



POLICY BRIEF | URBAN DEVELOPMENT, CLIMATE CHANGE AND HUMAN HEALTH

INTEGRATED SOLUTIONS TO ADDRESS HIGH LEVELS OF CLIMATE CHANGE

We are not yet on track to meet the Paris Agreement goal to keep global mean temperatures below 2°C (and ideally below 1.5°C) above pre-industrial levels. IMPRESSIONS modelled the impacts of higher levels of climate change (above +2°C) on human health under different socio-economic scenarios, including interactions with land use and urban development.

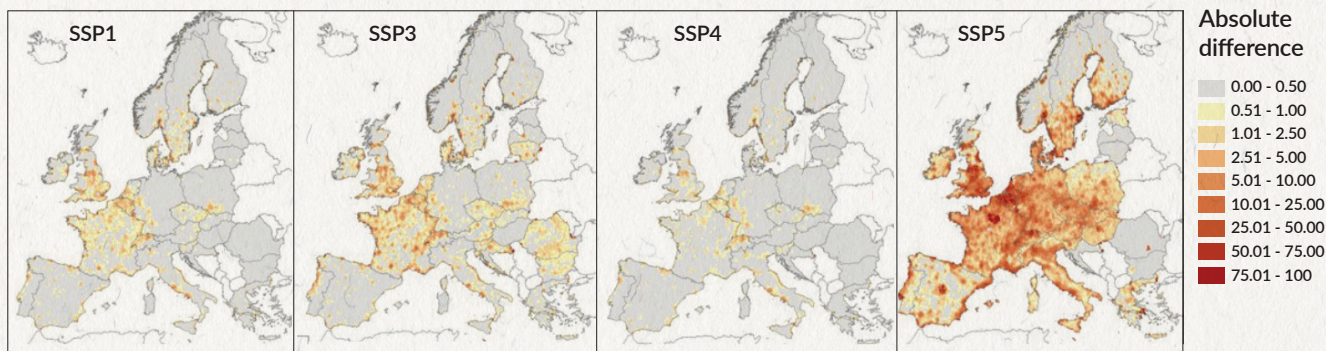
Key Messages

- Artificial surfaces in Europe could double by 2100 if urban sprawl is not controlled. This would increase flood risk and urban heat, compete with land for food production, and cause habitat loss and fragmentation. Strong planning policies are needed to promote compact and sustainable urban development.
- Without stronger action to limit climate change, higher temperatures will have significant impacts for human health and wellbeing in many parts of Europe, leading to almost 100,000 additional heat-related deaths per year. There are limits to the extent to which we can adapt to higher temperatures physically, and they are likely to change our daily routines.
- Higher temperatures together with land use change can cause a significant increase in exposure to Lyme disease, and greater awareness of the risks is needed.
- There is an urgent need to invest in climate-smart adaptation strategies based on energy-efficient buildings, passive cooling and nature-based solutions. There is a risk of maladaptation as increased use of energy-intensive space-cooling and heating, in response to increased weather extremes, will elevate greenhouse emissions.

How will urban development and climate change affect human health and wellbeing?

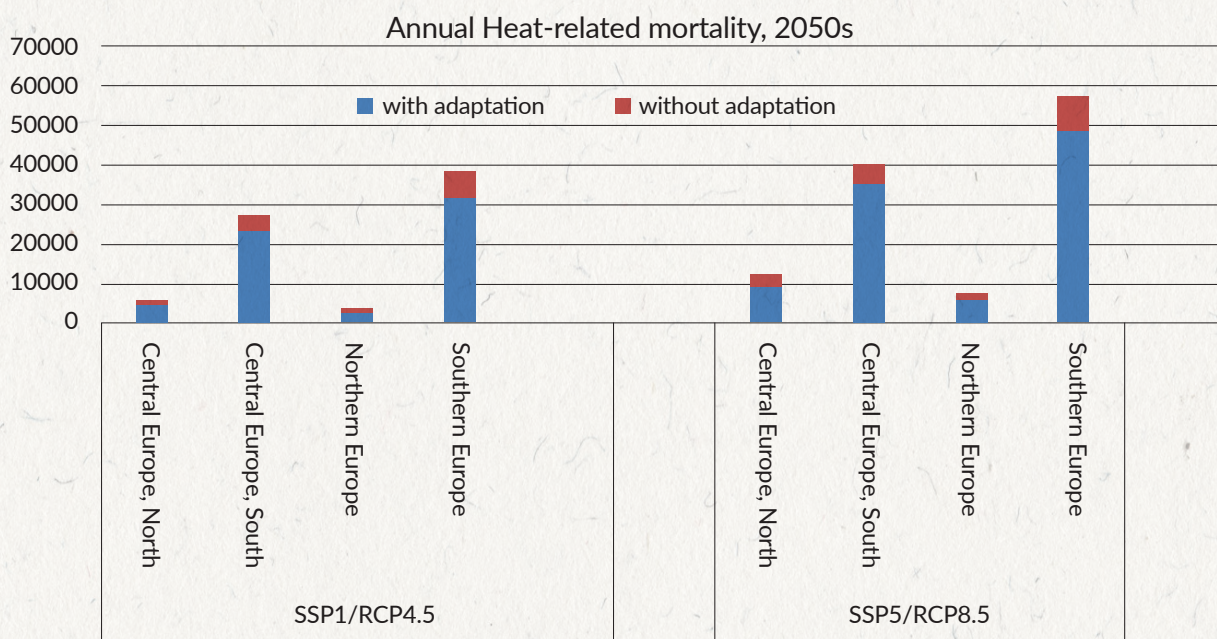
Urban development. IMPRESSIONS explored a range of future scenarios with contrasting patterns of urban development. In the 'fossil-fuelled development' scenario (SSP5), population growth of 47% coupled with lax planning policy, increasing wealth and preferences for single living and larger properties leads to a doubling in the area of artificial surfaces across Europe, from 4% of the land area today to 9% in 2100. The level of urban sprawl observed in this scenario – where only 18% of people live in cities – is a serious threat to Europe's sustainable urban agenda. It will encourage car dependency and thus elevate air pollution and carbon emissions; increase surface water flooding and the urban heat island effect; cause loss of ecosystem services and fragmentation of habitats for biodiversity; and could compete for land with agriculture and forestry, thus threatening local food and resource supply.

In contrast, in an environmentally aware scenario with zero population growth by 2100 (SSP1), society shifts towards more sustainable, compact development where 44% of people live in cities, with good access to public transport and other services, and artificial areas remain at their current level of 4%. In other scenarios, featuring high levels of inequality, weak planning and governance and low levels of environmental/social awareness (SSP3 and SSP4), poor urban planning leads to the emergence of urban ghettos with social challenges including unemployment, crime and segregation. These scenarios are likely to result in a low coping capacity and high vulnerability to climate change.



The projected change, from baseline to 2100, in % urban area in each grid cell under four different socio-economic scenarios characterised by sustainability (SSP1), regional conflict (SSP3), inequality (SSP4) and fossil-fuelled development (SSP5). Population stays the same in SSP1, falls by 38% in SSP3 and 22% in SSP4, and grows by 47% in SSP5 (see [Scenarios policy brief](#) for more details).

Heat impacts. Climate change will increase the frequency and intensity of weather extremes. Spells of both hot and cold weather can be expected, where hot weather especially is associated with significant acute impacts on mortality and morbidity. On our current trajectory towards the RCP8.5 scenario (average increase of approximately 3.6 to 5.4°C in Europe by 2100), heat-related deaths in Europe could increase from around 25,000 per year in the baseline to over 100,000 by the 2050s, without adaptation. Impacts vary strongly across Europe, with southern and central Europe showing particularly large increases in heat-related mortality. Mortality is very dependent on age, and the number of elderly and very elderly is projected to increase dramatically after mid-century across large parts of Europe.



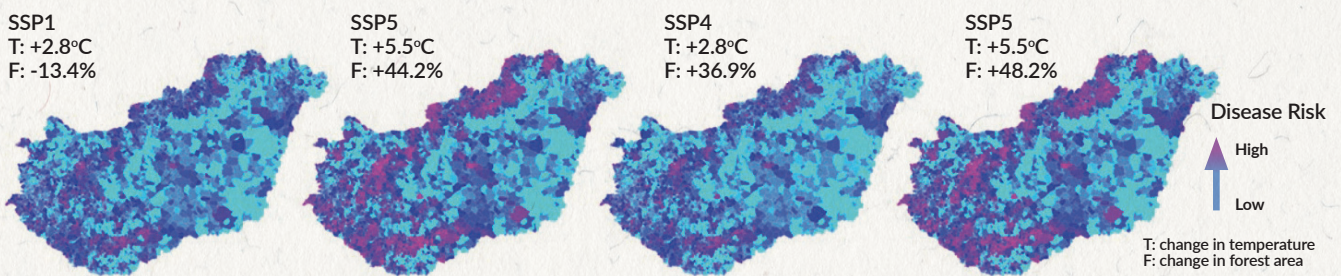
Future annual heat-related mortality in Europe, with and without adaptation for two scenarios: average temperature rise 2-3°C with sustainable development (RCP4.5 x SSP1) and average temperature rise of 3.6 to 5.4°C with urban sprawl (RCP8.5 x SSP5).

All populations are affected by high temperatures, but it is not known how quickly populations can adapt or the exact limits to adaptation. High ambient temperatures affect thermal comfort, productivity, energy use, and human health. One direct effect of a higher number of very hot days is likely to be the “slowing down” of work and other daily activities. Whether it occurs through “self-pacing” (which reduces output) or occupational interventions

(which increases costs), the end result is lower labour productivity and possibly an increase in occupational heat injury and death. High temperatures are likely to affect the capacity to undertake activities outdoors - whether for leisure or employment.

Climate change could also trigger longer periods of thermal inversion in cities leading to worsening air quality. There will be health benefits from milder winters (reduced cold-related mortality or morbidity), however with additional risks due to more slippery conditions in northern parts of Europe.

Lyme disease. Lyme disease is a potentially fatal infection spread by the bites of infected ticks, which has important implications for outdoor recreation. Cases of Lyme disease have risen recently due to greater exposure, as levels of outdoor activity have increased. Lyme disease risks are projected to increase in all scenarios in the two modelled areas – Scotland and Hungary – due to higher temperatures, which increase tick activity. It is likely that other European countries will also be affected.



Risk of Lyme disease in Hungary in 2100 based on the projected number of infected ticks per km² in four scenarios with lower (SSP1, SSP4) or higher (SSP3, SSP5) climate change (T) and different changes in forest area (F)

What adaptation and mitigation pathways are possible?

Urban areas are vulnerable to increased heat, flooding and pollution due to climate change, but they can also be centres of innovation for climate-smart technologies and new ways of living and working. Efficient use of resources such as water and energy, coupled with high human, social and natural capital, can increase coping capacity and reduce vulnerability to climate stress.

Compact and sustainable urban forms are a pre-requisite for achieving climate targets: to encourage walking, cycling and public transport, reduce car dependence and associated noise and air pollution, reduce heating/energy costs, encourage circular economies (lower material footprint), improve social service provision and reduce competition with land for agriculture, forestry and nature. New work-place arrangements, to reduce unnecessary travel and enable new forms of a sharing economy, could lead to multiple co-benefits for health, green wealth creation and more climate-resilient styles of urban living.

Green infrastructure in urban areas helps to prepare for climate change challenges, such as flooding and heat stress. The benefits of green and blue environments for health, not least mental health, have been widely reported. The challenge is to balance provision of green and blue infrastructure with the development of compact urban forms.

Adapting to heat. Urban areas need to develop heat-wave plans, including protection for vulnerable citizens. Improved urban planning and housing design, including retro-fitting, can reduce heat-related impacts. However, modelling suggests that as the climate becomes warmer, it will be increasingly challenging for naturally ventilated buildings to maintain comfortable indoor thermal conditions, so there is likely to be an increased uptake of active cooling systems. This will increase energy consumption and could lead to greater greenhouse gas emissions, unless zero-carbon energy sources are used.

Policy Recommendations

- **Plan for compact, green and sustainable cities.** Sustainable development scenarios are strongly dependent upon a substantial shift in societal preferences to high-density, environmentally-friendly city living. Strong planning regulations are required to achieve the targeted residential densities of city areas while protecting and enhancing the green and blue spaces that are needed for climate adaptation, health and wellbeing.
- **Develop climate-smart adaptation plans.** Adaptation plans should maximise the use of actions that have synergies with the goal of reducing greenhouse emissions. These include buildings with passive cooling, and nature-based solutions (such as green space and permeable surfaces, green roofs and walls, street trees, parks and wetlands) that provide cooling, shading and stormwater infiltration or retention together with other health and wellbeing benefits. To mitigate the impacts of any increase in the use of air conditioning, a rapid shift towards zero-carbon/renewable electricity should be promoted.
- **Raise awareness of Lyme disease.** Increase efforts to educate the public and public health practitioners so that both patients and doctors are aware of how to minimise risks and what to do in case of infection. Modelling the distribution of potential tick habitat will help design adaptive disease management strategies and information campaigns.

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Find out more: www.impressions-project.eu. and Terama et al. (2017) Modelling population structure in the context of urban land use change in Europe. Regional Environmental Change, DOI 10.1007/s10113-017-1194-5.

