Map Impact®

The Where of Compounding Climate Risks

Detailed mapping and monitoring of Heat, Drought, and Wildfire climate risks to support multiple stakeholders

A Map Impact white paper

December 2024

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Executive Summary

This white paper introduces HeatView™, DroughtView™, and WildfireView™, innovative data tools designed to provide detailed locational hazard assessments across the Unitied Kingdom. These products utilise high-resolution analyses to map risks associated with rising temperatures, reduced water availability, and increasing wildfire threats. Drawing on diverse open-source datasets – including satellite imagery from European Space Agency's Copernicus program and USGS's Landsat program, climate projections from the Met Office, health data from the Office for National Statistics (ONS), and locational data from Ordnance Survey (OS) – these tools deliver actionable insights for stakeholders across sectors.

Key Insights

1. Heat Stress: HeatView quantifies the intensity of urban-heat-islands using a combination of land surface temperature data, vegetation indices from Sentinel-2, historical meteorological and climatic data records. Hospitalisation and mortality data from ONS can be layered with these findings to identify high-risk areas and inform targeted interventions.

2. Drought: DroughtView employs vegetation indices such as Normalised Difference Vegetation Index (NDVI) from Sentinel-2 to monitor vegetation health and soil moisture proxies. Long-term climate projections from the Met Office are integrated to anticipate future drought 'hot spots' and assess water stress on agricultural and natural ecosystems

3. Wildfire: WildfireView leverages vegetative cover data from BiodiversityView to estimate fuel potential for load and fire propagation risk and the machine learning model is trained against known historical wildfire events. Landsat thermal imagery is combined with climate forecasts to identify locational areas susceptible to more prolonged dry spells and wildfire risk.

4. Compounding Risks: Growing evidence that the individual risks have a synergistic effect by combining in acute events to create calamitous outcomes. In 2024 there were some prolific examples of this synergy in Southern Europe and Canada with extreme heat causing drought and wildfires.

Benefits and Applications

Urban Planning: Inform strategies for cooling urban environments through green spaces and infrastructure adaptation.

Agriculture: Guide water-efficient farming practices and drought-resilient crop selections.

Conservation: Target wildfire prevention in critical habitats and biodiversity hotspots.

Public Safety: Enhance emergency preparedness for heatwaves and wildfire, protecting human health and property.

Asset Appraisal and Performance: Evidential assessment of current and future susceptibility to climate hazards that could impact asset valuations or insurability.

By integrating predictive modeling, granular spatial analysis, and climate forecasting, HeatView, DroughtView, and WildfireView empower policymakers, urban planners, emergency responders, and conservationists with tools to address climate challenges proactively. These solutions align with UK's broader climate adaptation strategies, supporting a resilient and sustainable future.

The methodologies and findings detailed in this paper underscore the urgency and feasibility of localised, data-driven responses to the growing climate crisis.

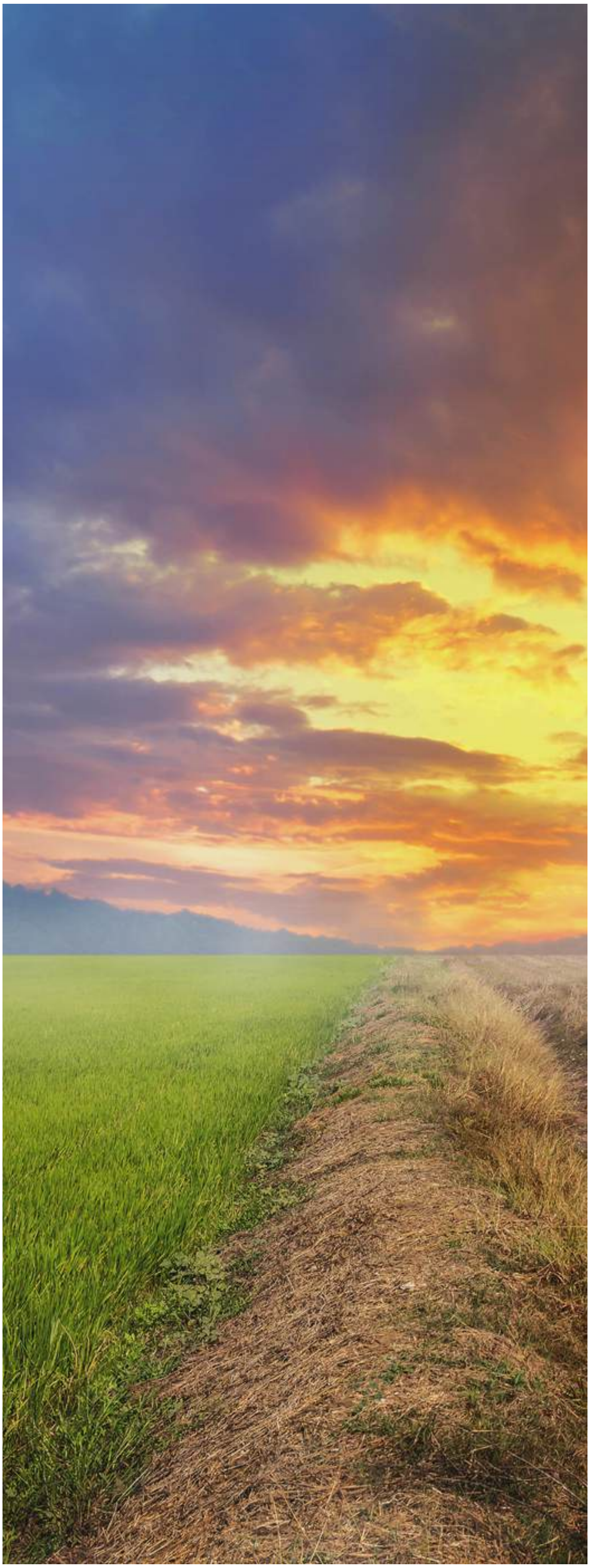
Introduction

Climate change poses increasingly severe challenges worldwide, and the United Kingdom is no exception. Rising temperatures, prolonged dry spells, and an uptick in extreme weather events are driving a surge in climate-related risks, including heat stress, drought, and wildfires. These phenomena, once considered rare in temperate regions, are becoming pressing concerns, with wide-ranging implications for human health, ecosystems, and infrastructure.

Effective risk management begins with accurate hazard identification. Understanding where and how these risks manifest at a granular level is critical for enabling proactive decision-making, informed planning, and resource allocation. However, traditional assessments often lack the detailed locational data from spatial resolution needed to address the multifaceted nature of climate risks.

To meet this challenge, Map Impact's suite of data tools: **HeatView™**, **DroughtView™**, and **WildfireView™** – delivers precise locational hazard assessments, covering every 50-metres of terrestrial landcover across the United Kingdom. These innovative products are designed to provide actionable insights, empowering policymakers, urban planners, asset financiers and insurers, and emergency responders to better anticipate and mitigate the impacts of climate change.

This white paper explores how HeatView, DroughtView, and WildfireView operate, their underlying methodologies, and their applications in identifying and addressing climate risks. By showcasing these data tools, we aim to demonstrate the value of high-resolution hazard mapping in fostering climate resilience and supporting sustainable development across the UK.



Physical Risks of Heat Stress, Drought, and Wildfire in the UK

Heat Stress

Heatwaves have become more frequent and intense, posing significant health and infrastructure risks. For instance, the summer of 2022 witnessed record-breaking temperatures exceeding 40°C in parts of England. Projections indicate that by the 2070s, southern UK regions could regularly experience days above 40°C, a marked increase from historical norms. Heat-related illnesses, including heat exhaustion and cardiovascular stress, disproportionately affect vulnerable populations such as the elderly and those with pre-existing health conditions. Without adaptive measures, heat related deaths in the UK could surpass 21,000 annually by the 2070s under high emissions scenarios. Long-term exposure to extreme heat can adversely affect the materials making up a building's infrastructure requiring planned mitigation and may require additional cooling or ventilation considerations, especially in areas impacted by urban heat island effects.

Drought

Adverse water stress events, caused by droughts, in the UK are becoming more frequent due to reduced summer rainfall, increased extreme heat, and higher evaporation rates. By 2070, summers could be up to 60% dryer, significantly impacting water availability for agriculture, ecosystems, and urban areas. The combination of these factors also exacerbates soil degradation, leading to reduced agricultural productivity and food insecurity. Additionally, longer-term exposure to repeated drought events can lead to significant undermining of property foundations and cause subsidence and stability issues – impacting asset values and insurability.

Wildfire

By integrating predictive modeling, granular spatial analysis, and climate forecasting, HeatView, DroughtView, and WildfireView empower policymakers, urban planners, emergency responders, and conservationists with tools to address climate challenges proactively. These solutions align with UK's broader climate adaptation strategies, supporting a resilient and sustainable future.
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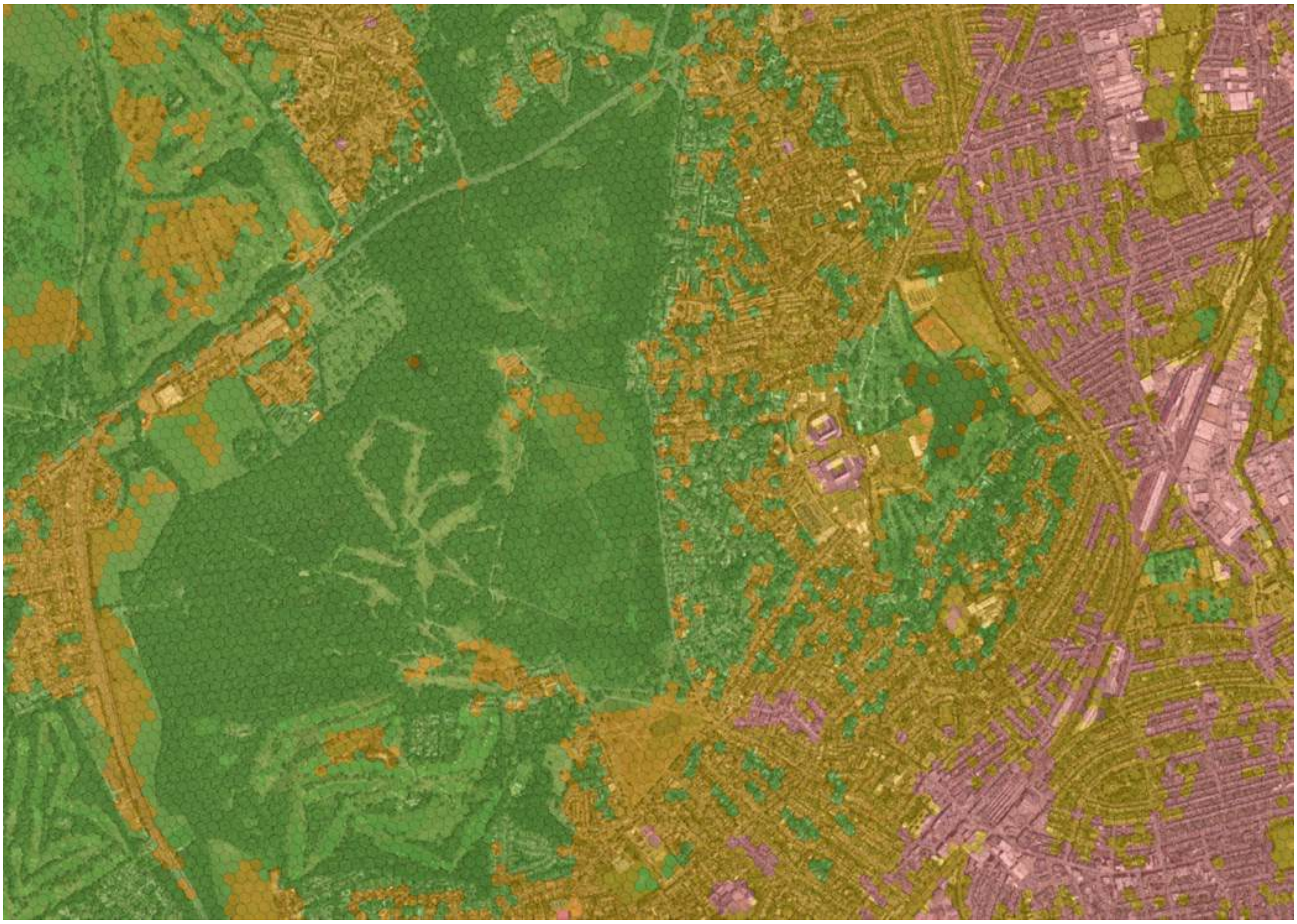
The Compounding Effect

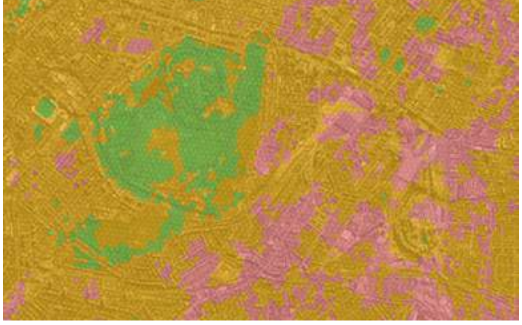
Whilst the three risks individually present prominent levels of acute hazard, their ability to work synergistically is even more impactful. In 2024 the world has witnessed the dramatic news coverage of extreme heat events, causing drought and subsequent wildfires, covering large areas of Australia, Canada, and Southern Europe – where hundreds of thousands of hectares of land have been put out of use, together with the resulting loss of habitats and species. The potential for these three physical risks to work in unison is prolific and warrants particularly close attention.

Implications and Mitigations

These risks necessitate robust adaptive measures and early warning; products like HeatView, DroughtView, and WildfireView can provide critical insight for hazard identification and mitigation at fine spatial scales, aiding policymakers, emergency responders, and urban planners in building resilience. The UK's approach to addressing these risks must align with broader climate strategies, focusing on reducing emissions, enhancing land management practices, and investing in sustainable infrastructure.



HeatView mapping in Richmond, London

Methodology Behind HeatView, DroughtView, and WildfireView

The innovative approach of all three of these Map Impact products is rooted in the integration of diverse datasets, advanced geospatial analysis, and predictive modeling. These tools combine open-source and proprietary data to deliver highly detailed locational hazard assessments. Below, we outline some of the data sources and methodologies underlying each product.

Data Sources

1. Satellite Imagery

Sentinel-2: Used for high-resolution optical imaging. Sentinel-2 provides detailed insights into land use and vegetative health. This data supports analysis of urban-heat-islands and drought susceptibility.

Landsat: Landsat's thermal bands enable precise mapping of land surface temperatures, aiding in identifying urban-heat-island effects and wildfire risk locations

2. National Datasets

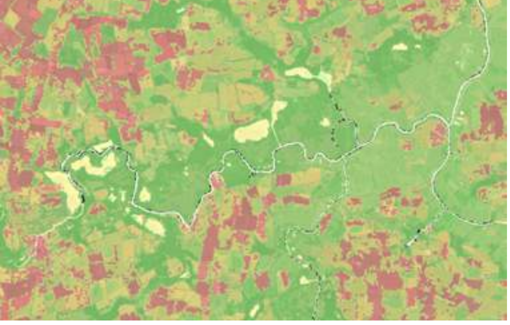
Office for National Statistics (ONS): Heat related hospitalisation and excess mortality data from ONS are crucial for understanding public health impacts and validating urban heat risk models.

Met Office Climate Projections: Future temperature and climate forecasts from UK Climate Projections (UKCP18) are used to anticipate changes in risk patterns under varying emission scenarios.

Ordnance Survey National Geographic Database (OS): The national mapping agency's data store of locational data

3. Proprietary Dataset

BiodiversityView®: Map Impact's in-house dataset provides comprehensive data on terrestrial habitat identification and condition and is assessed annually. This dataset is pivotal for assessing drought susceptibility, wildfire fuel availability, and potential urban greening strategies.

Analytical Framework

1. Heat Stress Susceptibility Assessment (HeatView)

HeatView quantifies the intensity of urban-heat-islands using a combination of land surface temperature data, vegetation indices from Sentinel-2, historical meteorological and climatic data records. Hospitalisation and mortality data from ONS can be layered with these findings to identify high-risk areas and inform targeted interventions.

2. Drought Susceptibility Assessment (DroughtView)

DroughtView employs vegetation indices such as Normalised Difference Vegetation Index (NDVI) from Sentinel-2 to monitor vegetation health and soil moisture proxies. Long-term climate projections from the Met Office are integrated to anticipate future drought 'hot spots' and assess water stress on agricultural and natural ecosystems

3. Wildfire Susceptibility Assessment (WildfireView)

WildfireView leverages vegetative cover data from BiodiversityView to estimate fuel potential for load and fire propagation risk and the machine learning model is trained against known historical wildfire events. Landsat thermal imagery is combined with climate forecasts to identify locational areas susceptible to more prolonged dry spells and wildfire risk.

Granular Assessment at a 50m Scale

These risks necessitate robust adaptive measures and early warning; products like HeatView, DroughtView, and WildfireView can provide critical insight for hazard identification and mitigation at fine spatial scales, aiding policymakers, emergency responders, and urban planners in building resilience. The UK's approach to addressing these risks must align with broader climate strategies, focusing on reducing emissions, enhancing land management practices, and investing in sustainable infrastructure.

Continuous Improvement

Our methods adapt as data and technology improve. We use machine learning and artificial intelligence to increase our prediction accuracy and expand the use of these tools in different areas and risk types. This data-driven approach helps HeatView, DroughtView, and WildfireView provide reliable insights. These insights empower users to effectively reduce the physical risks of climate change.

Benefits and Applications

The integration of HeatView, DroughtView, and WildfireView into climate risk management frameworks offers significant benefits across multiple sectors. By delivering high-resolution locational hazard susceptibility assessments, these tools enable data-driven decisions that enhance resilience, optimise resource allocations, and mitigate the impacts of climate change. Below are the key benefits and diverse applications of these data tools.

Benefits

1. Granular Hazard Identification

The 50-metre resolution of assessments allows for pinpoint accuracy in identifying locational risk hotspots, ensuring that interventions are both effective and resource-efficient. Localised insights are particularly valuable for tracking risks that vary within small geographic areas, such as urban-heat-islands or high-risk wildfire areas.

2. Improved Decision Making

Combining diverse datasets, including satellite imagery, climate projections, and demographic information, provides a comprehensive view of hazards. This empowers stakeholders to make informed, targeted decisions.

3. Proactive Adaptation

By forecasting future risks under different climate scenarios, these data tools enable stakeholders to implement preventive measures rather than reactive responses, reducing costs and long-term damages.

4. Cross-sector Utilization

The flexibility of these data tools supports a wide range of users, from policymakers and urban planners to financiers and insurers of assets, conservationists, and emergency responders.

5. Enhanced Climate Resilience

The outputs of HeatView, DroughtView, and WildfireView contribute directly to building climate-resilient communities by supporting strategic interventions at local, regional, and national scales.

Applications

1. Urban Planning and Infrastructure

HeatView: Urban authorities can use heat stress data to identify urban-heat-islands and implement strategies such as tree planting, reflective materials, or enhanced ventilation in densely populated areas. Local councils in cities such as Manchester and London for example can target cooling initiatives in vulnerable neighbourhoods, reducing heat-related health impacts.

2. Agriculture and Water Management

DroughtView: Farmers and water utility services can use drought risk assessments to optimise irrigation strategies, adapt crop selections, and prioritise regions for water conservation efforts. In places such as East Anglia, agricultural stakeholders can plan for water-efficient crops based on locational drought data and records, mitigating the economic impacts of water scarcity.

3. Conservation and Biodiversity

WildfireView: Conservationists can identify fire-prone ecosystems, like heathlands and forests, and implement firebreaks, controlled burns, or reforestation with less flammable species. The Wildlife Trust in Scotland's Caledonian Forest region for instance can prioritise fire management interventions using wildfire risk maps.

4. Public Health and Safety

HeatView: Local authorities and National Health agencies can use hazard data to prepare for and mitigate health impacts of acute extreme heat events, such as public cooling centres or targeted health warnings for vulnerable populations. During heatwaves, public health agencies can deploy resources to areas with historically high rates of heat-related hospitalisations.

5. Emergency Preparedness and Response

WildfireView: Emergency services can incorporate wildfire and heat stress risk data into contingency planning, enhancing their ability to respond swiftly and effectively to crises. Fire and rescue services in Somerset for instance can pre-position resources in high-riskareas during periods of extreme heat and dry conditions.

Applications (continued)

6. Asset Appraisal and Performance

Businesses and people purchase and invest in buildings and land, to live in and operate to produce goods and services. These economic assets are valuable – with value being assessed, financed, and insured – and can be vulnerable to risks that climate hazards pose on locations. Conveyancers are now guided to search and report on climate physical risks in property transactions and use these data tools to highlight relevant issues. Lenders and insurers will use these datasets to assess how climate hazards are impacting, current and future, portfolio assets and undertake stress testing scenarios to fulfil regulatory requirements from Bank of England and Prudential Regulatory Authority.

7. Policy Development and Funding Allocation

Policymakers can use outputs from these tools to shape climate adaption policies, direct funding to high-risk areas, and monitor the effectiveness of implemented measures. National government agencies may integrate these datasets into hazard maps that inform the UK Climate Change Risk Assessment process, ensuring investments align with emerging vulnerabilities.

By empowering stakeholders with precise, actionable insights, HeatView, DroughtView, and WildfireView bridge the gap between data and decision-making. Their widespread application fosters a more resilient, adaptive society equipped to face the physical risks of climate change.

Case Studies

1. Places for People

Places for People is a broad Community-focused leading UK social enterprise of 13,000 People who create, manage, and support thriving Communities across 245,000 homes - including 74,000 for social rent - through the largest development pipeline in the sector, in over 100 leisure centres, and for over a million Customers. In 2023-24, they created over £334m of social value for Customers and Communities.

Like others in the sector, it is increasingly committed to addressing the growing climate risks affecting its Customers' homes. Effectively tackling these risks relies on analysing reliable location-based data to understand vulnerability and develop mitigation strategies.

To support this initiative, PfP is working with Map Impact to conduct a sector leading proof of concept across 4,000 properties to assess the effectiveness of Map Impact's data in evaluating susceptibility to wildfires, heat stress, and drought. With the aim of improving the resilience of Customers' homes against adverse weather, the detail in these novel datasets exceeds that of previous solutions, enabling future implementation of postcode-level risk mitigation projects.

2. Martello

Martello is a provider of environmental search reports to the conveyancing market. In 2023 The Law Society of England and Wales produced guidance for conveyancers in residential and commercial property transactions to consider additional climate change physical risks, when establishing the report-on-title for the property. These additional risks include heat stress, drought, and wildfire. The guidance is anticipated to be strengthened in early 2025 via a Practice Note to conveyancers, which underscores their responsibilities to clients of 'care' and a duty to 'warn' of relevant risks.

The Martello team decided to anticipate requirements and sought reliable data to fulfil the new search item risks. HeatView was tested, and its ability to deliver locational outputs on-demand aligned with Martello's own values of cost-effective and timely outputs to conveyancing clients. Having successfully introduced the initial dataset, Martello is committed to introducing both DroughtView and WildfireView into its environmental reports by January 2025.

Conclusion

The increasing frequency and intensity of heat stress, drought, and wildfire in the UK due to climate change present significant challenges for communities, businesses, and policymakers. Effective identification and management of these physical risks are essential to safeguard infrastructure, protect vulnerable populations, and build resilience against future climate impacts.

Our products – HeatView, DroughtView, and WildfireView – offer advanced, location specific hazard assessments at a 50-meter resolution. Leveraging open-source data from Sentinel-2 satellites, Landsat imagery, and national datasets from OS, ONS and the UK Met Office, these data tools provide comprehensive insights into climate hazards across the UK. Combined with our proprietary BiodiversityView dataset, they enable a holistic analysis of landcover and management, enhancing risk detection and mitigation strategies.

Key Takeaways

• **Data Driven Decisions:** Accurate, granular risk data supports proactive, evidence based decision-making

• **Targeted Interventions:** Identifying high-risk areas enables focused mitigation efforts, improving resource allocation and reducing long-term costs

• **Strategic Resilience:** Integrating climate risk data into asset management and planning processes enhances resilience and sustainability goals

Looking Forward

As climate impacts intensify, collaboration between technology providers, governments, and industries is crucial. Our solutions exemplify how innovative data tools can bridge the gap between awareness and action, supporting strategic adaptations that benefit communities and ecosystems alike.

By leveraging comprehensive hazard assessments, organisations can not only mitigate immediate risks but also contribute to a more resilient, climate-adaptive future for the UK.

Sources and References

1. **UK Climate Projections (UKCP18)** – provide detailed information on future climate scenarios, including temperature, precipitation, and extreme weather risks. These projections are used for assessing heat stress, drought, and wildfire risks. Source: UK Met Office
2. **ONS Heat Related Health Data** – hospitalisation and mortality statistics are used to understand health impacts and validate urban-heat-island models. This includes data from past heatwaves and projections under future climate scenarios. Source: ONS
3. **Satellite Data** – Sentinel-2 provides optical and multispectral imagery for monitoring vegetation and urban-heat-islands. Source: Copernicus Sentinel-2 Mission. Landsat provides thermal band data for assessing land surface temperature, critical for heat and wildfire modeling. Source: USGS Landsat Program.
4. **Met Office Analysis of Climate Extremes** – highlights the impacts of climate change on the UK, including projections of hotter, drier summers and increased wildfire risks. These insights are integrated into the risk assessments for HeatView, DroughtView, and WildfireView. Source: Met Office – Climate Change in the UK
5. **Real World Examples** – Saddleworth Moor Wildfire (2018) Guardian coverage highlighting the increasing threats of UK wildfires. Source: Guardian media. Wild Ken Hill Norfolk wildfire event covered in BBC Spring Watch. Source: BBC
6. **Heatwave Mortality Statistics** – analysed for understanding of urban vulnerability during 2003 to 2022 heatwave events. Source: Public Health England Heatwave Plan.
7. **BiodiversityView Dataset** – Map Impact dataset of habitat cover and performance to inform on land management and assess drought and wildfire risks. Source: Map Impact
8. **Intergovernmental Panel on Climate Change** – provides broader context and validation for climate hazard modeling, including regional impacts for Europe and high-emission scenario implications. Source: IPCC 6th Assessment Report (2021)
9. **Ordnance Survey National Geographic Database** – provides datasets used to support national locational risk assessments; strategic partner to Map Impact. Source: OS
10. **Case Studies** – Places for People make use of HeatView, WildfireView, and DroughtView for climate resilience. Source: Internal Communications. Martello incorporates HeatView into environmental search reports. Source: newsbywire

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