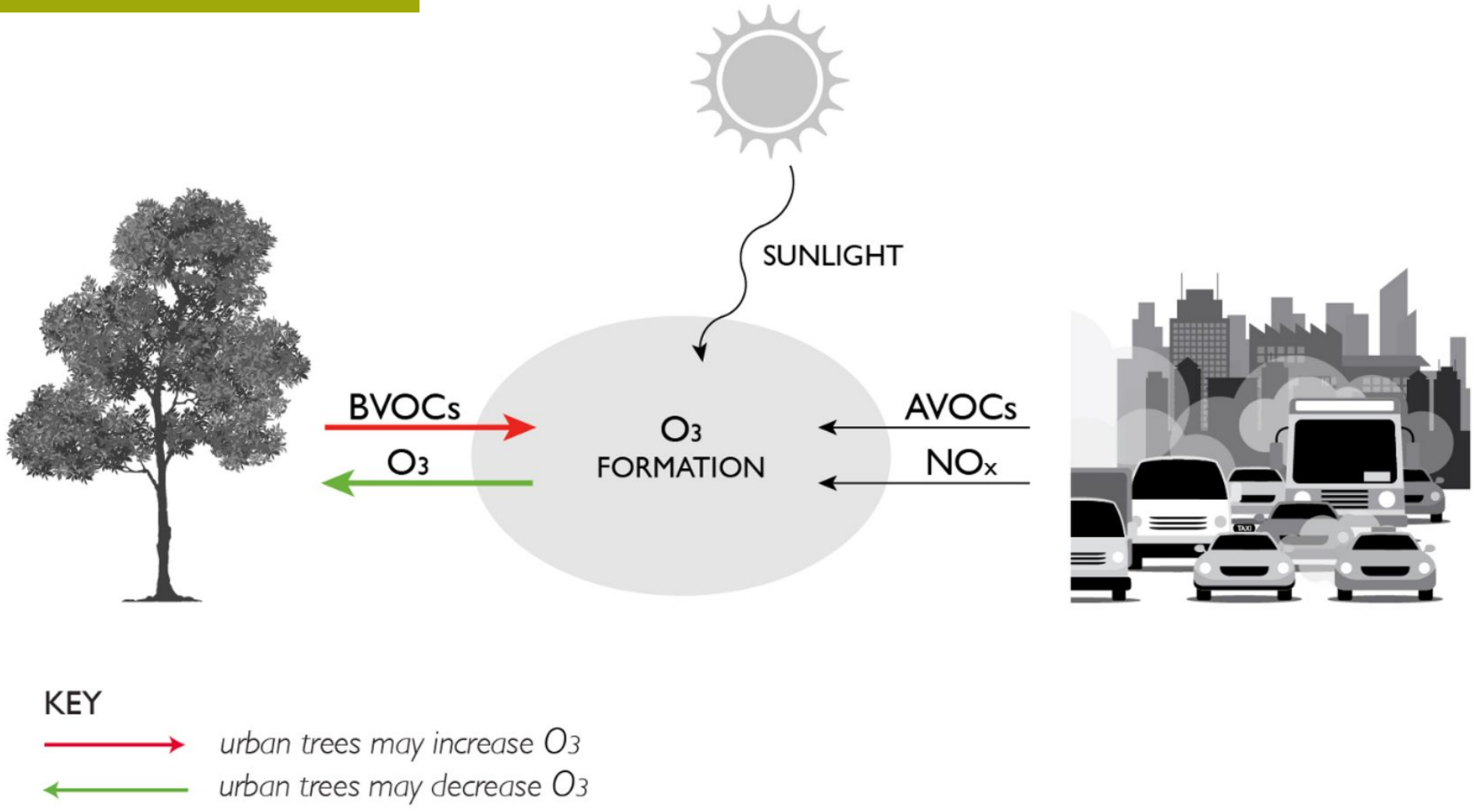
*urban trees may reduce AQ*

*urban trees may reduce or improve AQ*

*urban trees may improve AQ*

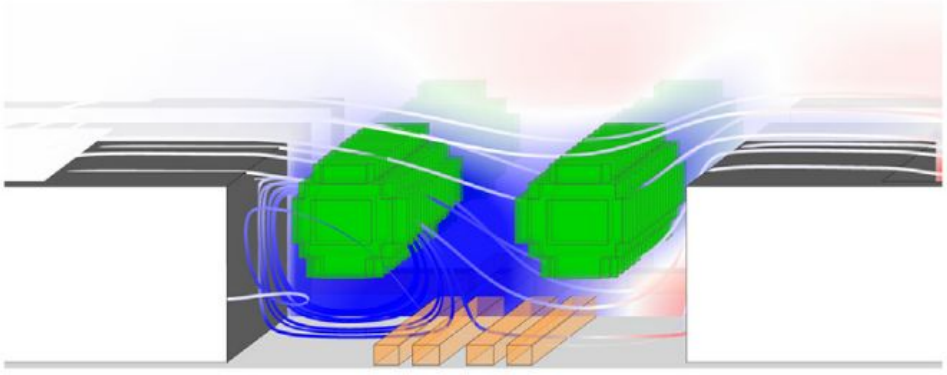
Eisenman et al. (2019)

# Luchtkwaliteit

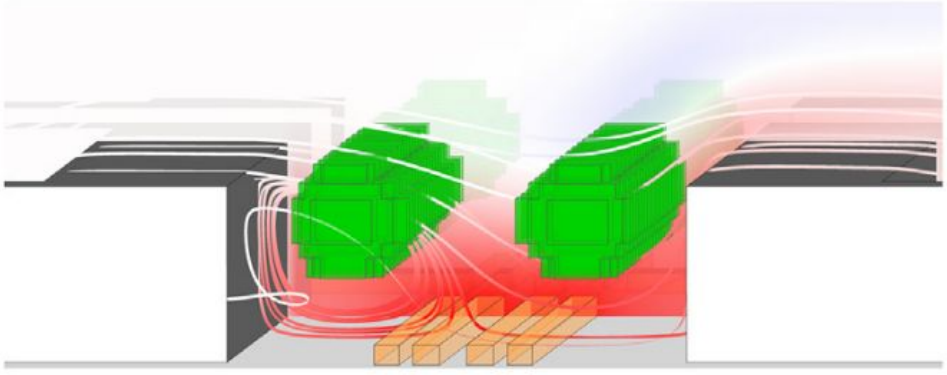



Eisenman et al. (2019)

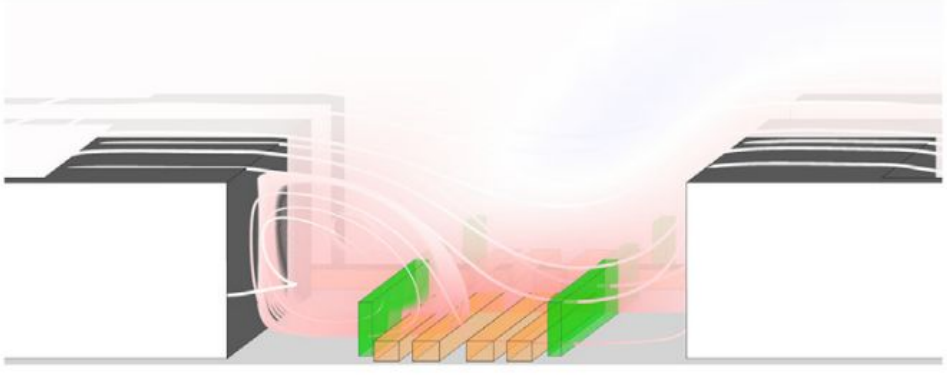
# Luchtkwaliteit



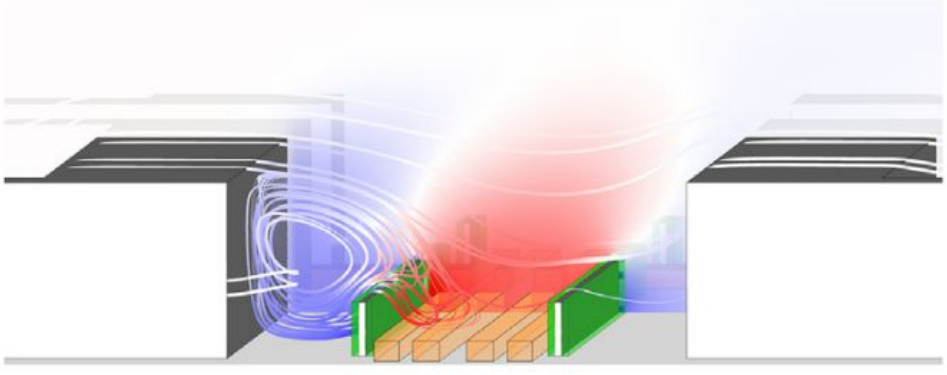
Relative difference in wind speed



Relative difference in EC concentration:



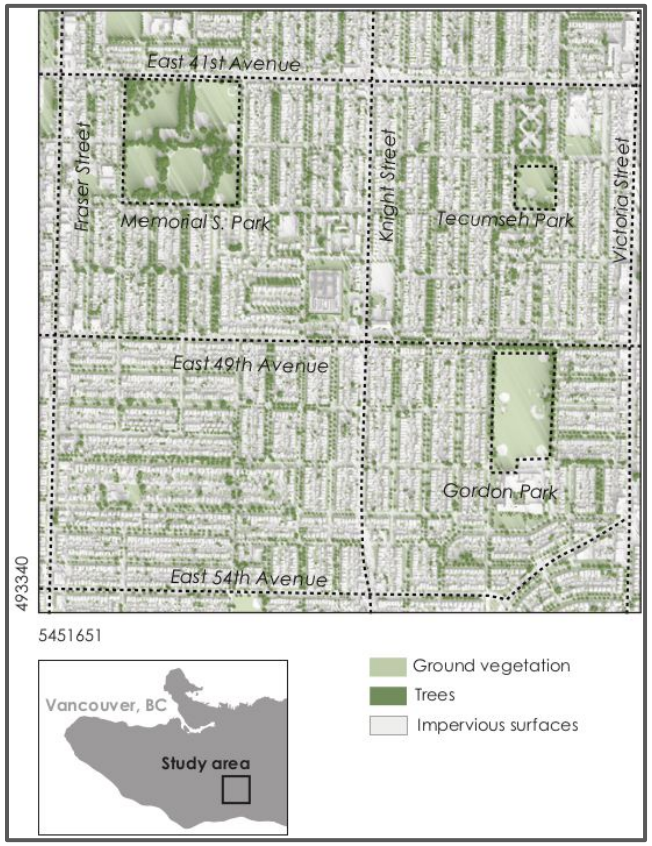
Relative difference in EC concentration:

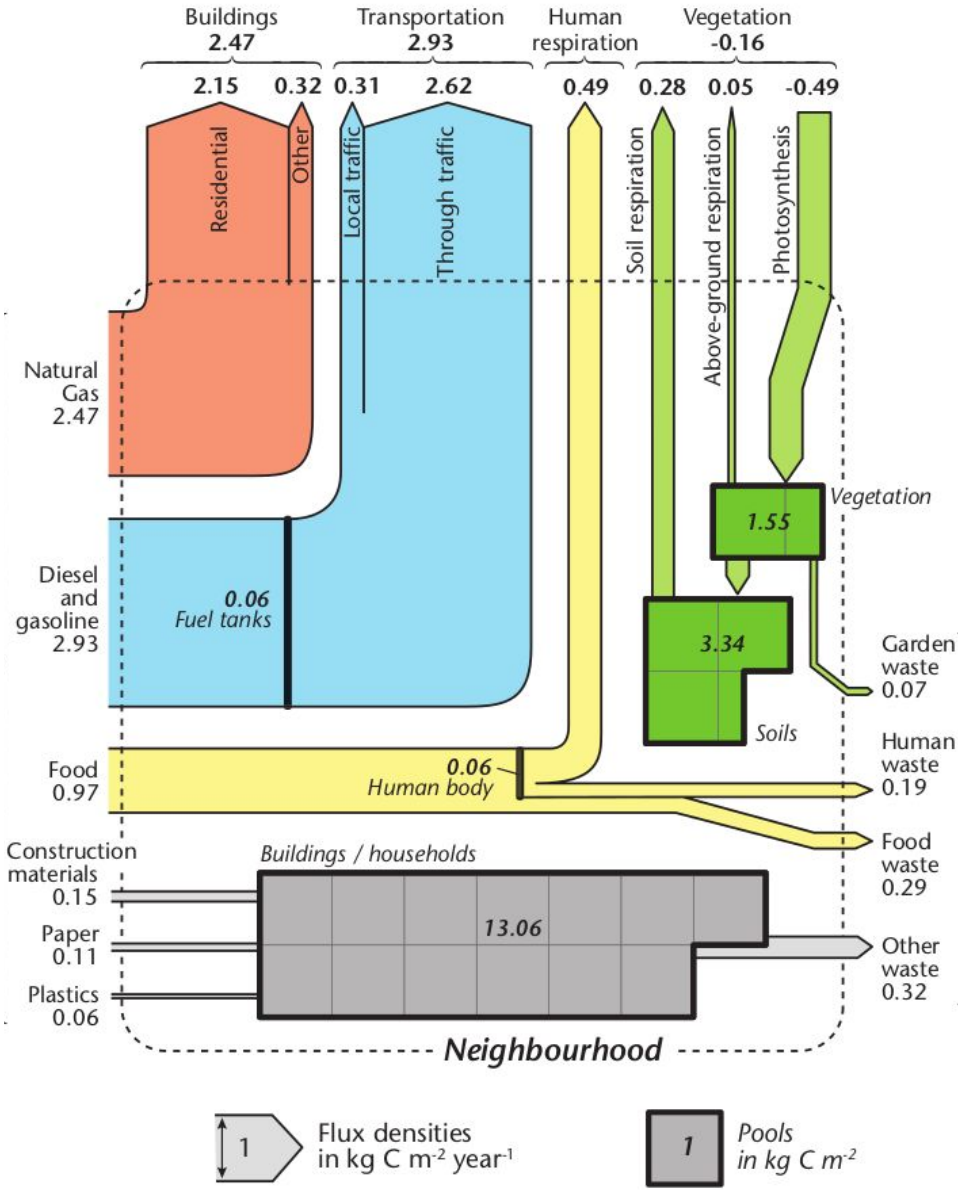


Relative difference in EC concentration:


Vos et al. (2013)

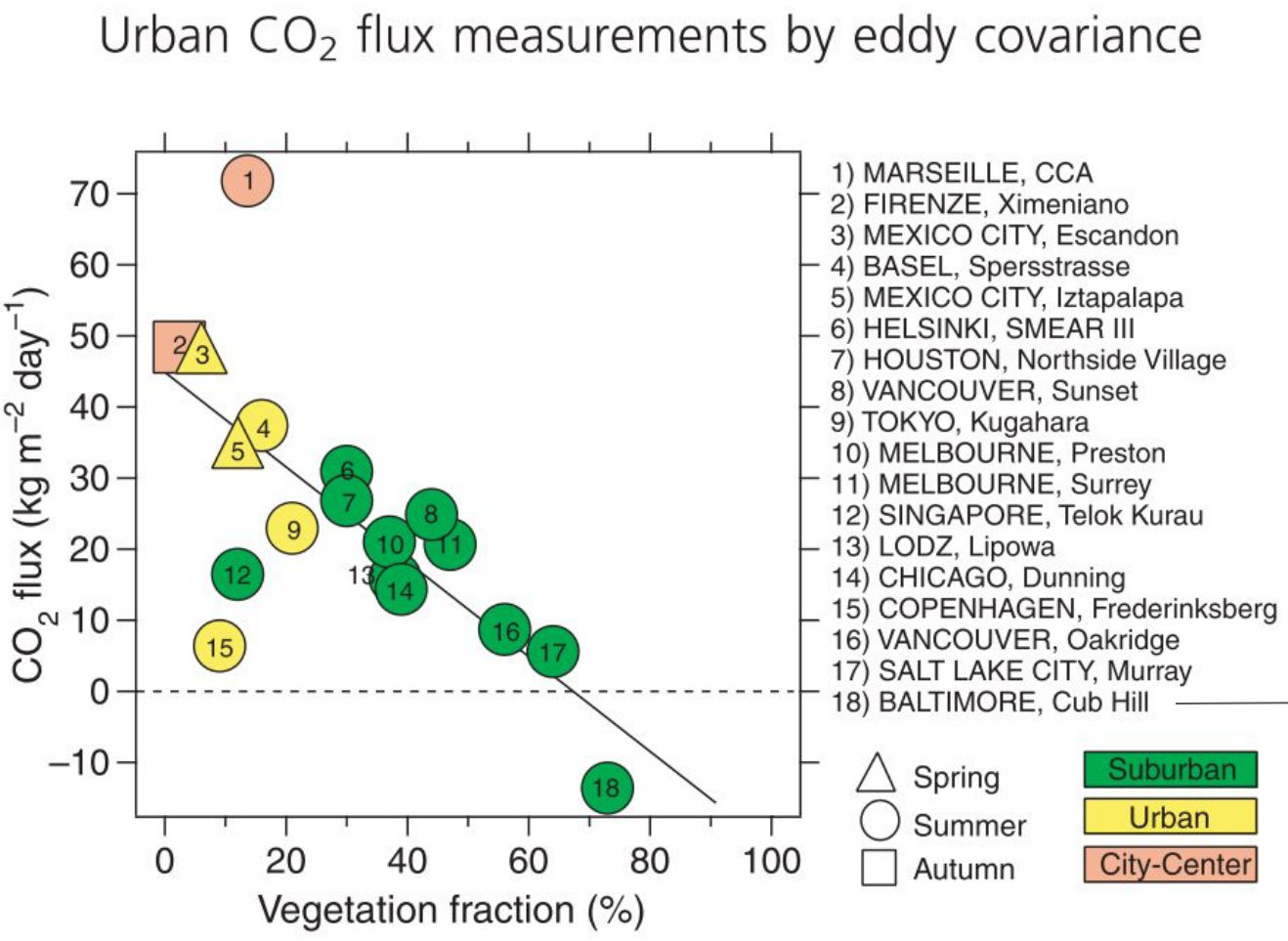
# $CO_2$ sequestration




Kellet et al. (2013)

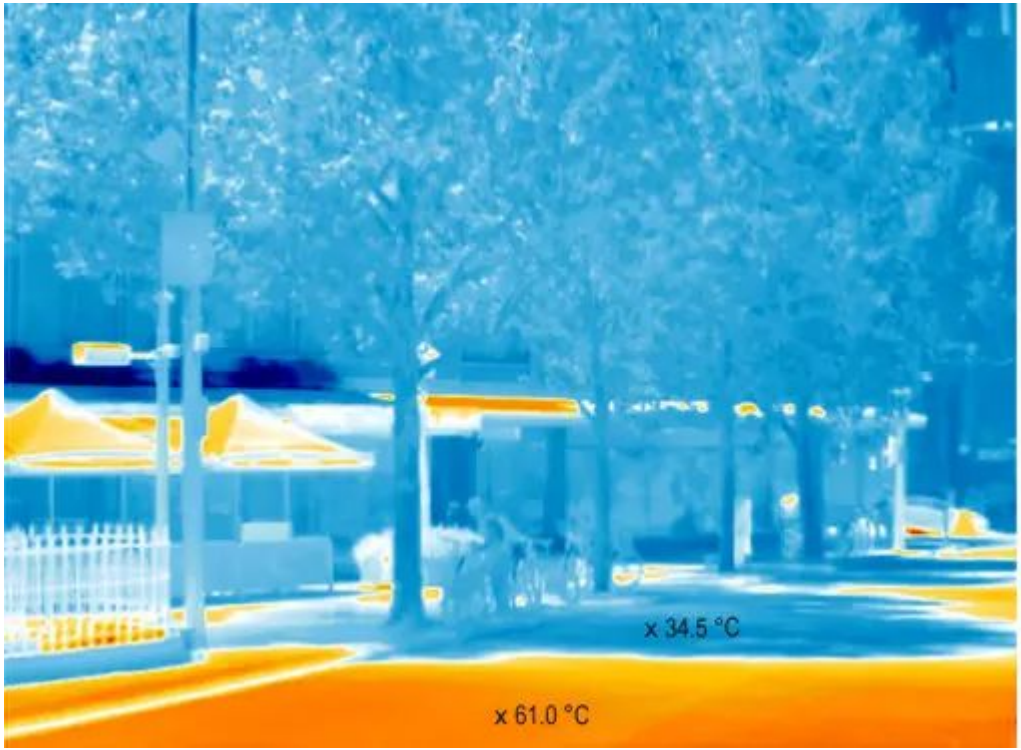
# $CO_2$ sequestration

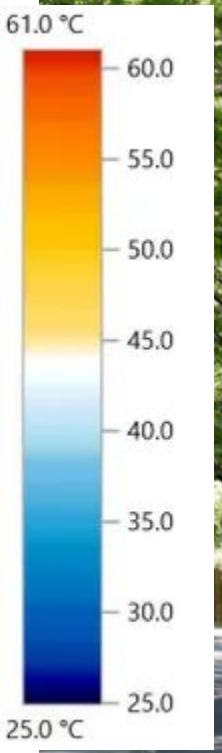




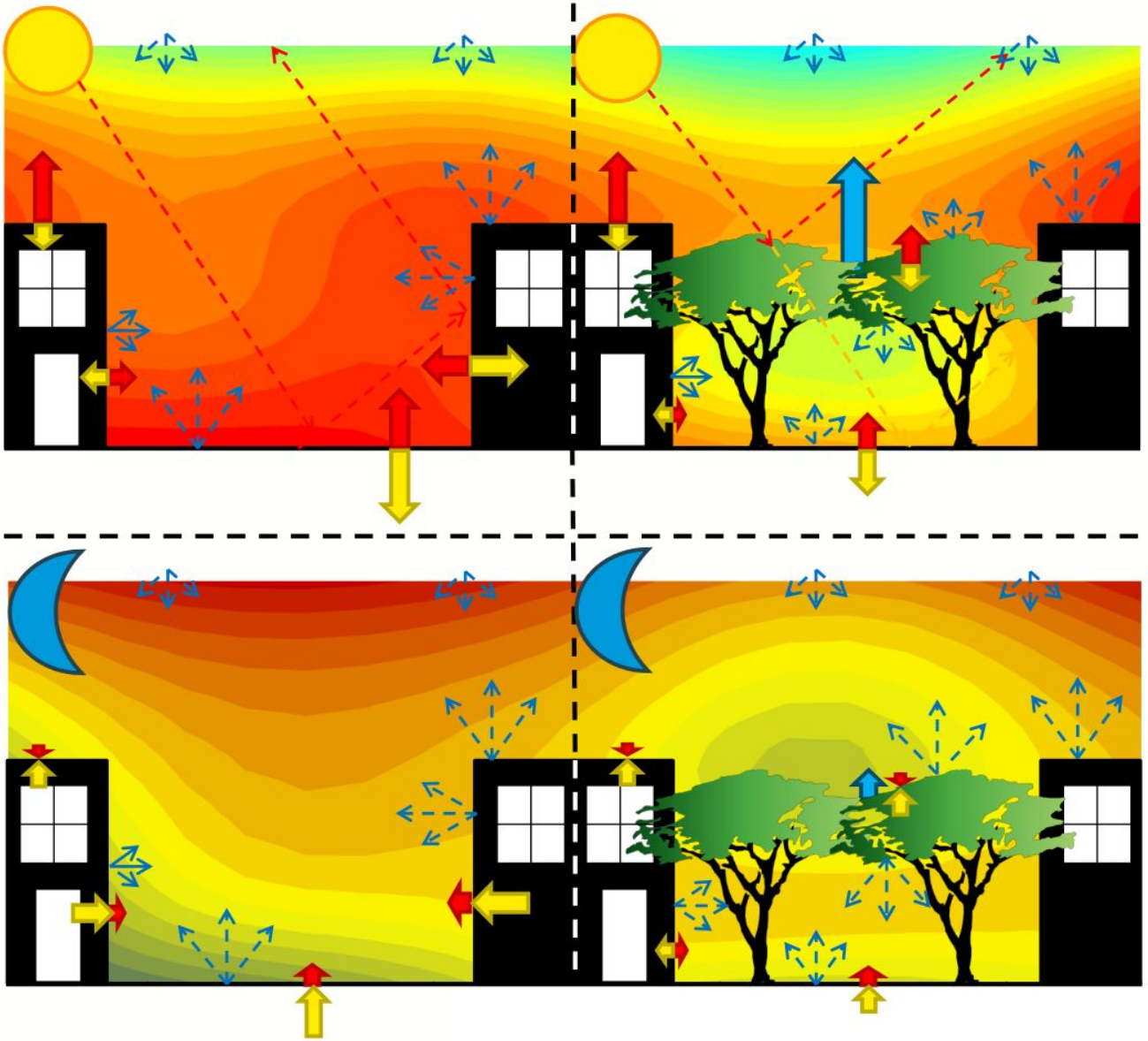
Velasco & Roth (2010)

# Temperatuur



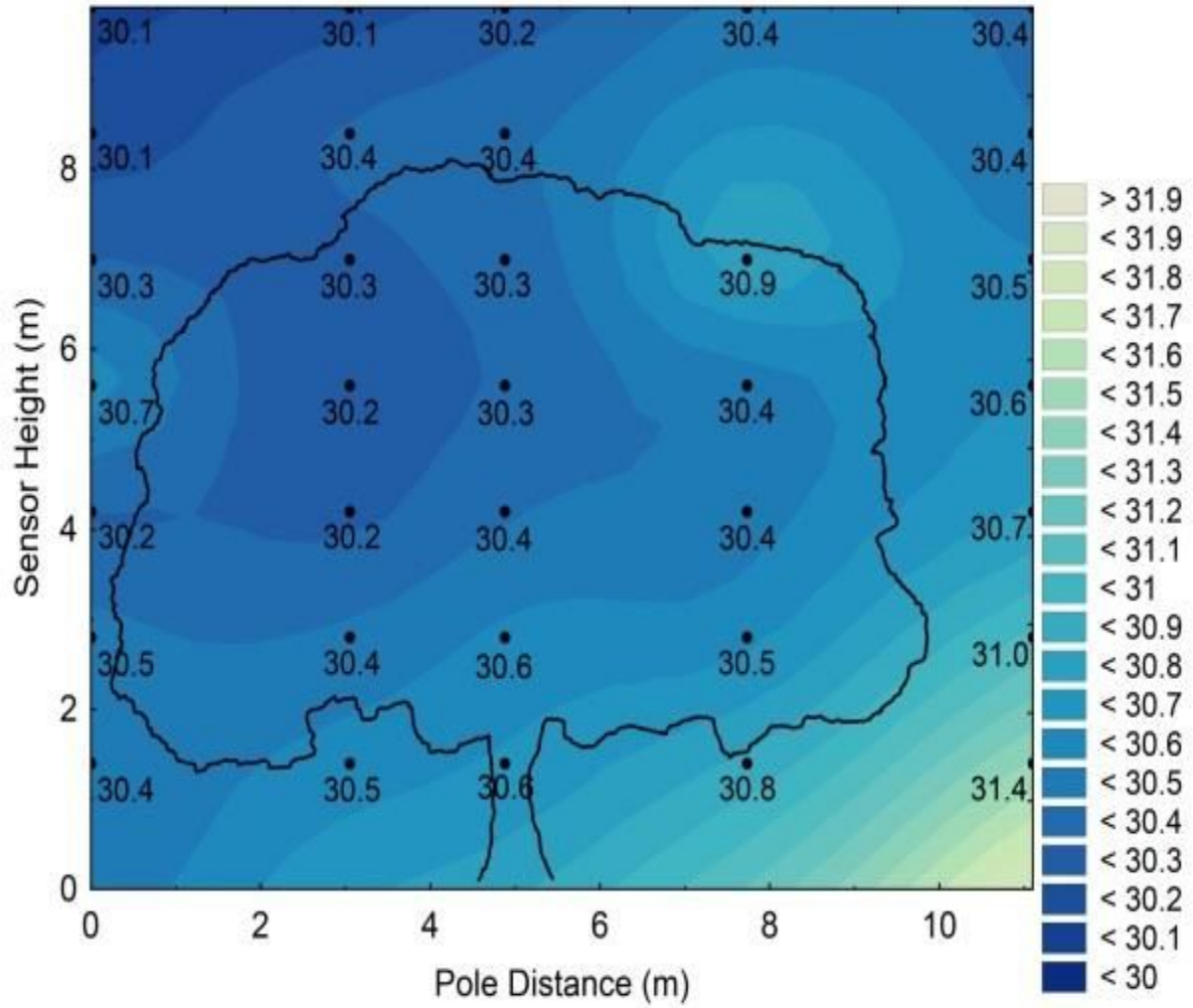



# Temperatuur



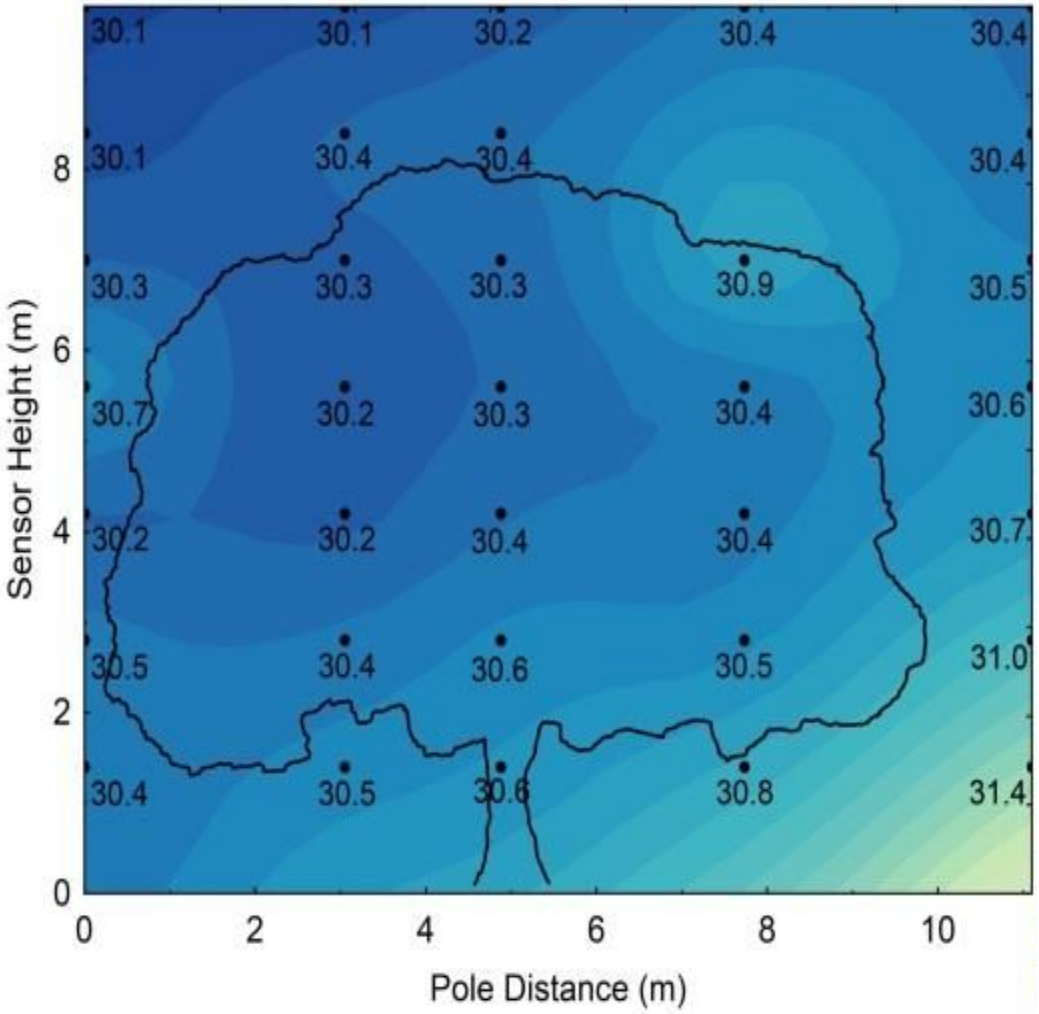
Andrew Coutts (2015)

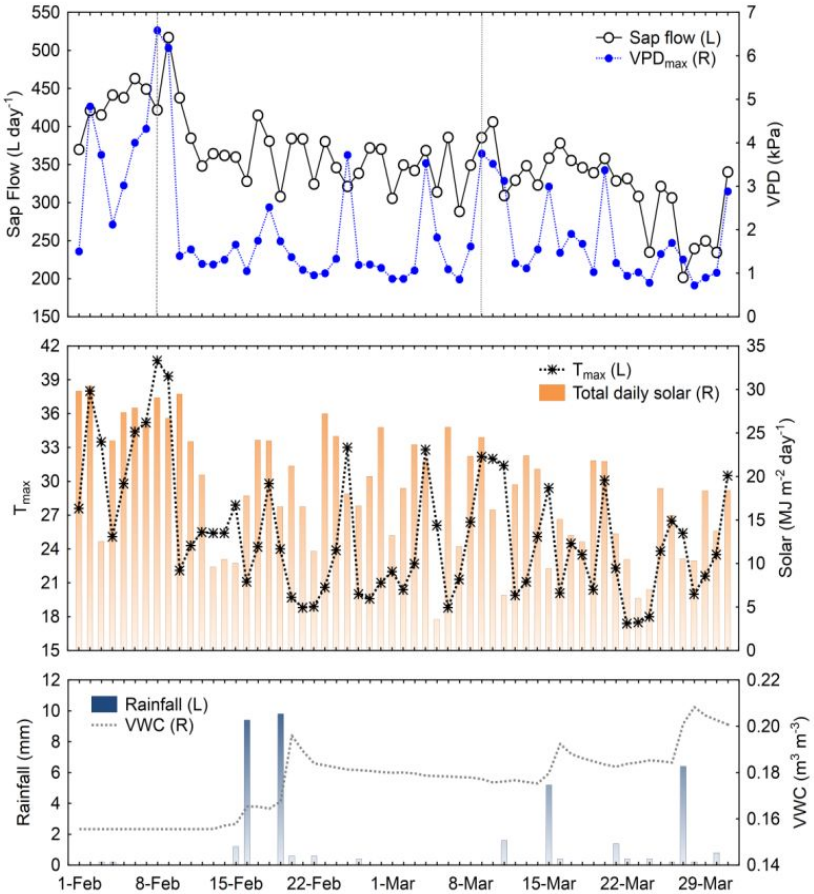
# Temperatuur




Andrew Coutts (2015)

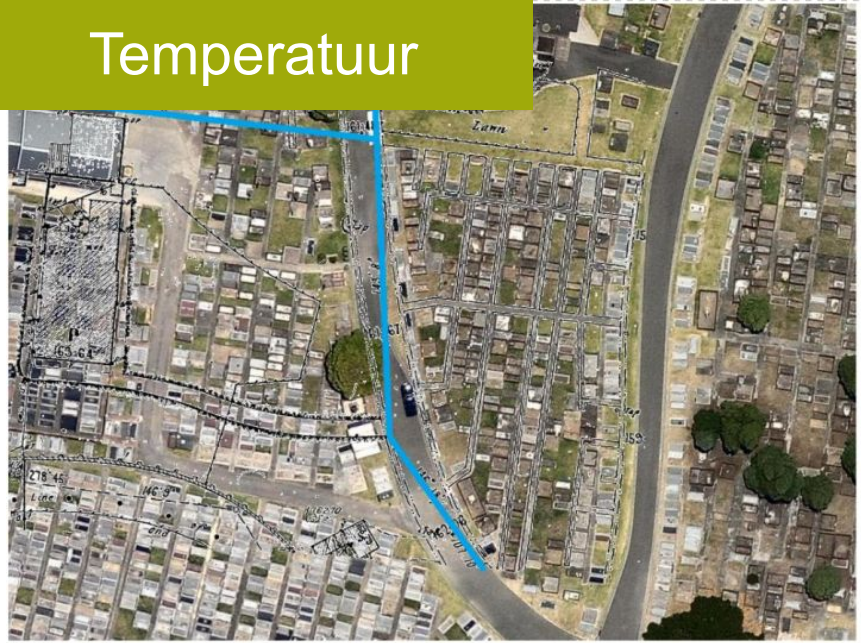
# Temperatuur

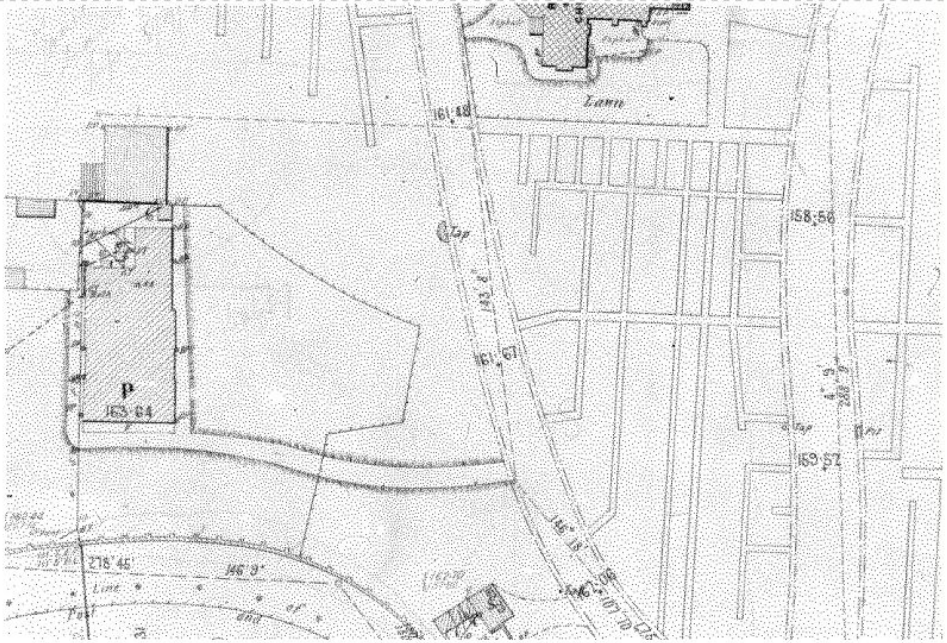


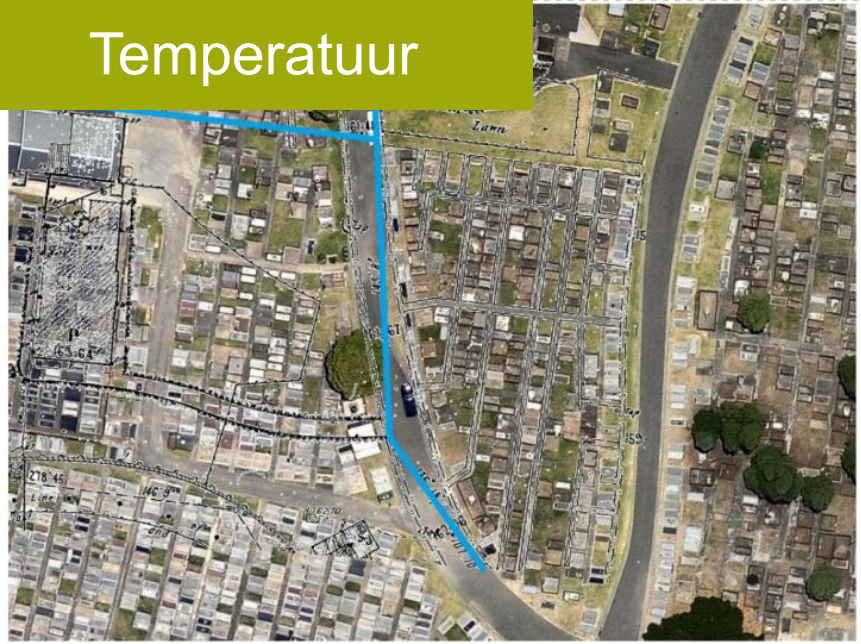

Andrew Coutts (2015)

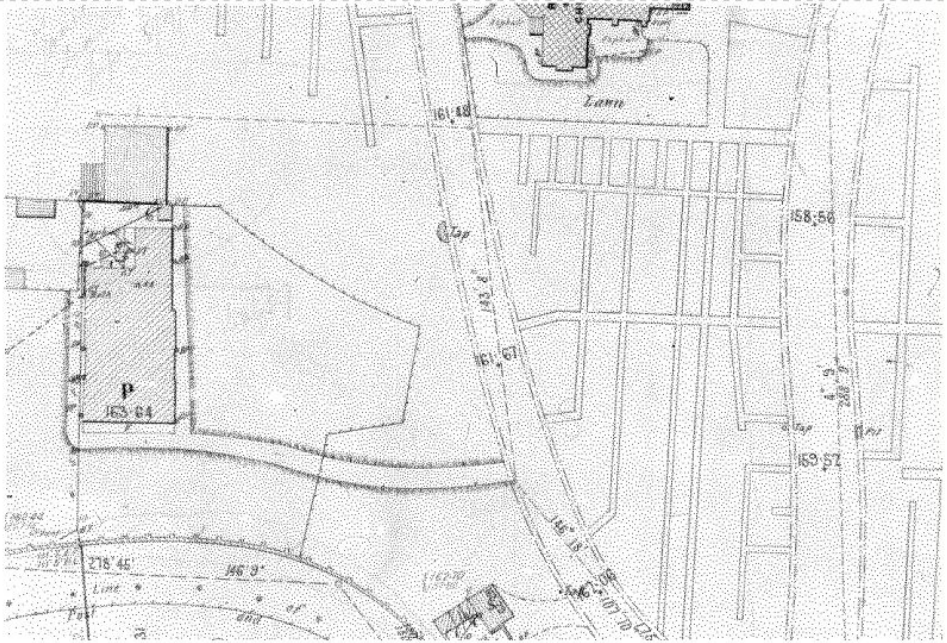
# Temperatuur

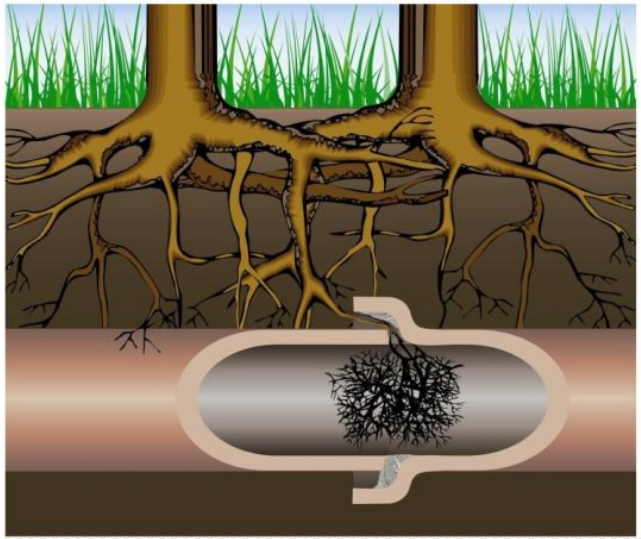




# Temperatuur







Andrew Coutts (2015)

# Watering our cities: The capacity for Water Sensitive Urban Design to support urban cooling and improve human thermal comfort in the Australian context


**Andrew M. Coutts**
Monash University, Australia

**Nigel J. Tapper**
Monash University, Australia

**Jason Beringer**
Monash University, Australia

**Margaret Loughnan**
Monash University, Australia

**Matthias Demuzere**
Catholic University Leuven, Belgium

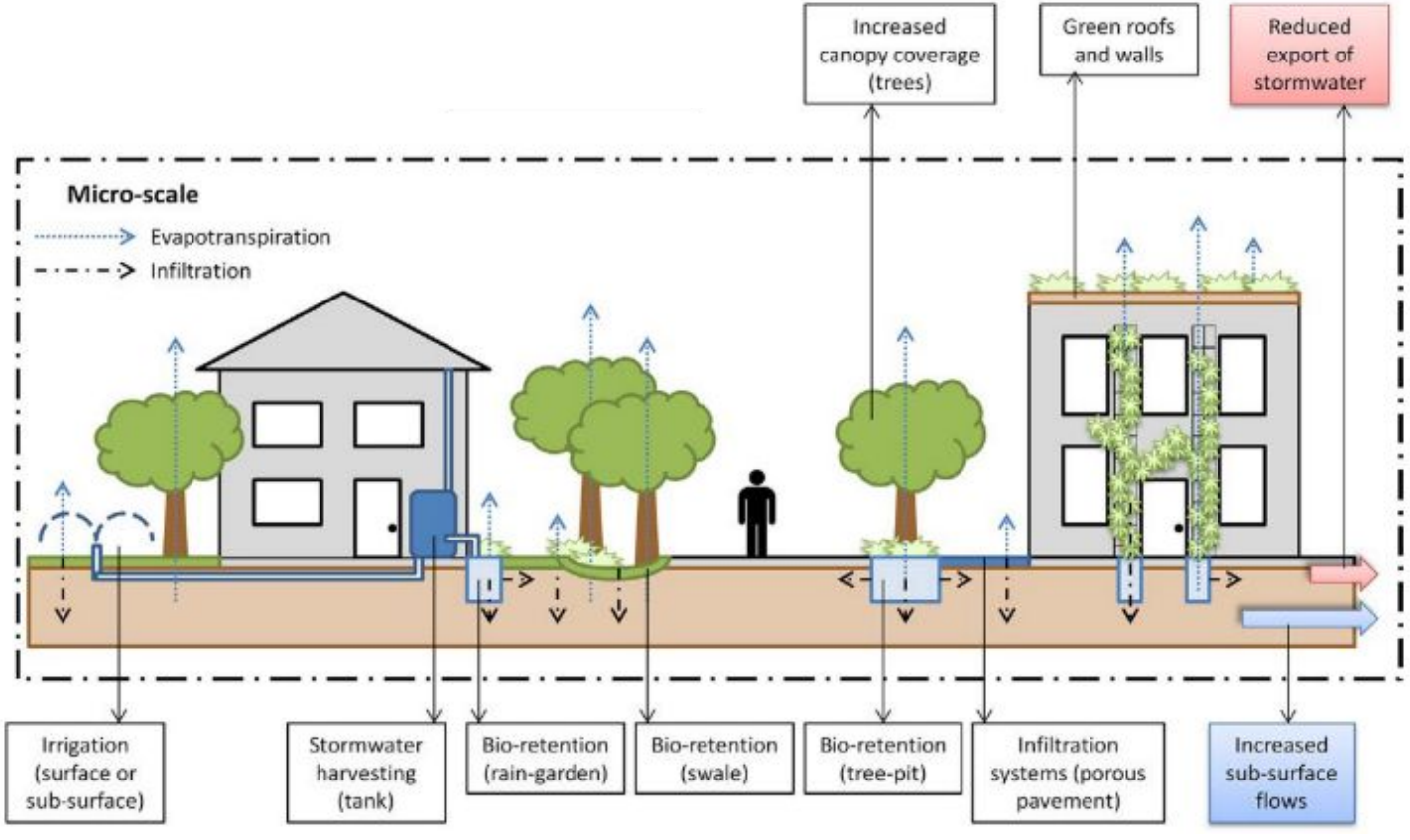


Progress in Physical Geography
37(1) 2–28



DOI: 10.1177/0309133312461032
ppg.sagepub.com
SAGE


CRC for
Water Sensitive Cities



- Bestaande regenwaterputten
- Nieuwe buffer voor regenwater
- Waterbuffer retentiedak

# Stedelijk groen

## Een wondermiddel voor meer leefbare steden?

# Stedelijk groen

- Biedt ontegensprekelijk zeer veel voordelen (ecosysteemdiensten)

Maar:

- Wat, waar, wanneer, en met welk doel?
- Prioriteiten stellen, return on investment!
- Een én … én … én verhaal
- Problemen bij de wortel aanpakken

# Bedankt.

RUB

www.b-kode.be

# Referenties

- Bratman GN, Hamilton JP, Hahn KS, Daily GC, Gross JJ. Nature experience reduces rumination and subgenual prefrontal cortex activation. Proc Natl Acad Sci U S A. 2015;112(28):8567-8572. doi:10.1073/pnas.1510459112
- Eisenman TS, Churkina G, Jariwala SP, et al. Urban trees, air quality, and asthma: An interdisciplinary review. Landsc Urban Plan. 2019;187(April):47-59. doi:10.1016/j.landurbplan.2019.02.010
- Hausfather Z, Moore FC. Net-zero commitments could limit warming to below 2 °C. Nature. 2022;604(7905):247-248. doi:10.1038/d41586-022-00874-1
- IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press.
- Kellett R, Christen A, Coops NC, et al. A systems approach to carbon cycling and emissions modeling at an urban neighborhood scale. Landsc Urban Plan. 2013;110:48-58. doi:10.1016/j.landurbplan.2012.10.002
- Meinshausen M, Lewis J, McGlade C, et al. Realization of Paris Agreement pledges may limit warming just below 2 °C. Nature. 2022;604(7905):304-309. doi:10.1038/s41586-022-04553-z
- Velasco E, Roth M. Cities as Net Sources of CO2: Review of Atmospheric CO2 Exchange in Urban Environments Measured by Eddy Covariance Technique. Geogr Compass. 2010;4(9):1238-1259. doi:10.1111/j.1749-8198.2010.00384.x
- Vos PEJ, Maiheu B, Vankerkom J, Janssen S. Improving local air quality in cities: To tree or not to tree? Environ Pollut. 2013;183C:113-122. doi:10.1016/j.envpol.2012.10.021
- Wong NH, Tan CL, Kolokotsa DD, Takebayashi H. Greenery as a mitigation and adaptation strategy to urban heat. Nat Rev Earth Environ. 2021. doi:10.1038/s43017-020-00129-5
- WWF, 2016. Living Planet Report