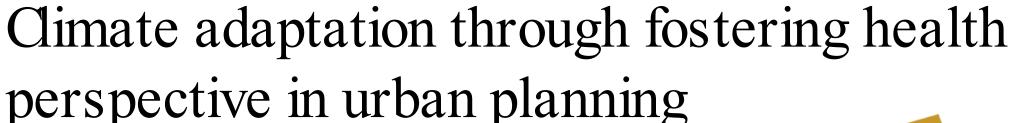


Lecture

Monday 15th of May, 11:00 AM





CNR Team-Stefania La Grutta, Velia Malizia , Giacomo Ilardo, Anna Bonomolo, Omar Shatarat















OUTLINE



- Climate and health: Evidence and effects of climate change on health
- Temperature, Climate change and health effects (mortality)
- Adaptation and mitigation: The role of public health where we are and what we can do
- Conclusion





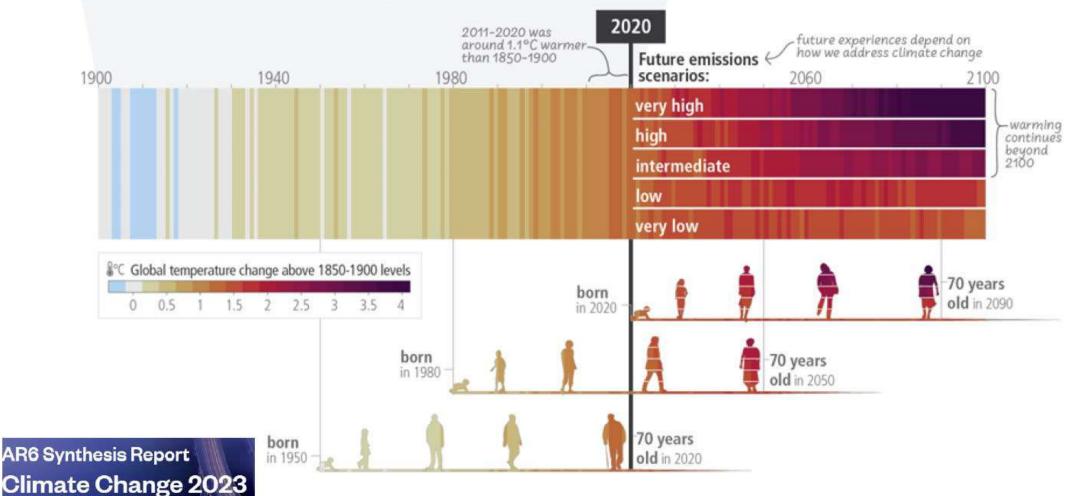
Global heating: an urgent call for action to protect health The Lancet November 4, 2022

- Accelerating collapse of some of the most important planetary systems underpinning human survival.
 - The Antarctic ice-shelf has contracted by almost 2% since 1997; further loss and thinning could lead to substantial sea-level rises.
 - Climate change is causing rapid acidification of the Arctic Ocean, risking long-lasting damage to the region's ecology.
 - Climate effects are endangering the ability of forests to mitigate adverse atmospheric changes, especially in the Amazon and North America. Forest resilience is declining, with a halving of tree life expectancies in some regions.
 - The world is edging closer to multiple tipping points that, once crossed, will drive temperature change well above 2°C.
- The key conclusion from these findings is that our current actions are insufficient to limit heating to the Paris target of 1.5°C



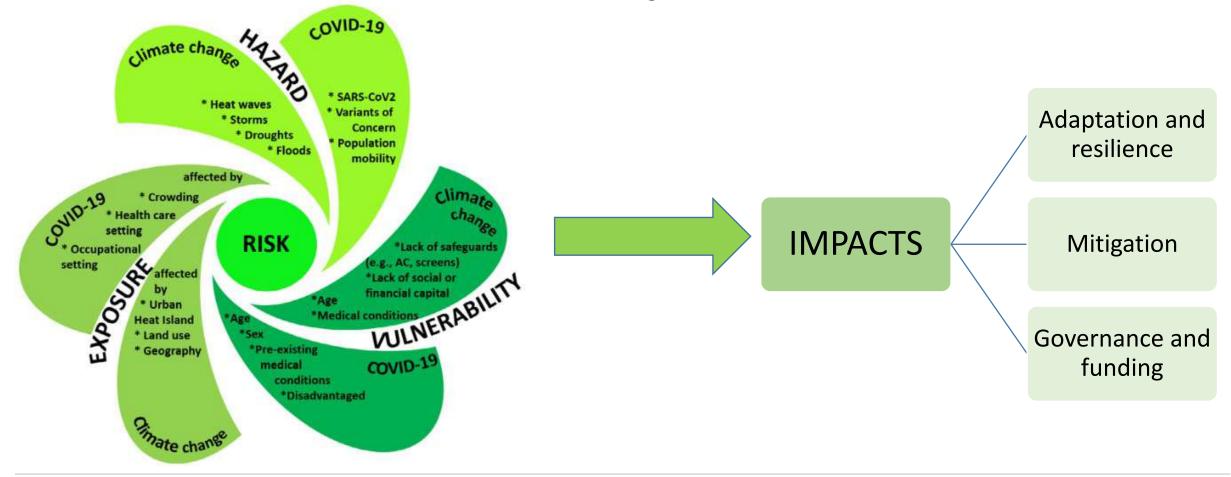


c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term





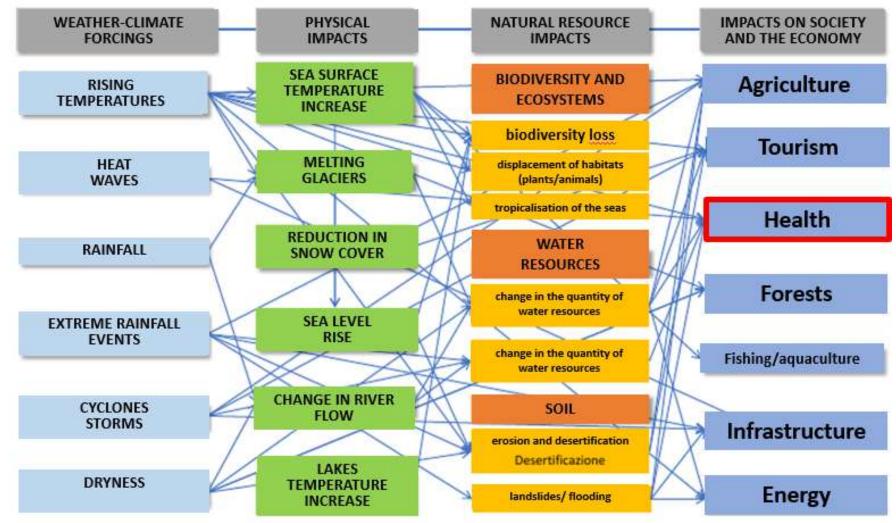
Multiple risks, complexity in managing the response to change. Example COVID-19 and Climate Change.







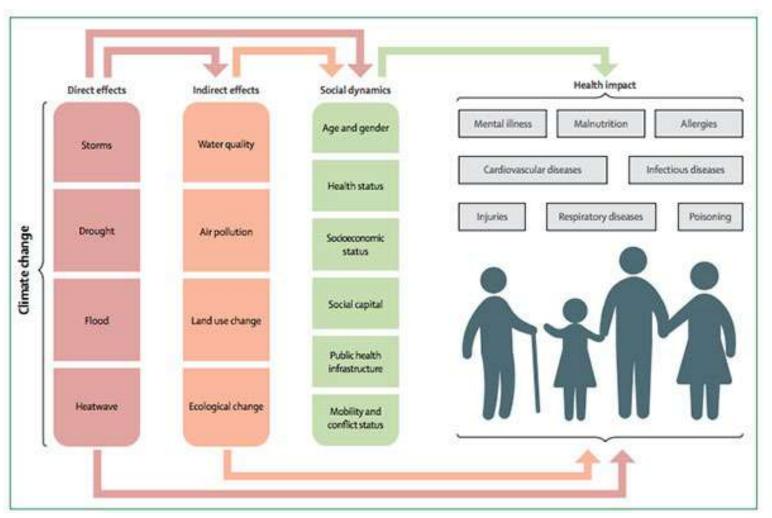
Impact of climate change: an illustrative framework







Direct and indirect effects of climate change on health









- Temperature, Climate change and health effects (mortality)



Erasmus+ Action Type: KA220-HED - Cooperation partnerships in higher education Climate change, cities, communities and Equity in health Cli-CC.HE Project Reference: 2021-1-IT02-KA220-HED-000032223

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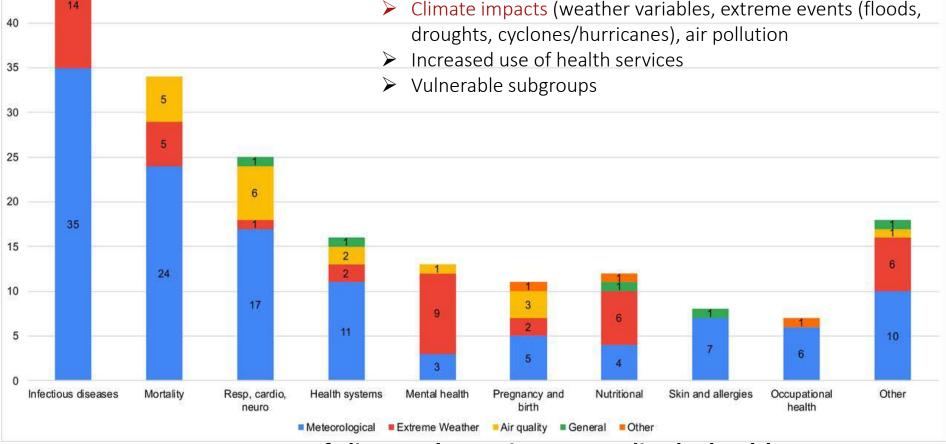


Evidence on climate change and health effects

Rocque et al. BMJ Open 2021

Overview of the systematic reviews

- 94 reviews with at least 1 health outcome related to CC.
- > 10 health outcomes (mortality, infectious diseases, cardiovascular, respiratory and neurological diseases, nutrition (food availability and quality)
- Climate impacts (weather variables, extreme events (floods, droughts, cyclones/hurricanes), air pollution

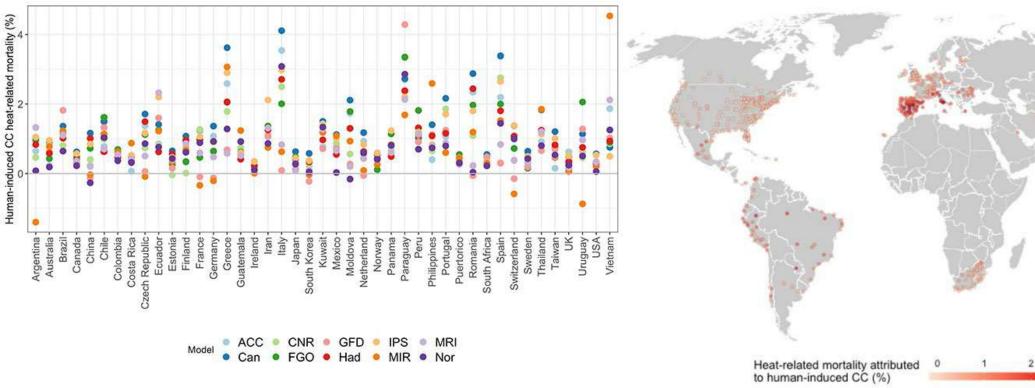


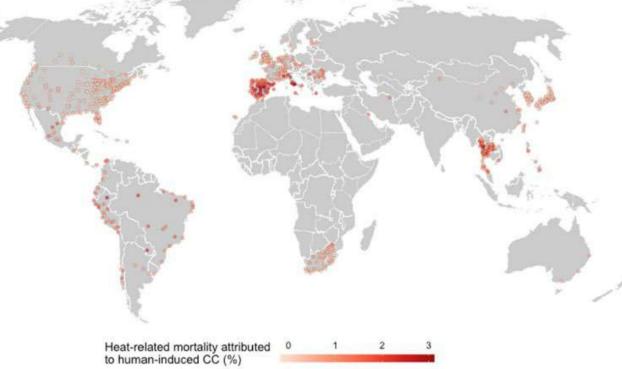
Frequency of climate change impact studies by health outcome





GLOBAL. Anthropogenic contribution to climate change and impacts in terms of change in the heat-attributable mortality fraction.





Increases in heat-related mortality over the period 1991-2018 due to climate change. Europe and the Mediterranean among the areas most at risk. In Italy 30% of heat-related mortality is caused by anthropogenic climate change (var%)

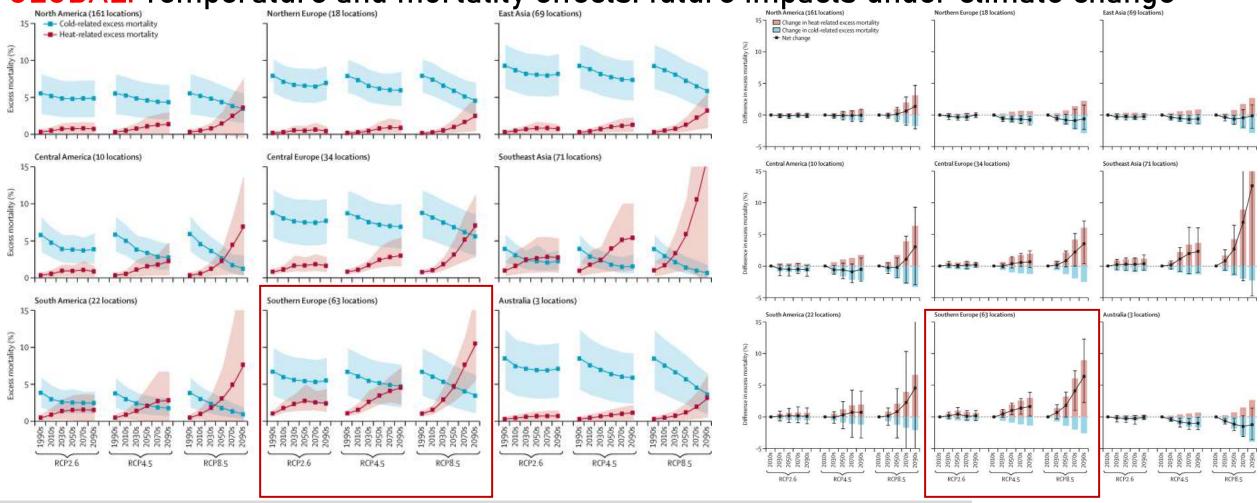
Extended Data Fig. 4. Location-specific heat-related mortality attributed to human-induced climate change (CC) between 1991-2018.

Vicedo-Cabrera et al. 2021





GLOBAL. Temperature and mortality effects: future impacts under climate change



Positive trend with increase in excess mortality due to heat and reduction in mortality associated with cold. Mediterranean among the areas at greatest risk.

Gasparrini et al. 2017





European Commission. Impacts of climate change (temperature extremes) on mortality



JRC TECHNICAL REPORT

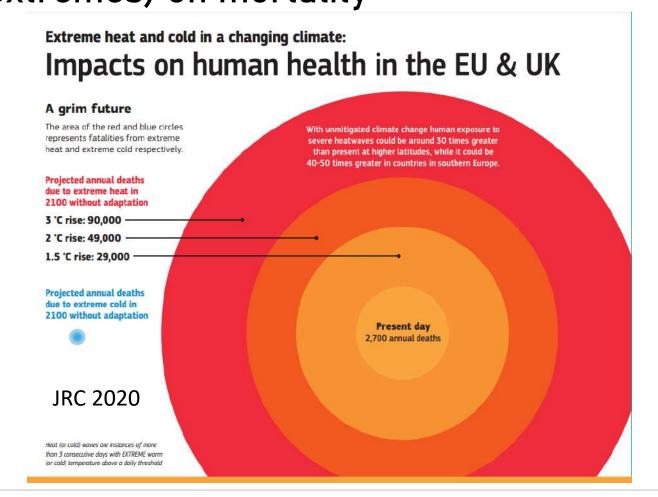
Global warming and human impacts of heat and cold extremes in the EU

JRC PESETA IV project - Task 11

Naumann G., Russo S., Formetta G., barreta D., Forzieri G., Girardello M., and Feyen L.

2020









EUROPE. Future impacts according to climate change scenarios in Europe. Variation in temperature effects (hot and cold) on mortality.

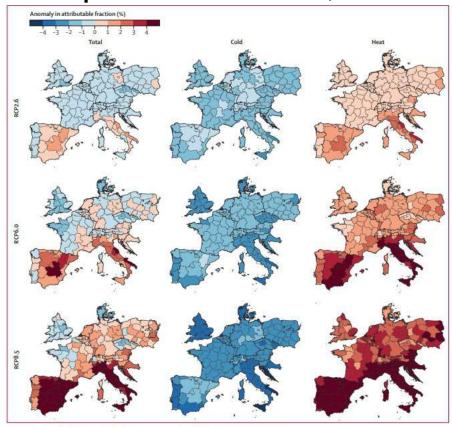


Figure 4: Attributable fraction anomalies by RCP scenario at the end of the 21st century (2070-2099)

Anomalies are calculated as the average of the four models, and expressed with respect to the reference period (1976-2005). RCP-Representative Concentration Pathway.

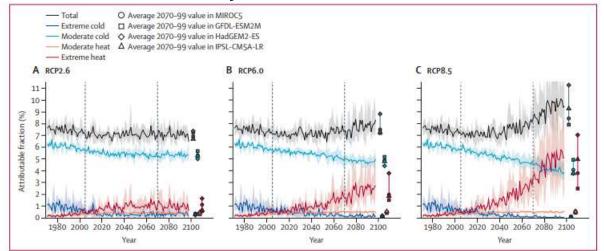


Figure 5: Projections of attributable fraction by RCP scenario in Europe

The attributable fraction is shown for all, extreme cold, moderate cold, moderate heat, and extreme heat temperatures. Projections correspond to the average of the four models. The shaded areas are CIs to the range of the ensemble of models. RCP=Representative Concentration Pathway.

Limits

- Does not consider adaptation, population variation
- Change in temperature-mortality association

Change in temperature impact on mortality (% attributable fraction change) under different climate change scenarios for the period 2070-2099. Mediterranean among the areas at greatest risk, Italy 9.87% (8.53-11.19).

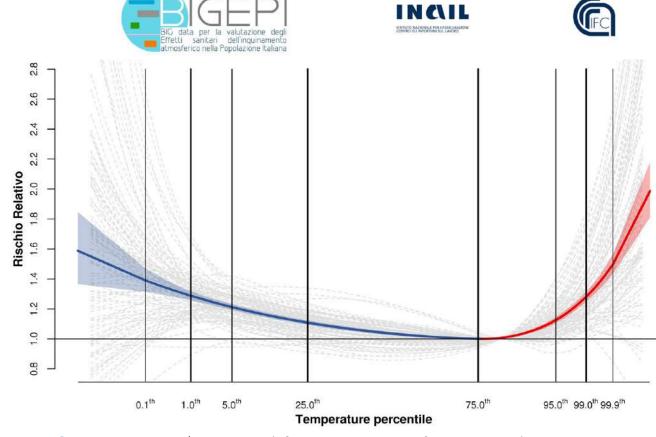
Martinez Solanas et al, 2021





ITALY. Effects of extreme temperatures on mortality by cause at national level

- In each province, time series by municipality with: daily count of deaths (outcome), municipal daily average temperature (exposure), daily confounders (time trends, day of the week, flu epidemics, summer holidays/seasons, etc.).
- Analysis by: cause of death, age (0-74, 75+), gender, type of municipality (urban, suburban, rural)
- Conditional Poisson regression with overdispersion (gnm, libreria gnm, software R)



- Cold: RR at the 1st percentile (of the province-specific distribution) compared to the 25th percentile, used as a reference
- **HEAT**: RR at the 99th percentile (of the province-specific distribution) compared to the 75th percentile, used as a reference





ITALY. RESULTS - estimates of temperature effect on mortality by cause

MORTALITY BY CAUSE

Naturals

Cardiovascular

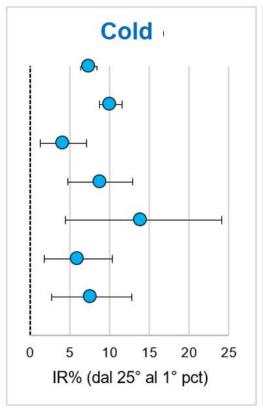
Respiratory

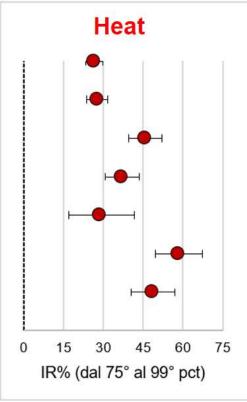
Metabolic

Diabetes

Nervous

Mental





Mortality by cause	Cold			Heat		
	RR	IC 95%		RR	IC 95%	
Naturals	1.074	1.064	1.084	1.265	1.233	1.297
Cardiovascular	1.101	1.087	1.116	1.277	1.238	1.318
Cardiac	1.099	1.082	1.115	1.253	1.219	1.288
Ischaemic	1.141	1.104	1.180	1.095	1.057	1.134
Cerebrovascular	1.121	1.088	1.155	1.270	1.216	1.327
Respiratory	1.042	1.013	1.071	1.458	1.397	1.521
Nervous	1.060	1.018	1.104	1.583	1.497	1.675
Mental	1.076	1.027	1.128	1.484	1.404	1.569
Metaboslic	1.088	1.048	1.129	1.369	1.306	1.435
Diabetes	1.139	1.045	1.241	1.287	1.169	1.418











Climate change-air pollution-urban greening

PUBLIC HEALTH CLIMATE CHANGE AIR POLLUTION Birth outcomes Air pollution Carbon monoxide Cardiovascular Extreme heat (CO) disease Environmental • Lead Cognitive decline degradation Nitrogen dioxide Diabetes Increasing allergies (NO₂) Lung cancer Severe wheather Ozone (O₃) ■ Mental health Vector ecology ■ Particulate matter Premature ■ Water/food supply (PM) mortality Water quality ■ Sulfur dioxide (SO₂) Respiratory disease **GREEN SPACES**

PATHWAYS TO HEALTH

Individual status

- Heathy lifestyle
- Immune system function
- ■Mental status
- ■Physical fitness

HEALTH STATUS AND WELLBEING

Phsycal health

- Allergies
- Cardiovascular effect
- Injuries
- Mortality rates
- Obesity
- Pregnancy outcome
- Vector-borne disease

Physical health

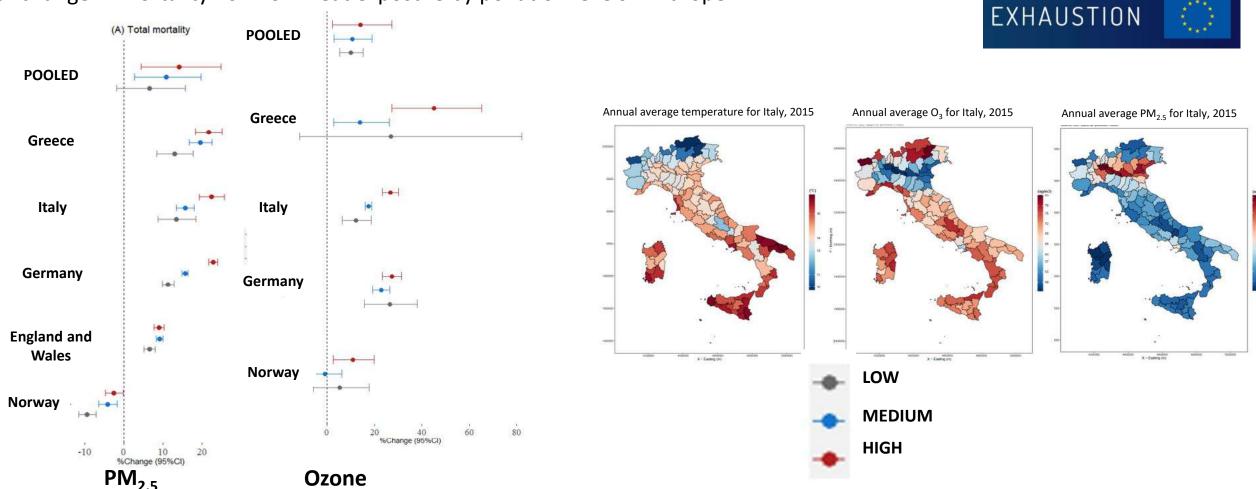
- ■Cognitive function
- Depression
- Psychological weelbeing
- Stress





Interaction between air pollution ($PM_{2.5}$ and Ozone) and temperatures

% change in mortality risk from heat exposure by pollution levels in Europe

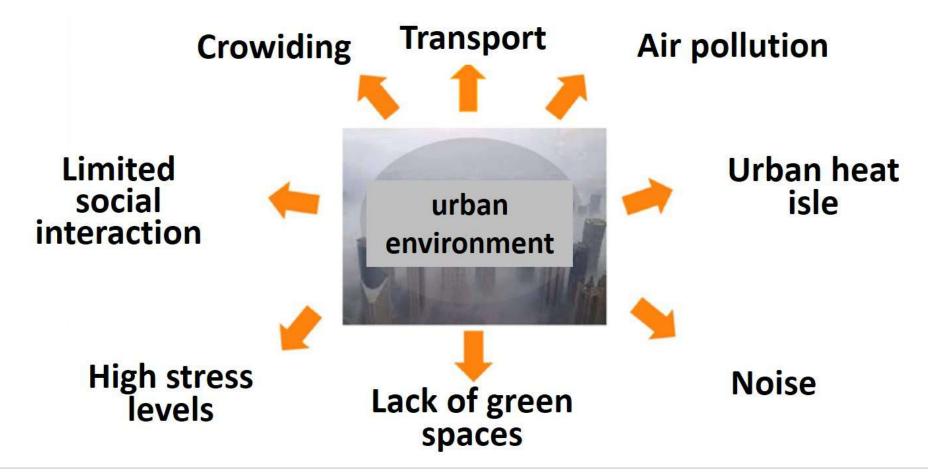




Air pollution in cities



By 2050, more than 70 per cent of the world's population will live in urban environments (UN, 2014)







OUTLINE



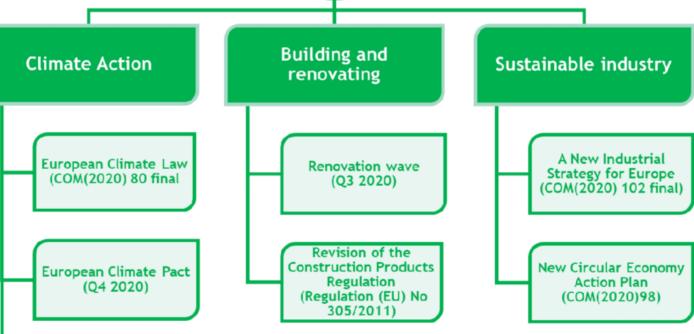
- Climate and health: Evidence and effects of climate change on health
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Mitigation policies in Europe





New Adaptation Strategy to Climate Change (2021)

https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52019DC0640&from=ET





Policies for adaptation to climate change

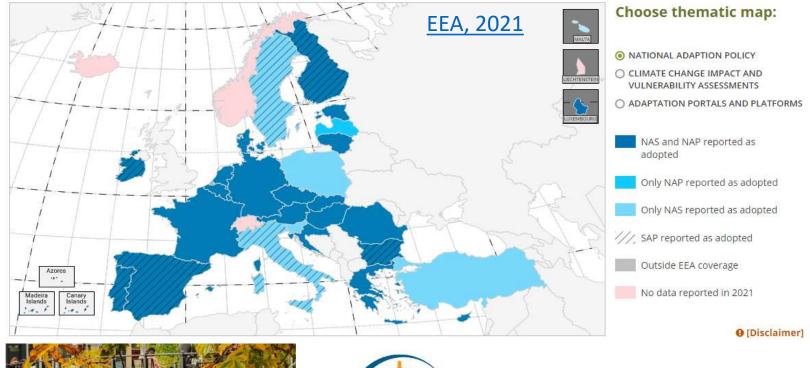
Climate change adaptation plans

Only 3 EU countries

have specific health plans (Sweden, Finland and Ireland)



The thematic maps illustrate the reported status and information provided by the member countries. The thematic maps don't necessary reflect the formal status in the country.





Oct 18, 2021 Mapping of stakeholders in Europe working on adaptation





Project Reference: 2021-1-IT02-KA220-HED-000032223

Responding to climate change what to do?



CLEAN ENERGY

CLEAN TECHNOLOGY

WASTE TO RESOURCES

























EMERGENCY PREPAREDNESS

RESILIENT BUILDINGS

& INFRASTRUCTURE

Mitigation - reduction of emissions

CLEANER INDUSTRY

Adaptation and resilience

Erasmus+ Action Type: KA220-HED - Cooperation partnerships in higher education Climate change, cities, communities and Equity in health Cli-CC.HE
Project Reference: 2021-1-IT02-KA220-HED-000032223



Climate change and health: solutions and responses for resilience

SIXTH ASSESSMENT REPORT

2022

ipcc





Working Group II - Impacts, Adaptation and Vulnerability

INTERGOVERNMENTAL PANEL ON CHIMOTE CHONE

Climate change and human health and wellbeing: Risks and responses

LIMATE HAZAROS, VULNERABI	LITY AND EXPOSURE	IMPACT AND RISKS	SOLUTIONS SPACE AND CLIMATE RESILIEN	T DEVELOPMENT PATHWAYS
Vulnerability and upstream eterminants of health outcomes	Exposure pathway	Example health outcomes	Health System Solution Space	Climate Resilent Development Pathways
Environmental factors Air pollution Biodiversity loss Deforestation Desertification Land degradation Land-use change Water pollution	Social factors	Physical and mental health risks, displacement, forced migration, other context-specific risks	Environmentally sustainable and resilient technologies and infrastructure	
	Vector distribution and ecology	Chikungunya, dengue, hantavirus, Lyme disease, malaria, Rift Valley, West Nile, Zika	Health information systems (includes integrated risk monitoring and early warning and response systems, vulnerability, capacity, and adapta-	Fully implementing dimate-resilient health system:
Socioeconomic factors	7		tion assessments, health component of national adaptation plans, health and climate research)	
Growing inequity Demographic change Economic growth Migration and (im)mobility Urbanization Science and tech investment	Nutrient dense diets and food safety	Malnutrition, salmonella, foodborne diseases	Service delivery (includes climate-smart health programs, management of environmental determinants of health, disaster risk reduction	Achieving universal healthcare coverage Achieving net zero Greenhouse Gas Emission
	Water quality and quantity	Diarrheal diseases, campylobacteria infections, cholera, cryptosporidiosis, algal blooms	Collaborations with other sectors, agencies, and civil society	from healthcare systems and services Achieving the Sustainable Development Goal Adopting mitigation policies and technologies with signific
	Air quality	Exacerbated respiratory	and twi society	
Susceptibility Political commitment Social infrastructure Socioeconomic conditions Population health status Individual factors		diseases, allergies, cardiovascular disease	Leadership and governance Coherent policies and strategies	health co-benefits
	Heat stress	Heat-related illness and death, adverse pregnancy outcomes,	Sufficient health workforce	
	(lost worker productivity	Health authorities	
	Extreme weather events	Injuries, fatalities, mental health effects	Strenghtening health delivery and system resilience Leveraging climate change specific funding streams	

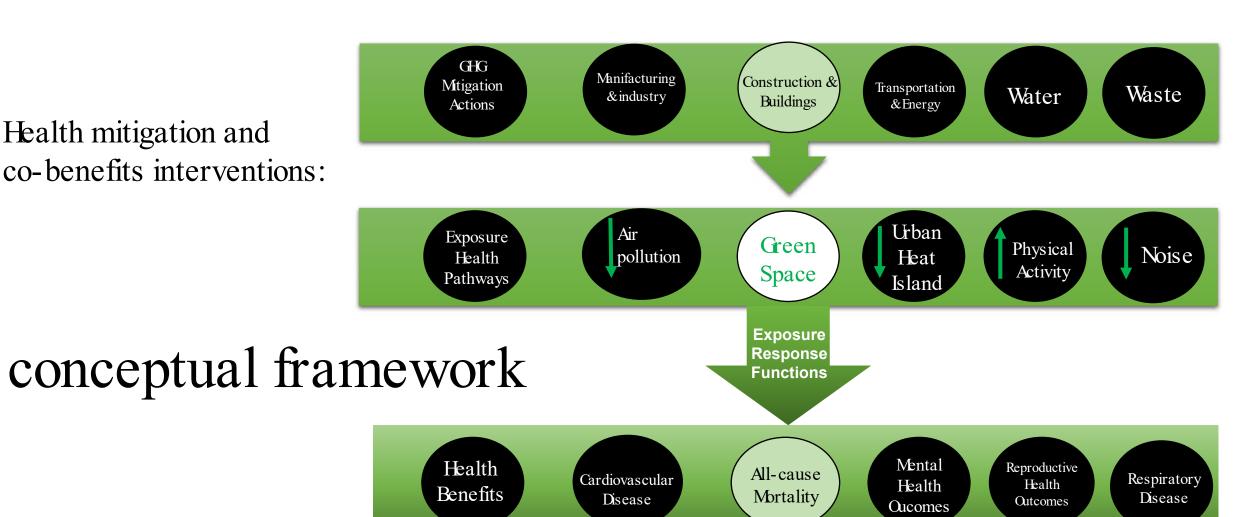
Figure 1: Multiple socio-economic environmental factors interact with climate risks to shape human health and well-being.

Achievina climate recilient development requires leveraging opportunities in the solution space within health systems and across other sectors. (Figure TS.8)





Health mitigation and co-benefits interventions:

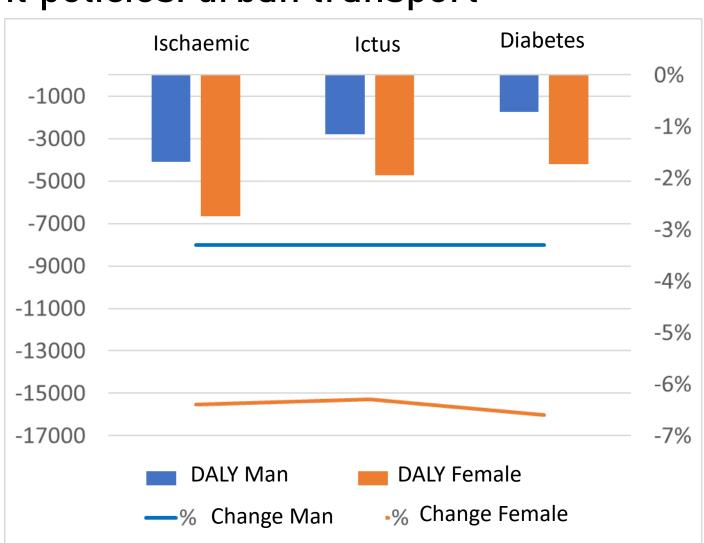




Co-benefit policies: urban transport

- ■Scenario in urban transport in 2040 compared to baseline (2012) in São Paulo, Brazil: active transport and reduction in private car and motorbike use
- Greater co-benefits in women associated with increased physical activity
- Reductions are also observed for motorbike accidents and air pollution (in these cases greater co-benefits in men)

DALY, **disability-adjusted life year**: the sum of the years of life lost to due to premature mortality (YLLs) and the years lived with a disability (YLDs)





Co-benefit policies: diet

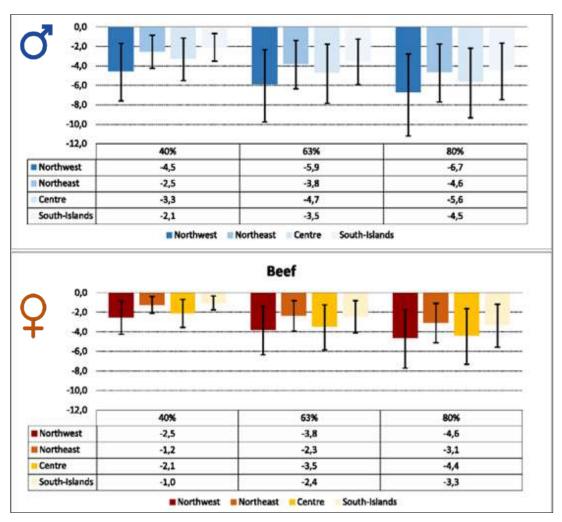


The greatest co-benefits of improving diet, e.g. by reducing red meat consumption in men.

If consumption is reduced to the recommended amount of 150 grams/week* (-63% compared to current consumption) 4.4% of deaths from colorectal cancer can be avoided in men (avoidable deaths are 3.0% in women)

Similar reductions are observed for cardiovascular deaths, again with the greatest benefits in men.

^{*} Recommended dosage according to the Mediterranean Diet Pyramid



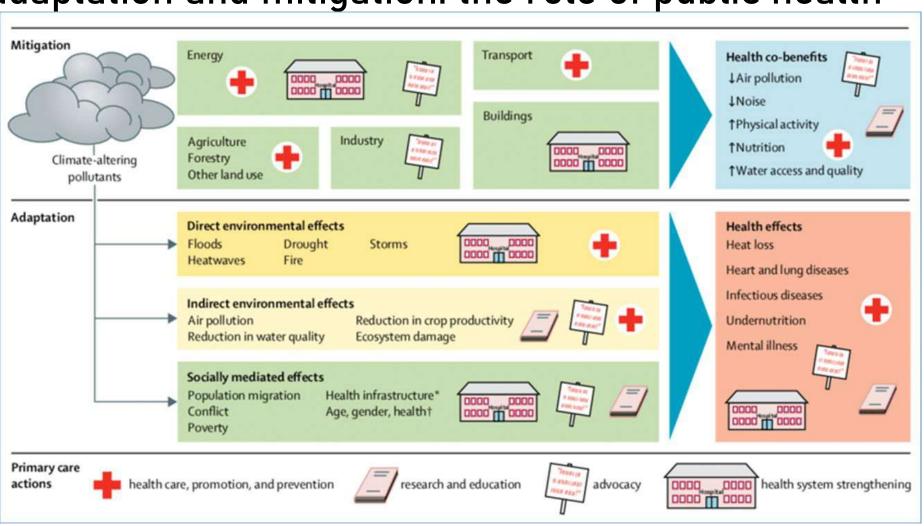
Italy, 2012 (Farchi et al. 2017)





Climate change adaptation and mitigation: the role of public health

- Reduce public health emissions (define roadmap and interventions)
- Promote and monitor mitigation actions with health co-benefits
- •Investments in sustainable infrastructure and technology
- Training health personnel
- Advocacy
- Leadership and Governance







Climate change adaptation and mitigation: the role of public health

 Monitoring climate risk and health impacts Cross-sectional climate and health research Measuring benefits solutions (eg.naturebased) •Health co-benefit assessment of mitigation Facilitating policies, actions Promotion, prevention actions and responses and training Climate and Guidance for Health decision-makers Training · Planning and Advocacy and responding to public extreme events outreach Multidisciplinary actions interventions Promoting healthy environments and lifestyles



How can

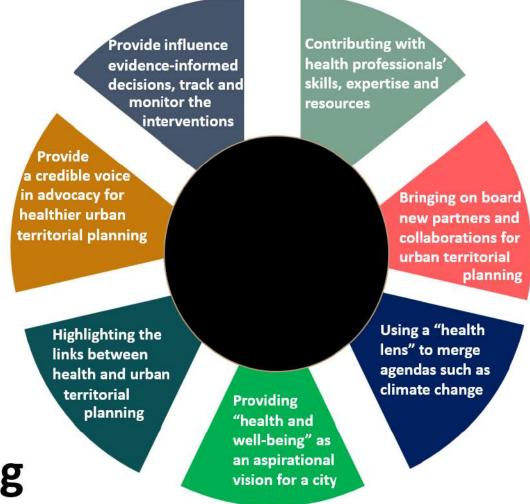


unlock



new opportunities for

Urban and Territorial Planning



INTEGRATING HEALTH IN URBAN AND TERRITORIAL PLANNING: A SOURCEBOOK.2020

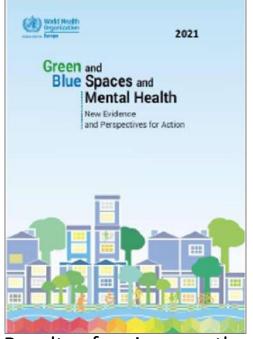




Access to greenery as a service of quality and health



Safe, well-managed and accessible parks and green spaces promote respiratory health, physical activity, mental well-being and social interaction in communities.



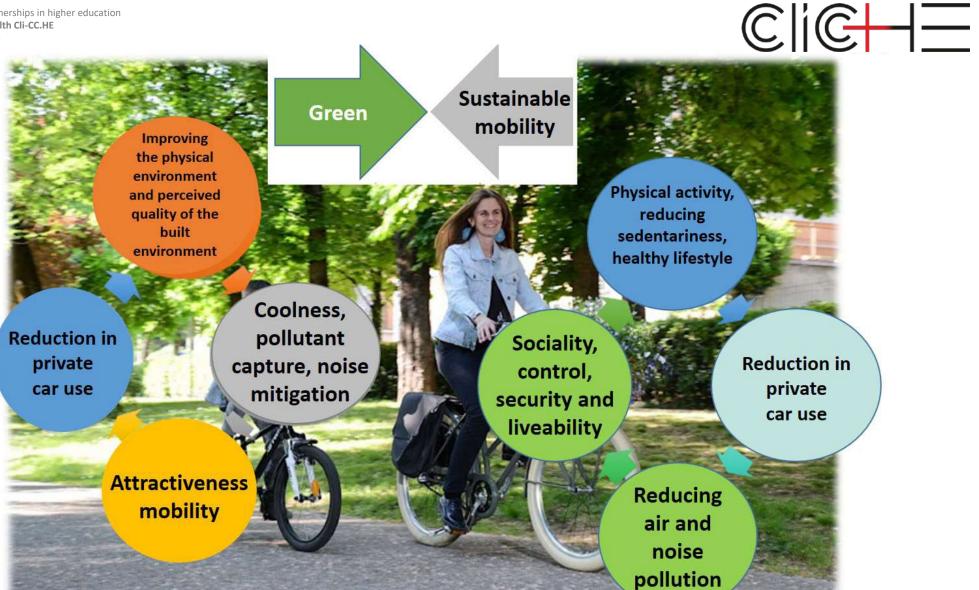
Results of reviews on the types and characteristics of green and blue spaces in relation to mental health confirm the beneficial relationship.

The presence of greenery improves the aesthetic perception of the landscape and lends beauty to urban spaces, increasing property values and making neighbourhoods more attractive.





Project Reference: 2021-1-IT02-KA220-HED-000032223







How can

URBAN AND TERRITORIAL PLANNING contribute



Helping to deliver national health plans such as those on non-communicable diseases Reducing the burden of disease and improving the access to health care

Ensuring that Urban
Territorial Planning
operates well mitigating
climate change and
respecting relationship
to land

Helping to tackle the spatial and environmental "causes of the causes" of illness and health inequity

Ensuring that health outcomes are considered commitments in the training of all built environment specialists Raising level of health literacy of the upstream causes that result in adverse downstream health outcomes

INTEGRATING HEALTH IN URBAN AND TERRITORIAL PLANNING: A SOURCEBOOK, 2020



FOSTERING SUSTAINABLE URBAN AND TERRITORIAL PLANNING

1. Supporting active mobility, public transport and social interactions and reduce use of energy and resources

5. Better integration of evaluation of health impacts of urban environment interventions with the planning system

HEALTH

as

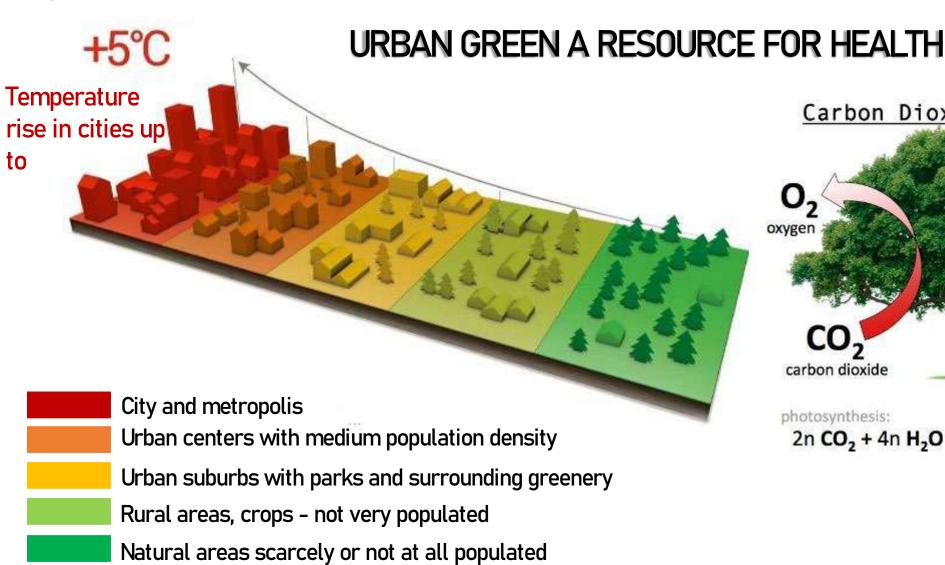
2. Supporting the wellbeing and resilience of vulnerable sub-populations

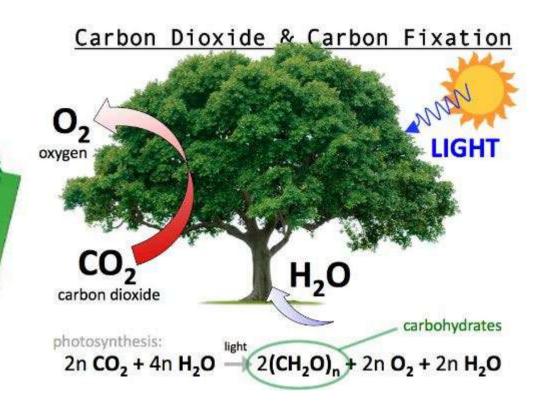
OUTCOME 5 QUALIFIERS

4. Designing health benefits into nature-based solutions for ecosystem services, climate mitigation and resilience 3. Facilitating better health through access to economic opportunities, amenities and services









Project Reference: 2021-1-IT02-KA220-HED-000032223



Urban green: biodiversity of use and functions

Resilience quality of life

=

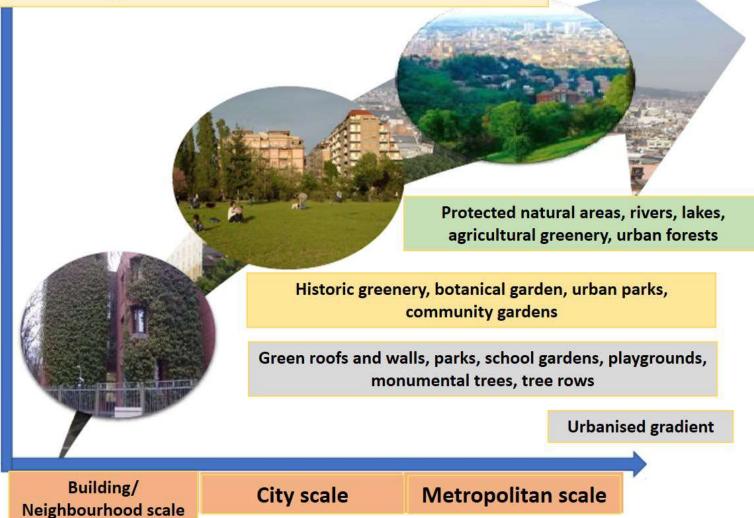
Urban heat island mitigation, rain water infiltration, air and soil pollutants

+

Leisure and recreation, outdoor physical activity, sociability

+

Thermal insulation, energy saving





Erasmus+ Action Type: KA220-HED - Cooperation partnerships in higher education Climate change, cities, communities and Equity in health Cli-CC.HE Project Reference: 2021-1-IT02-KA220-HED-000032223

URBAN GREEN A RESOURCE FOR HEALTH







URBAN GREEN A RESOURCE FOR HEALTH

HEALTH MITIGATION INTERVENTIONS

Total and average annual reduction of deaths attributable to a temperature reduction of 1.3°C of the specific city average temperature

Total and average annual reduction of deaths attributable to a temperature reduction of 1.3°C and 2°C of the specific city average temperature

Total and average annual reduction of deaths attributable to a temperature reduction of 2°C of the specific city average temperature





EXAMPLE

Selected area for NBS interventions

Selected area: examples of critical issues

- heavily built up area;
- poor vegetative cover;
- high prevalence of population> 65 years;
- presence of pollutant production activities.

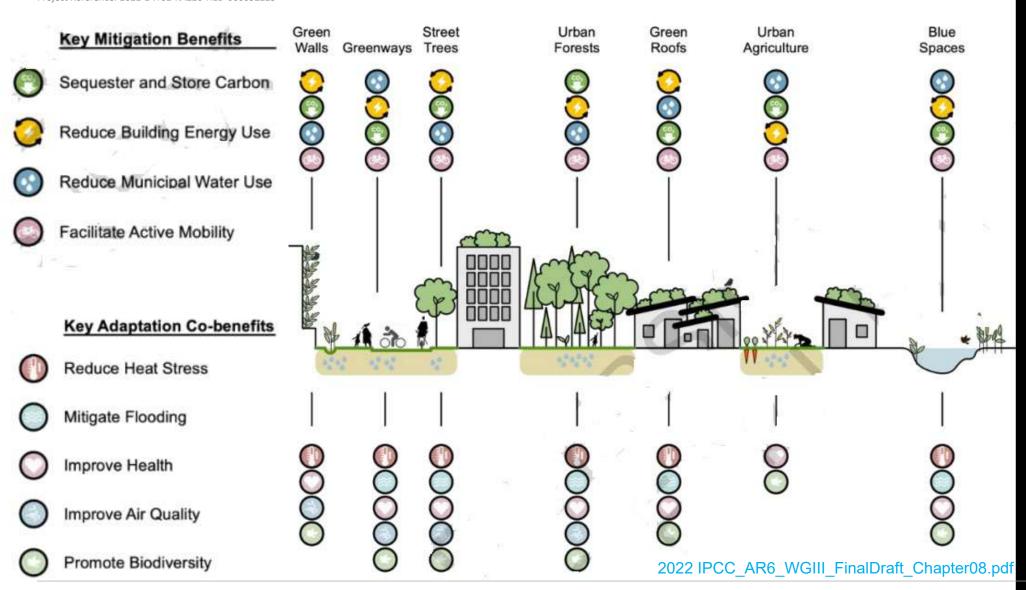
What to do: examples of activities

- analysis of the actual state of the area using microclimatic software;
- survey of plant species present and selection of tree, shrub and herbaceous species to be included;
- elaboration of different cooling scenarios;
- •simulation of the scenes with quantification of the benefits (temperature, relative humidity, etc.).



Erasmus+ Action Type: KA220-HED - Cooperation partnerships in higher education Climate change, cities, communities and Equity in health Cli-CC.HE
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Potential integration of various green and blue infrastructure strategies within an urban system



<u>Urban forests</u> and <u>street trees</u> provide the greatest mitigation benefit because of their ability to sequester and store carbon while simultaneously reducing building energy demand.

	Urban Green and Blue Infrastructure	Mitigation Benefits	Adaptation Co-benefits	SDG Linkages
Urban Forests				1 Summer 2 mm 3 mm 4 mm 1 mm 1 mm 1 mm 1 mm 1 mm 1
Street Trees				3 stress and 8 source and 9 source and 13 stress 15 source and 15 source

2022 IPCC_AR6_WGIII_FinalDraft_Chapter08.pdf





The assessments of mitigation benefits are dependent on context, scale, and spatial arrangement of each green infrastructure type and their proximity to buildings.



Local implementations of urban green infrastructure can pursue toward inclusive sustainable urban planning (SDG 11.3) and the provision of safe, inclusive and accessible green and public spaces for all.









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CONCLUSIONS

The importance of urban green infrastructure for reducing the total warming in urban areas due to its local cooling effect on temperature and its benefits for climate adaptation.

Urban green infrastructure involves the protection, sustainable management, and restoration of natural or modified ecosystems while simultaneously providing benefits for human well-being and biodiversity.









Thanks for your attention

CNR Team
Stefania La Grutta, Velia Malizia , Giacomo Ilardo, Anna
Bonomolo, Omar Shatarat



