**Written evidence submitted by the Nature-based Solutions Initiative at the University of Oxford, the Royal Society for the Protection of Birds (RSPB) and the Worldwide Fund for Nature (WWF)**

EAC Inquiry on Heat Resilience and Sustainable Cooling

*Summary*

Climate change is intensifying and increasing the likelihood of extreme and prolonged heat events. Statistics have indicated that around 2,800 more people aged 65 and over died in England during the 2022 summer heatwaves. Factors such as age and health inequalities affect how vulnerable people are to extreme heat. Increasing use of air conditioning is projected to cause substantial additional greenhouse gas emissions, exacerbating climate change.

High-quality nature-based solutions including street trees and urban woodlands, parks, green roofs and green walls can offer an approach to improving heat resilience without increasing emissions, and they also deliver a range of co-benefits for people and wildlife. However, due to the magnitude of projected climate change impacts (and risk to nature itself), technological solutions - especially improvements to building design and insulation - will be needed in conjunction with nature-based solutions as part of a hybrid approach to improving heat resilience whilst helping limit increases in energy consumption.

To expand the use of nature-based solutions, it is important that government departments at national, regional and local levels communicate more with each other about nature-based solutions to help break down silos and harmonise policy support. Community co-design is vital in the success of nature-based solutions and the government should mandate the use of defined standards for delivery such as the IUCN Global Standard for Nature-based Solutions.

Based on reports such as the third Climate Change Risk Assessment, we have a good understanding of the trajectory of change in terms of extreme heat. However, policy mechanisms such as the third National Adaptation Programme and National Planning Policy Framework are inadequate in their current form to properly incentivise heat resilience measures, particularly nature-based solutions. In particular, there is an urgent need to provide stronger protection for existing mature urban trees and green spaces, increase nature-rich green and blue spaces in deprived areas, and accelerate uptake of high-quality green roofs.

Alongside green infrastructure, the UK's existing public and private sector housing stock urgently needs initiatives such as the Energy Company Obligation Scheme to overcome the well-known barriers to deployment of energy-saving measures, in order to retrofit and insulate properties to a high standard. This would not only reduce energy bills and carbon emissions, but also keep homes warmer in winter and cooler in summer, thereby making homes more comfortable places to live and reducing the negative health impacts associated with living in poor quality housing.

Reversible heat pumps are also poised to play a crucial role in addressing future cooling (and heating) demands in households. They are energy efficient and their dual functionality eliminates the need for separate heating and cooling systems, simplifying installation and maintenance processes.

Excess deaths from heatwaves in the UK are preventable. As the intensity and frequency of heatwaves increases with climate change, the Government must do more to prepare for and prevent overheating through ensuring we have a robust and well-resourced national plan in place to help the UK be more resilient to extreme heat.

*Q1. What evidence exists on the relationship between heat and human health (mortality and morbidity), and which communities are worst affected?*

Last year, the UK experienced record-breaking heat with temperatures exceeding 40°C. As the UK is not experienced or well equipped for dealing with extreme heat, there were huge human health implications and impacts on care services. Statistics have indicated that around 2,800 more people aged 65 and over died in England during the 2022 summer heatwaves alone than would have otherwise. Looking across a longer time horizon, there is statistical evidence that a total of 10,649 excess deaths occurred in heat-periods from 2016 to 2021 for people aged 70 years and over. Many of these deaths could have been prevented if the UK had a better informed and implemented strategy for extreme heat conditions.

Climate change is intensifying and increasing the likelihood of extreme and prolonged heat events. A study by a team of leading climate scientists found that the 2022 heatwave was made at least 10-times more likely due to human-induced climate change.

Other factors also come into play when considering the health risks of extreme heat, including urbanisation, the UK's ageing population, pressures on services and local levels of preparedness. Homeless people are less likely to have access to water and suncream, and are more exposed to the intense heat without shelter. Elderly people, those confined to a bed and those with chronic health conditions are more likely to face mortality during heatwaves. Existing health inequalities, notably in the UK for Black Asian and Ethnic Minority communities will likely lead to increased health impacts during heatwaves. Socio-economic inequalities will also exacerbate the health impacts of heat events with those living in more densely populated urban areas and with limited access to gardens, green space and proper ventilation being more vulnerable.

*Q2. How can sustainable cooling solutions and adaptation strategies be implemented in such a way as to minimise overheating, reduce energy consumption and prevent overloading of the electricity grid during peak demand?*

Due to the 'urban heat island effect', cities experience average day and night temperatures which are 1 to 3°C warmer than surrounding natural and agricultural landscapes which can lead to higher risks to health during heat events.

There is a high risk that increased use of air conditioning, with its high energy consumption (worldwide cooling energy demand is projected to exceed the combined 2016 electricity generation of the US, EU and Japan by 2050), will lead to further greenhouse gas emissions and thus trap us in a vicious circle by exacerbating climate change. However, there are two options that can tackle urban heat without increased energy use: building design and nature-based solutions.

Sustainable building design can make use of passive cooling features, good insulation, ventilation, reflective (white-painted) surfaces, awnings, shutters and blinds. In line with our expertise, in this response we will focus on the use of high-quality nature-based solutions for cooling and shading, but emphasise that due to the magnitude of projected climate change impacts (and risk to nature itself), technological solutions will often be needed in conjunction with nature-based solutions as part of a hybrid approach to improving heat resilience whilst helping limit increases in energy consumption.

Nature-based solutions are actions which involve people working with nature to address societal challenges, such as our need to adapt to climate change, with benefits for both people and biodiversity. In the built environment, this includes various types of green-blue infrastructure, such

as street trees, urban woodland and parks, green roofs, green walls, water features and other urban greening, which provide a cooling effect through shading and evaporation. In line with Natural England's Green Infrastructure Standards, green infrastructure should consist of a connected network of healthy, biodiverse habitats to deliver maximum benefits for people and nature.

By directly cooling and shading buildings, green infrastructure helps to reduce energy demand for cooling, saving both costs and carbon emissions. Urban greening was estimated to deliver benefits worth nearly £300 million per year for 11 UK city regions, through avoided worker productivity losses and reduced cooling costs. Research in Glasgow has shown that surface temperatures can be up to 20°C lower and air temperatures up to 8°C lower under trees in a park. A global review in Nature found that vegetation on the ground typically reduces peak surface temperature by 2–9°C, while green roofs and green walls reduce surface temperature by ~17°C.

Even small urban green spaces such as community gardens can help bring a cooling effect. Well-designed green roofs can also contribute to urban cooling and increase the thermal efficiency of buildings, as well as helping manage stormwater and providing biodiversity benefits. Green roofs help to save energy costs and emissions from heating or air conditioning, provided they are well designed with adequate substrate depth (e.g. complying with the GRO Code for green roof best practice). Green roofs have been found to cool the buildings beneath them by as much as 12°C in Italy and 27°C in Texas compared to conventional roofs, while green walls can be up to 32°C cooler than conventional walls and can save up to 59% of energy in the building. A study has even shown that green roofs installed in the West Midlands were estimated to offset 25% of heat-related mortality. In addition, when installed as part of 'bio-solar' roofs, green roofs can improve the efficiency of photovoltaic panels by reducing overheating.

A major strength of green infrastructure is that it can simultaneously address other climate impacts by reducing flooding and increasing groundwater infiltration, which can boost groundwater reserves and thus help to reduce water scarcity. It also provides other co-benefits for health and the economy, making places more attractive to workers, visitors and businesses. For example, the annual economic contribution of the City of London's eight million trees was estimated to be £132.7 million annually, including through evaporative cooling increasing air-conditioning unit efficiency. This cooling from urban trees was predicted to save up to £22 million in annual energy consumption across inner London alone. Crucially, green infrastructure also supports urban biodiversity, helping to deliver on the government's nature recovery goals and providing nature-rich green spaces that deliver health and wellbeing benefits for local people.

High-quality nature-based solutions in urban spaces should therefore be implemented, enhanced and protected due to their potential to help with adaptation sustainably and deliver co-benefits without associated high energy consumption. However, nature-based solutions are themselves at risk from climate change impacts such as drought and heatwaves. This highlights the need to redouble efforts to reduce greenhouse gas emissions to limit climate impacts. Climate resilience can be enhanced through establishing healthy, diverse and connected urban ecosystems, intelligent design such as use of grey water for irrigation, and reducing other stressors such as air and water pollution.

**Recommendations:**

1. Recognise urban trees and other green-blue infrastructure as essential infrastructure alongside utilities, to be incorporated at the first stage of planning and help drive forward implementation of high-quality nature-based solutions in urban settings.

2. Mature trees, hedgerows and woodlands are far more valuable for cooling and shading than newly planted ones but too often these are lost during new development. Much stronger protection for existing trees and woodland is therefore needed in the planning system.
3. Budgets available to local authorities to invest in and manage urban green infrastructure should be increased without risk of stop-start investment.
4. In addition to policies driving the quantity or area of nature-based solutions, it is vital that regulations and standards are put in place and used to ensure good quality (e.g. Trees in the Townscape principles can be applied to ensure high quality integration of trees into urban areas). Evidence hubs and information resources should also be promoted such as IGNITION and Naturvation.
5. For the full benefits of urban nature-based solutions to be realised, it is important that a rich variety of blue and green infrastructure measures are considered in order to cater for a range of climatic conditions and to support a greater diversity of wildlife, in turn strengthening the resilience of people *and* nature.
6. To increase climate resilience and maximise biodiversity benefits, urban green infrastructure should consist of connected networks of healthy ecosystems incorporating a diverse mix of native species (following Natural England's Green Infrastructure Standards), and other stressors including air and water pollution should be reduced.

*Q3. What actions can be taken to protect those most vulnerable to the impacts of extreme heat?*

In line with the expertise of the RSPB, Nature-based Solutions Initiative and WWF, this response will focus primarily on nature-based actions which can be used to protect those most vulnerable to the impacts of extreme heat. Complementary approaches to cooling (such as improved ventilation and insulation) are also important and will play a key role alongside nature-based solutions as part of a hybrid approach as mentioned above, but we are particularly keen to highlight the co-benefits that nature can deliver in tackling extreme heat.

As outlined in response to inquiry question two, improving the quantity, quality and access to nature-rich spaces in the built environment can help bring multiple benefits including respite from extreme heat. However, the proportion of green and blue space in urban areas is declining (2% reduction between 2016 and 2022). In addition, deprived communities have less access to green space: in the 200 most disadvantaged urban Lower Super Output Areas (those with the lowest levels of accessible green space combined with the highest levels of deprivation), only 3% of people have access to green space within a 15-minute walk. These communities are also those that are most vulnerable to climate change impacts such as overheating and flooding. Increasing green space and urban trees in these areas is a priority.

To maximise the benefits for vulnerable communities it is important to co-design nature-based solutions in urban areas. Given the particular socio-economic and socio-cultural challenges facing some urban communities, it is vital to integrate a participatory placemaking approach to equitable co-design, co-creation and co-management of urban nature-based solutions. This should include multiple stakeholders and beneficiaries, with the social impacts of urban nature-based solutions (including hidden drivers that lead to 'green gentrification') explicitly considered to avoid exacerbating existing socio-environmental inequalities. This would increase the chance of designing nature-rich spaces which are resilient, genuinely accessible, usable and valued community assets that meet the needs of people in a given area.

Detailed spatial planning is also a very important part in delivering effective cooling through nature-based solutions. This could help identify opportunities to strategically and sensitively locate new green spaces near more deprived and in-need communities in order to maximise health and wellbeing benefits. It could also help in terms of designing in co-benefits for example through locating woodland strips and hedges between transport infrastructure and homes in order to deliver air pollution and noise reduction alongside the cooling effects.

**Recommendations:**

7. Capacity and skills gaps across local authorities and associated organisations should be addressed, particularly around designing nature-based solutions to suit local conditions and socio-economic circumstances.
8. Requirements should be put in place for local authorities to protect and provide green space and urban trees, with strengthened supporting planning policy, especially in the most deprived communities identified on the Natural England green infrastructure map. This should also mandate long-term monitoring and evaluation of nature-based solutions to gather stronger evidence on the benefits of nature-based solutions, including how impacts differ across different vulnerable groups.
9. Detailed spatial planning and co-design with local communities should be an integral part of any roll-out of nature-based solutions to address overheating in the built environment.
10. This must all be underpinned by robust financing. Blended finance options that use public funding to leverage private funding must be developed as well as ensuring that different funding sources can work together.

*Q4. To what extent do the Government's Climate Change Risk Assessment and National Adaptation Programme (as well as other related strategies such as the Net Zero Strategy and Heat and Buildings Strategy) identify and address the risks from extreme heat? (Note: The third NAP, covering the five-year period from 2023-2028, is expected to be published in the summer of 2023)*

Relating specifically to human health, chapter five of the UK's third Climate Change Risk Assessment (CCRA3) technical report focuses on Health, Communities and the Built Environment. This provides a comprehensive overview of the evidence regarding key risks and opportunities for the UK population including addressing how climate change risks are likely to vary across different settlement types and regions. There is also consideration of whether the health impacts of climate change will disproportionately affect certain groups. This assessment spans two scenarios (2°C and 4°C global average temperature increases) and includes an assessment of the magnitude of risks and the potential future impacts.

The Natural Environment Chapter of CCRA3 also identifies the impacts of extreme heat on both nature and worked land (agriculture and forestry). In particular, there is a focus on the current and future impacts of wildfire associated with extreme heat. In the recent third National Adaptation Programme (NAP3) for England, there are positive proposals outlined to address wildfire including supporting the Home Office to scope out a Wildfire Strategy and Action Plan by mid-2024.

The latest adaptation progress report (March 2023) to Government from the Climate Change Committee highlighted that we lack adequate policies (including within the planning system) and funding to address overheating in existing homes and buildings. It also highlighted that a greater understanding is needed on the efforts required to address risks as well as key areas such as heat thresholds. A particular area of criticism in the progress report is the lack of policies to incentivise

adaptation in existing buildings, despite the Green Building Council stating that 80% of homes that will exist in 2050 are already built.

Despite these recommendations, NAP3 does not sufficiently address the risks of extreme heating as it only includes broad commitments around 'proportionate interventions' for overheating and retrofitting which are not specific, targetted or time bound. There is also a heavy reliance on existing policy areas regarding both nature and people (such as Environmental Land Management Schemes and recent updates to Building Regulations respectively), many of which were already in existence before the Climate Change Committee's progress report recommending greater ambition.

On the nature side, the CCRA3, Net Zero Strategy and NAP3 all acknowledge the benefits of nature-based solutions. CCRA3 recommends more integrated ecosystem-based approaches or nature-based solutions to contribute to adaptation, due to the high-level of inter-relationships between the natural environment and other sectors, as well as the chance to work with rather than against nature. In the recent Climate Change Committee adaptation progress report, a required outcome was 'biodiverse green roofs, street trees and sustainable drainage'. NAP3 also recognises that restoring nature has a wide range of potential benefits for helping communities, buildings, infrastructure and wildlife to adapt to climate change, such as cooling. However, in NAP3, DEFRA missed an opportunity to deliver nature-based solutions in the built environment as there are no new commitments or financing to incorporate nature into urban spaces to help provide cooling and other benefits.

Q5. Does *the current planning framework do enough to encourage heat resilience measures such as cooling shelters, water bodies, green infrastructure and shading to be integrated into urban planning? Where such measures are incorporated, how accessible and successful are they?*

The National Planning Policy Framework (NPPF) is highly inadequate in encouraging (or ensuring) heat resilience measures as it rarely, and only weakly, discusses urban cooling and lacks the necessary detail, incentives or mandates for meaningful action against extreme heat. At its core, the statutory purpose of the planning system should be defined in legislation with climate and nature recovery at its heart, and with reference to the Climate and Environment Acts.

More specifically, Section 12 of the NPPF deals with achieving well designed places. There is encouragement within this to include street trees in urban areas, but very little else from a heat resilience perspective. It also encourages all authorities to prepare local design codes, and there is a National Model Design Code to set a template which includes consideration of heating to some extent. However, there is an issue that these are all *encouraged* rather than *mandated* and rely too much on proactive efforts from local planning authorities to prioritise climate relative to other matters against a backdrop of major budget, capacity and skills challenges.

Heat resilience is not prioritised in the NPPF and therefore often gets lost. For example, Section 14 of the NPPF addresses climate but features very little detail on how built environments can be made more resilient to extreme heat. A key improvement here could be to be more specific and refer to other terminology such as high-quality nature-based solutions, and define what they are, supported by clear and accessible examples. Across the planning sector there needs to be more widespread awareness-raising of the potential of nature-based solutions in urban areas and an upskilling of planning officers and developer consultants on how to improve resilience through nature whilst delivering multiple co-benefits.

In general, heat resilience measures are not widely incorporated into new developments in the UK. There are notable exceptions such as Barratt Homes' Kingsbrook development which has been designed with wildlife-friendly features to help reconcile the requirements for housing in harmony with nature. However, even projects such as these have limitations due to the system rather than developers themselves, such as the mismatch in how local authorities interpret aspects of the NPPF and their own Local Plans.

Many measures to deliver climate resilience in existing properties are the result of costly retrofit projects to retrospectively correct what was not considered at the time. Some of these projects are on more recent developments (from approximately the last 50 years or less). The next tranche of retrofit projects will come from what we have been building in the last 20-30 years and continue to build now. Retrofit projects are also not implemented consistently across different areas as they tend to be driven by a few individuals rather than through local or national policy levers.

With regard to their success in delivering the desired adaptation, many peer reviewed papers report on the thermo-regulation of buildings through incorporating street trees and other green infrastructure. For example, a systematic review of evidence on green walls found that they could reduce energy demand for cooling buildings by up to 51%, and reduce the urban heat island by up to 5$^{o}$C. There is also a substantial evidence base on co-benefits such as carbon sequestration, flood alleviation and the absorption of airborne pollutants(e.g. this evidence synthesis and this global review). The Naturvation project has compiled an urban nature atlas demonstrating successful delivery of hundreds of projects globally, and the UK's IGNITION project has compiled a comprehensive evidence synthesis quantifying the outcomes of urban nature-based solutions.

In summary, the science and knowledge is there to demonstrate that nature-based measures are effective at tackling overheating in urban environments, but there is an inertia in the system due to a lack of protection for existing green infrastructure and a reliance on local actors to deliver nature-based solutions voluntarily.

*Q6. What can be done to protect the UK's existing public and private sector housing stock from the impacts of extreme heat while ensuring that homes are sufficiently warm in the winter months?*

First and foremost, existing schemes which aim to improve the insulation of the UK's existing public and private sector housing stock urgently need improving, in order to become effective programmes which retrofit properties to a high standard and would keep homes warmer in winter and cooler in summer; especially when used in conjunction with other cooling measures such as improved ventilation, blinds, shutters and awnings. Neglecting insulation not only puts households at risk of being more vulnerable during periods of extreme temperatures, but it also puts a strain on household expenses; for instance, the decision to discontinue insulation initiatives in 2013 has reportedly added £2.5bn to household energy bills in the UK.

The Government's landmark Energy Company Obligation (ECO) Scheme has the potential to facilitate the installation of energy-saving measures in households which may otherwise lack the financial means. Over the period spanning 2013-2021, the Scheme has collectively saved low-income households an estimated £1.75bn on energy bills. However, ECO has yet to reach its full potential. Since the introduction of ECO4, installations have drastically declined, with only 6.6% of the homes it was projected to support in the scheme's first six months actually being supported.

Urgent attention is needed to address the challenges the scheme faces, which includes widening the eligibility of homes for ECO4, to ensure more people can benefit from the scheme, and providing long-term training and funding to support skills and supply chains. In addition, because most of the government's current energy efficiency support schemes for households end in 2025/26, there is a need to start planning the scaling up of support for households in additional waves of ECO. The government should start planning now for a new and bigger single integrated scheme, which will step up the delivery of existing schemes. Indeed, the UK government should also look at ways of scaling up existing programmes, such as the Great British Insulation Scheme, particularly in its latter years, in 2024/25 and 2025/26.

These building improvement measures can be complemented by a green-blue infrastructure retrofit programme, targeting the areas with the least existing green space as identified in England by Natural England's Green Infrastructure maps. This would be a cost-effective approach to improving climate resilience and bringing a wide range of additional benefits to people and nature. This would include implementing nature-based solutions such as sustainable drainage systems, increasing street tree canopy cover (including in association with bioretention rain gardens alongside kerbs), creating or expanding urban parks, and mapping the potential for retrofit of green and biosolar roofs and green walls. Some pioneering examples of urban greening programmes already exist, such as the use of the Urban Greening Factor as a planning requirement to incentivise installation of green roofs in London, but this needs to be urgently scaled up across the UK.

In addition to creating new areas of green space, investment is urgently needed to improve the climate resilience and cooling capacity of existing urban spaces, which often consist mainly of short-mown amenity grass or - worse - hard surfaces or artificial grass that contribute to the urban heat island effect. This could include adding trees, shrubs and herbaceous planting, as well as replacing short-mown turf with areas of longer flower-rich grass. These nature-rich green spaces will have much greater cooling ability than conventional amenity grass, as well as soaking up more floodwater and bringing benefits for urban biodiversity, including pollinators. Guidance is available to help educate the public and local policymakers on the benefits of managing urban green spaces for nature and climate resilience.

*Q7. What role might reversible heat pumps (which can act as both heating and cooling systems) and other emerging technological solutions, such as the development of smart materials, play in meeting future cooling demands?*

Reversible heat pumps are poised to play a crucial role in addressing future cooling (and heating) demands in households. They are already being used effectively in European countries with similar climates to the UK, and also those which experience hotter summers and cooler winters, making them versatile solutions for year-round thermal comfort. Their dual functionality increases their attractiveness and eliminates the need for separate heating and cooling systems, simplifying installation and maintenance processes.

Heat pumps are incredibly energy efficient, and have been found to be up to three times more efficient than gas boilers, as they are able to give out three to four units of heat for every unit of electricity consumed. This means they require less energy to run, which reduces the overall energy demand of the household. Additionally, because they run on electricity, reliance on fossil fuels can help decrease, which has the added benefit of reducing household carbon emissions and improving

indoor air quality. Heat pumps have repeatedly been found, by many different organisations, to have the potential to reduce energy bills, while also raising property value by £4,500 - £8,000.

As such, there are a wide range of benefits to heat pumps and, as stated, they have the potential to play a crucial role in the future of cooling houses in the UK, particularly as the climate crisis advances and heat waves become more common. However, they will only play a crucial role if the government makes a concerted effort to overcome the barriers currently faced by the heat pump industry, which is stunting deployment.

The Government's Boiler Upgrade Scheme has seen lower than anticipated uptake. This can be attributed to many different factors, including low awareness of heat pumps amongst the general population, coupled with widespread misinformation surrounding heat pumps, a turbulent political landscape and the cost-of-living crisis. In order to overcome these barriers, the Government should take proactive steps to support the heat pump industry and provide further detail on how the allocated £6 billion of public funding will be used to support the extension of the Boiler Upgrade Scheme between 2025 to 2028; this should also include details of how enhanced support will be available before then.

Improved marketing and advertising of the scheme is also essential, as is better customer support services. Many people do not know where to go for trusted support or advice, remedying this would go a long way to driving uptake. Likewise, sustained and expanded government backing for green finance products, such as an Energy Saving Stamp Duty, would further incentivise uptake.

Plans for the future of the Clean Heat Market Mechanism and grant schemes after 2028 must be laid out as soon as possible, and no later than 2025, in order to prevent a sudden drop-off in the market and avoid any potential market instability. Moreover, if reversible heat pumps are to fulfil their potential and meet future cooling demands, then a concerted effort to upskill the workforce and ensure adequate delivery of the Energy Company Obligation schemes for insulation (to ensure the most effective use of heat pumps) are imperative.

While reversible heat pumps have the potential to play a defining role in meeting future cooling demands, failing to address the aforementioned barriers could hinder their ability to reach their full potential. Without intervention, reliance on less efficient air conditioning systems during increasingly frequent heat waves may rise, underscoring the urgency of action.

*Q10. How effectively is the Government working across departments and with local authorities to ensure a coordinated approach is taken to heat resilience?*

High mortality rates relating to heat events are indicative of the need for improvement in the Government's approach to heat resilience.

As high-quality nature-based solutions are an effective approach to building up heat resilience, bringing multiple co-benefits, it is important that government departments at national, regional and local levels communicate more with each other about nature-based solutions. This would help towards breaking down silos, overcoming barriers, identifying common goals and harmonising policy support.

Disjointed and siloed decision-making at both national and local government levels can lead to missed opportunities for nature-based solutions. Lack of policy coherence can also lead to activities in one sector causing damage to existing nature-based solutions, or implementation of poor-quality

interventions aimed at just one goal that fail to deliver multiple benefits. For example, policies to promote housing and infrastructure development are driving the loss of woodlands, wetlands, urban trees and green spaces that provide climate adaptation services.

Alongside helping to tackle extreme heat, nature-based solutions offer the potential for synergies between many policy goals, but only if carefully designed and supported by an integrated approach that addresses climate change and nature recovery alongside other policy issues. Policy coherence could be promoted through developing shared cross-departmental visions, using a systems approach to consider interactions between policy objectives. Setting up cross-departmental working groups in all four national governments is necessary to promote the heat resilience agenda and the delivery of high quality nature-based solutions by developing shared visions, targets and action plans. The Climate Resilience Board, which was a commitment in the third National Adaptation Programme, could be instrumental in having oversight of this and should have a clear focus on the potential for nature-based solutions in helping us adapt.

Nature-based solutions delivery should be integrated into local plans and policies through a participatory landscape approach, to deliver a diverse portfolio of the right nature-based solutions in the right places while balancing multiple objectives. Solutions should be co-designed to ensure that they meet stakeholder needs, and to ensure buy-in, as well as supported by education and engagement explaining why such an approach is being adopted and the benefits it would bring.

As implementation will largely be local, the Government should mandate the use of set quality standards such as the IUCN Global Standard for Nature-Based Solutions. Minimum standards should also be set for green roofs in national and local planning policies, equivalent to 'Biodiverse Green Roofs' with adequate depth of substrate to deliver cooling and drainage services, as defined in the 2021 GRO (Green Roof Organisation) code, to move away from the current preference for thin sedum mats with few benefits. Higher standards should also be adopted for sustainable drainage systems to ensure that high quality open, vegetated systems with benefits for water quality, biodiversity and amenity are delivered rather than basic underground pipes and tanks. Revised standards have been developed for England which should now be adopted in line with Climate Change Committee recommendations.

Finally, more long-term research and monitoring could potentially be delivered by Centres of Excellence for nature-based solutions research and demonstration, e.g. a global centre, local or regional centres and/or topic-based centres, which could be integrated with regional or national delivery institutions. In particular, further work is needed to address key issues such as how to ensure adequate irrigation for urban green infrastructure without exacerbating water scarcity, how to overcome regulatory barriers to the use of biosolar roofs, and how to increase green space in deprived areas without leading to 'green gentrification'. It would also be useful to increase monitoring of outcomes in the UK, to complement the extensive global evidence base.

*Q11. Does the UK need a dedicated Heat Resilience Strategy? What lessons can be learned from other nations when it comes to national strategies for heat resilience?*

The UK is likely to face at least 30% more uncomfortably hot days if the world overshoots the 1.5°C target, and is one of the most underprepared countries in the world. It is therefore of vital importance that the UK has a detailed and robust national plan in place to help the country be more heat resilient, which is properly resourced at the local authority level. Capacity, knowledge and collaboration, as well as financial resources, must be increased locally, taking into account local

variations in the risk of extreme heat and level of vulnerability of the population (e.g. with more funding for areas with high levels of deprivation, high urban heat island effects and low green space cover).

Whilst this should be underpinned by a national top-down strategic direction and supported through central government funding, any dedicated Heat Resilience Strategy must ensure a holistic approach is taken which mandates cross-department delivery across the UK. A Heat Resilience Strategy must help urgently engage different parts of government across the UK and should see a range of departments (such as DEFRA, DLUHC and DfT) jointly responsible for the delivery and implementation of the strategy. Without cross-governmental support, the urgent actions and necessary high ambitions will not be realised. Arguably, such a National Heat Resilience Strategy should have been announced as part of the most recent National Adaptation Programme (July 2023).

A Heat Resilience Strategy should consider interactions with other extreme weather conditions and associated risks such as drought and wildfires, rather than focussing on heat in isolation. To focus only on heat would risk missing opportunities to identify synergies and deliver co-benefits. As a key part of this, planning frameworks should provide stronger protection for existing green infrastructure including urban trees and green spaces, and incentivise the use of well planned high-quality nature-based solutions to tackle extreme heat alongside delivering co-benefits (e.g. for flood protection, carbon storage, air and water quality and nature recovery) which are not available through other approaches such as insulation.

An example of this thinking can be seen in the Athens Resilience Strategy for 2030 which includes making Athens a 'green city' as a fundamental part of the vision for the city. This includes integrating natural systems into the urban fabric of Athens to improve the city's air quality and reduce impacts of flooding alongside the cooling benefits. This has financial support from the national to local level as well as through the private sector.

Excess deaths from heatwaves in the UK are preventable. As the intensity and frequency of heatwaves increases with climate change, the Government must do more to prepare for and prevent overheating by urgently improving both grey and green infrastructure, to reduce the growing health, environmental, social and economic consequences of extreme heat.

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