NATURANCE

Nature for insurance, insurance for nature

(Grant Agreement 101060464)

Deliverable D2.2 - *Scorecard publication on each business case, labs round II*

WP2 – Innovation finance & policy labs

Version 2.0 | 28 March 2025

HORIZON-CL6-2021-BIODIV-01-06 - Nature-based solutions, prevention and reduction of risks and the insurance sector

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Acknowledgements

ClimateWise and its Nature and Insurance Steering Group are gratefully acknowledged for their active participation to the CISL Innovation Lab and contribution to this deliverable. Also acknowledged is the participation, to the second Innovation Lab, of the Joint Nature Steering Group of the Banking Environment Initiative and the Investment Leaders Group.

This project has received funding from the European Union's Horizon Europe Research and Innovation Program under grant agreement No 101060464

Deliverable Title	Scorecard publication on each business case, labs round II
Brief Description	A report summarizing the findings from the second cohort of innovation labs aimed at exploring the feasibility and potential of nature-based insurance and investment solutions in real-world contexts, identifying and testing shared design principles, and exploring pathways to implementation.
WP number	WP2
Lead Beneficiary	LSE
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Deliverable Due Date	31/03/2025
Actual Delivery Date	28/03/2025
Nature of the Deliverable	R – Report
Dissemination Level	PU - Public

Document History

Date	Ver.	Contributors	Comment
22 January 2025	1.0	Corinne Martin, Angela Small (CISL)	Initiate template
13 February 2025	1.1	Corinne Martin, Angela Small, Laura Deltenre, Nina Seega (CISL)	Draft first version of the CISL Innovation Lab
26 February 2025	1.2	Giada Bastanzi, Fulvio Biddau, Stefano Ceolotto, Jaroslav Mysiak, Andrea Staccione (CMCC)	Draft first version of the CMCC Innovation Lab
28 February 2025 (1 month before submission)	1.3	Jerker Jarso (internal reviewer)	
03-14 March 2025	1.4	ClimateWise Nature & Insurance Steering Group	Correct factual errors and contribute examples

This project has received funding from the European Union's Horizon Europe Research and Innovation Program under grant agreement No 101060464

21 March 2025	1.5	Corinne Martin, Angela Small, Laura Deltenre, Natalie Thompson, Joanna Wood, Nina Seega (CISL)	Second version of the CISL Innovation Lab
28 March 2025	2.0	Zuzanna Kozlowska (LSE)	Final review

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Executive Summary

Innovation Labs (ILs) are collaborative spaces that allow participants to challenge dominant or business-as-usual approaches through experimentation and social learning.

ILs can vary in format but they typically consist of a series of workshops, conducted over 6 to 9 months. The process follows design thinking, starting with the observation of the status quo and followed by the exploration of innovative solutions. Participants develop a business case, which describes the proposed innovation and the strategy for its implementation. The results are reported in the scorecard summary, and shared with relevant stakeholders in the form of the final report.

As part of the second round of Innovation Labs under the NATURANCE project, a series of workshops explored how insurance can support investment in nature-based solutions (NbS) and address climate-related financial challenges. These Labs, hosted by Cambridge Institute for Sustainability Leadership (CISL), Willis Towers Watson (WTW), and Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), identified regulatory, financial, and operational barriers while fostering cross-sectoral collaboration to develop innovative insurance solutions for climate resilience.

CISL: How can insurance be an enabler to catalyse investment into nature-based projects?

The Centre for Sustainable Finance at CISL ran its Innovation Lab in collaboration with ClimateWise, an insurance industry member network. This Lab, focused on sector-wide change, consisted of three online workshops over five months. It aimed to explore how insurance can be an enabler to catalyse investment in nature-based projects.

The Lab's main objectives were to (1) investigate the role of the financial sector in facilitating investment in nature-based projects, and (2) explore innovative financing methods to accelerate the adoption of investments in nature-based projects. One of the three workshops brought along two other member networks focused on sustainability issues and representing investors (Investment Leaders Group) and bankers (Banking Environment Initiative), so as to bring a cross-industry perspective.

Lab workshop #1 aimed to understand the current insurance landscape and where new product development is required. It resulted in six areas of focus (partnerships, risk mitigation, data integration, financial innovation, value assessment, and community engagement), taken forward during Lab workshop #2, which aimed to explore innovative financing models (as a cross-industry collaboration), to accelerate investments into nature-based projects. Lab workshop #3 saw the collaborative development of a roadmap for implementation of innovative financing models, which will be particularly useful to practitioners working on nature-based projects, or exploring this area of the insurance landscape. The Lab also collated concrete, real-world, examples of innovations in the insurance sector, which help bring to life the roadmap, as well as demonstrating what is already possible.

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WTW: Financing for heat action plans at city-level in Europe

Urban heatwaves present an escalating climate risk across Europe, with events like the 2003 heatwave causing over 70,000 deaths. Despite this, dedicated financing for extreme heat preparedness and response is lacking. WTW hosted three workshops to explore financial challenges and trigger-based financing, such as parametric insurance, focusing on beneficiary groups and Nature-based Solutions.

The first workshop identified key barriers: (1) financing constraints, (2) lack of granular data, and (3) governance challenges. The second workshop examined two use cases: applying trigger-based financing to London's Hot Weather Severe Weather Emergency Protocol (H-SWEP) fund for rough sleepers and using risk analytics for managing heat impacts on green spaces.

The final workshop evaluated H-SWEP as a Business Case, identifying inefficiencies in fund distribution and decision-making. Findings suggested trigger-based financing could improve fund management, but further engagement with local authorities and outreach teams is needed to assess its feasibility.

CMCC: Boosting flood resilience in Italy through controlled flooding, community insurance and nature-based solutions

CMCC established an Innovation Lab to integrate controlled flooding, a novel community insurance scheme, and NbS for flood risk management in Northern Italy. The IL assesses the operational, regulatory, and financial feasibility of the scheme and its commercial appeal to insurers within the complex flood management framework. Key stakeholders include regional water boards, insurers, public administrations, and regulatory bodies.

Before the IL kickoff, CMCC engaged stakeholders and experts. The first meeting established a scientific basis and funding proposal. The second meeting assessed public sector participation and legal challenges. The third meeting evaluated technical feasibility with insurers and regulators.

Key challenges identified include governance fragmentation, insurance feasibility concerns, landowner compensation, and NbS adoption barriers. The IL successfully refined the insurance-backed controlled flooding scheme, fostering cross-sector collaboration and laying the groundwork for more integrated flood risk management strategies.

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Abbreviations

Acqua Plurima per lo Sviluppo Sostenibile (AcquaPluSS)
Artificial Intelligence (AI)
Association of British Insurers (ABI)
Banking Environment Initiative (BEI)
Biodiversity Net Gain (BNG)
Cambridge Institute for Sustainability Leadership (CISL)
Centre for Sustainable Finance (CSF)
Common Agricultural Policy (CAP)
Department for Environment, Food and Rural Affairs (DEFRA)
Disaster Risk Management (DRM)
Energy Performance Certificates (EPC)
Environmental, Social, and Governance (ESG)
Equality, Diversity, and Inclusion (EDI)
European Insurance and Occupational Pensions Authority (EIOPA)
European Union (EU)
Flood Risk Management Plans (FRMPs)
Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC)
Global Infrastructure Basel Foundation (GIB-Foundation)
Greater London Authority (GLA)
Heat(-health) Action Plans (HAPs)
Hot Weather Severe Weather Emergency Protocol (H-SWEP)
Indigenous Peoples and Local Communities (IPLC)
Innovation labs (ILs)
Institute for Environmental Studies (IVM)
Insurance Development Forum (IDF)
International Institute for Applied Systems Analysis (IIASA)
International Institute for Sustainable Development (IISD)
Investment Leaders Group (ILG)
Italian Institute for Insurance Supervision (IVASS)
Knowledge Network (KN)
London School of Economics (LSE)
Ministry of Environment and Energy Security (MASE)
Ministry of Housing, Communities and Local Government (MHCLG)
National Association for Reclamation and Land Improvements (ANBI)
National Audit Office (NAO)
National Health Service (NHS)
Natural Flood Management (NFM)
Nature-based Solutions (NbS)
Taskforce on Nature-related Financial Disclosures (TNFD)

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No Second Night Out (NSNO)
Non-governmental Organisations (NGOs)
Normalized Difference Vegetation Index (NDVI)
Po River Basin District Authority (AdBPo)
Provincial Territorial Coordination Plans (PTCPs)
Research & Development (R&D)
Rough Sleeping Initiative (RSI)
Rural Development Plans (RDPs)
Sustainable Markets Initiative (SMI)
Task Force on Climate-related Financial Risks (TFCR)
Territorial Government Plans (TGPs)
UK Security Health Agency (UKSHA)
Union Bancaire Privée (UBP)
Urban Heat Island (UHI)
Wildfire Risk Management (WFRM)
Willis Towers Watson (WTW)
Work Package (WP)
World Economic Forum (WEF)

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Introduction to the Deliverable

Purpose and Structure:

Innovation labs are safe spaces that offer a collaborative environment where different agents are joined together for the purpose of innovating and generating new solutions (Arrighi et al. 2016). The NATURANCE ILs bring together many different types of actors and knowledge, fostering experimentation and experiential social learning (Koelle et al. 2019).The format gives participants the freedom to challenge dominant or business-as-usual approaches, and to innovate new pathways for societal transformation. Key to their success is how the ILs are facilitated and how different voices can be heard (Koelle et al. 2019, Reed & Abernethy 2018). The management structure of the NATURANCE hubs follows the principles of good governance, reflecting diversity in the composition of the partners and ensuring an open and high-quality decision-making process.

Design Thinking Approach:

The IL approach is based on the design thinking process, which has its roots in product development, but is increasingly used in the public sector e.g. to innovate policymaking (Mintrom & Luetjens 2016). Design thinking starts with the observation of the status quo followed by the exploration of the challenge. The definition and exploration of the problem in combination with potential solutions or innovations are used to develop a prototype business case, which is then critically stress-tested and questioned to identify potential knowledge gaps and barriers for implementation.

Implementation and Leadership:

It is intended that three rounds of three ILs will be facilitated over the course of the NATURANCE project, i.e. nine ILs in total. So far, two rounds of ILs have been completed. Each consortium member leads at least one IL over the course of the NATURANCE project. Themes are collaboratively decided by Knowledge Network (KN) representatives, covering NbS in risk transfer, investment, or advisory.

Participant Selection:

ILs are intended to have between 5-10 participants, but the exact number can vary depending on the specific topic and need for expertise. The selection or nomination of participants should be guided by the following questions:

- What expertise do we need and what expertise can we provide?
- Which sectors and stakeholders should be represented?

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In addition to the required expertise and representation of all relevant sectors, the selection should be informed by equality, diversity, and inclusion (EDI) criteria including gender, race, disability, and age.

Format and Logistics:

ILs can last between 1 and 9 months but should not exceed the 9-month timeframe. Over the course of the IL, a series of workshops, small group discussions, or roundtable discussions are organised. The format of the meetings also depends on whether the meetings are online, in-person or in a hybrid format. Following those workshops or group discussions, participants follow up on agreed-upon action items.

Expectations and Reporting:

While the key problem statement that will be addressed in the IL is defined in detail during the first session of the IL, setting the overall expectations and the outcomes to aim for, given the theme, format and timeframe of the IL, helps to steer the group while running the IL. The expectations for the IL should be informed by the following questions:

- What is the scope of the challenge being addressed by the IL addresses and what is out of scope?
- Is there any ambiguity in the concepts and terms that will be addressed in the IL, which need to be clarified with the participants in the first session?
- Are there any risks that could lead to an unsuccessful outcome of the IL; how can these risks be managed?

After the completion of the IL, the outcomes of the IL need to be summarized and reported using the scorecard and business case summary, and other documentation or minutes created during the IL. The scorecard consists of four sections: (1) Problem statement, current baseline & innovation, (2) implementation & execution, (3) Financing, (4) Impact. Each section consists of three core questions that should be answered using the material and documentation from the IL in combination with the inputs from the NATURANCE consortium lead. Each question is scored from 1 (lowest) to 5 (highest). In case a question cannot be answered or assessed based on the outcomes of the IL, the question is scored with a 0. This means each of the four sections can reach a maximum of 15 points, resulting in a maximum total score of 60 for all four sections.

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First round of ILs:

During the first round of Innovation labs, IIASA, IVM and LSE led initiatives with three distinct focus areas: wildfire (IIASA), NbS as part of the reconstruction process after the 2021 floods in the Netherlands (IVM), and nature-based solutions for urban flooding in the UK (LSE).

All three innovation lab proposals presented their pitches during the first Naturance Webstival on June 14-15, 2023. The pitches and innovation lab expo marked the kick-off for the first cohort of innovation labs. After the three pitches, three parallel virtual break-out rooms for each innovation lab were provided as a space to further discuss the idea of the innovation lab and get feedback from the Webstival participants and expert groups. Webstival participants were also able to join one of the breakout rooms to show their interest in the innovation lab, provide feedback, and explore opportunities to collaborate. All three break-out sessions had good participation rates and provided valuable feedback and networking opportunities for the innovation lab leads.

LSE: Investing in Natural Flood Management (NMF) in Urban Areas in the UK

LSE's IL aimed to co-develop business cases with relevant stakeholders that enable insurers to unlock both direct and indirect investments into natural flood management in urban areas in the UK. It explored how insurers can support NFM implementation to protect properties, sustain insurance access, and enhance urban resilience. This innovation lab brought together relevant stakeholders including insurers, NFM experts, local councils, and others to identify and develop mechanisms that enable insurers to unlock investment in NFM.

IVM: Methods to Quantify Flood Risk Reduction and Co-Benefits of NbS in the Netherlands

IVM's IL aimed to co-design with relevant stakeholders improved methods for assessing the risk reduction and co-benefits of NbS for limiting flood risk in the province of Limburg in the Netherlands. The innovation lab involved stakeholders such as Dutch insurers and local governments to improve the most relevant methods to identify and value the key benefits of NbS to inform sustainable finance mechanisms for NbS and aimed to draw general lessons for applying these methods internationally.

IIASA: Harnessing Insurance to Promote Nature-Based Solutions for Wildfire Risk Management

Taking place within the Firelogue-NATURANCE collaboration, IIASA's IL explored the role of insurance in promoting NbS for wildfire risk management (WFRM). Participants discussed how insurers can collaborate with risk managers, ecologists, and other stakeholders, to develop innovative insurance products that encourage the use of NbS and explore the ways insurance companies can support local communities, national forest agencies, and other policy agents in adopting NbS for managing wildfire risk. The discussion motivated a follow-up Innovation Lab that

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took place in Solsona, Spain, July 4-6, as part of the Horizon Europe Firelogue project's Wildfire Insurance Working Group in collaboration with NATURANCE. Throughout the lab, interactive exercises were used to explore policy options and the business case for implementing NbS for WFRM.

Second round of ILs:

The second round of Innovation Labs under the NATURANCE project was hosted by Cambridge Institute for Sustainability Leadership (CISL), Willis Towers Watson (WTW), and Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC). The Labs identified regulatory, financial, and operational barriers while fostering cross-sectoral collaboration to develop innovative insurance solutions for climate resilience. A comprehensive description of the Innovation Labs, including the key insights, findings, and outcomes from each session, is provided below in the following order:

1. How can insurance be an enabler to catalyse investment into nature-based projects? (CISL)
2. Financing for heat action plans at city-level in Europe (WTW)
3. Boosting flood resilience in Italy through controlled flooding, community insurance and nature-based solutions (CMCC)

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How can insurance be an enabler to catalyse investment into nature-based projects?

By Cambridge Institute for Sustainability Leadership (CISL)

Executive summary

The Centre for Sustainable Finance at CISL ran its Innovation Lab in collaboration with ClimateWise, an insurance industry member network. This Lab, focused on sector-wide change, consisted of three online workshops over five months. It aimed to explore how insurance can be an enabler to catalyse investment in nature-based projects.

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Introduction and purpose of the Innovation Lab

This Innovation Lab was run by the Centre for Sustainable Finance (CSF) at the Cambridge Institute for Sustainability Leadership (CISL), in collaboration with ClimateWise (Box 1).

ClimateWise brings together the insurance industry into a member network convened by Cambridge Institute for Sustainability Leadership (CISL), which integrates sustainable leadership with world-leading research capability, to address the impacts of climate change. ClimateWise is uniquely placed to bring together business, government and academic

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expertise; it provides a collective voice for the industry; a forum to interact with other stakeholders, and it enables the transition of the insurance industry through a defined set of Principles aligned to disclosure requirements.

The **Nature and Insurance Steering Group** comprises a subset of ClimateWise members whose focus is on nature-related issues. These practitioners influence the research strategy and pipeline at CISL's Centre for Sustainable Finance, and contribute to, and provide feedback on, on-going research activities (such as NATURANCE). In the process, they are kept abreast of nature-related developments that are relevant to financial institutions.

Box 1. ClimateWise and its Nature and Insurance Steering Group.

The central question to be addressed by the Lab was:

> "*How can insurance be an enabler to catalyse investment into nature-based projects?*"

The Lab, consisting of three interconnected 2h online Lab workshops, was conducted over a period of five months (Figure 1). The primary purpose was to bring together representatives from the insurance industry to explore this central question.

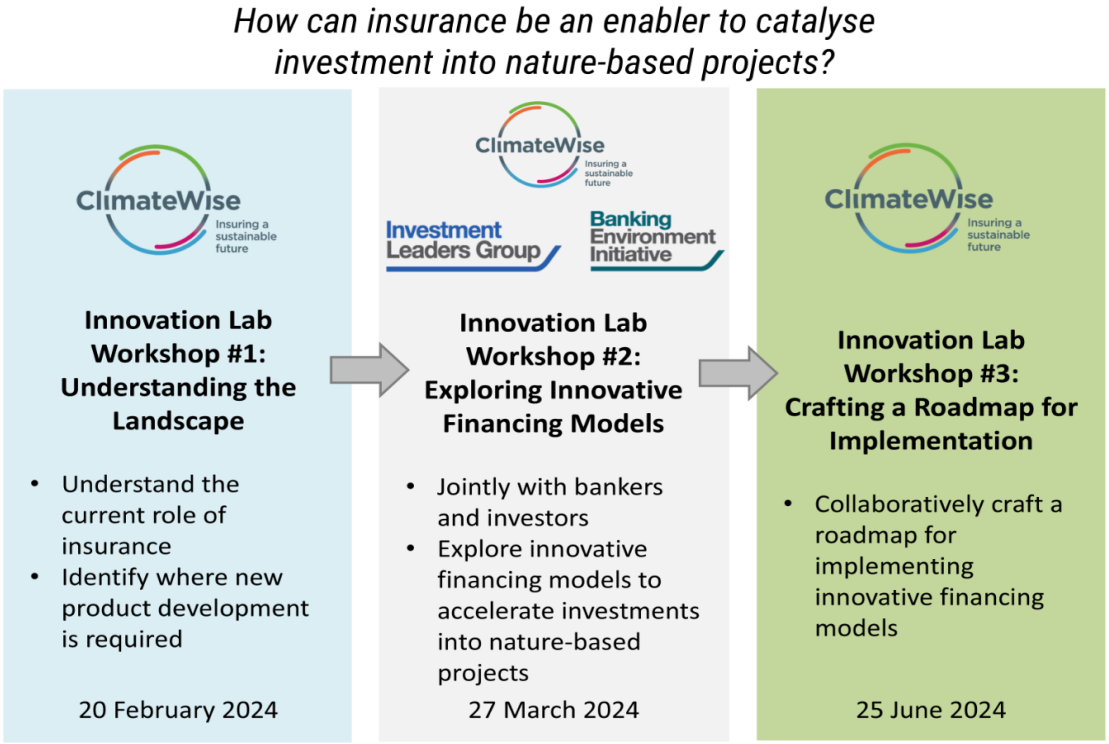

Figure 1 Three workshops formed the Innovation Lab entitled "How can insurance be an enabler to catalyse investment into nature-based projects?".

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A key finding from Lab workshop #1 was the need for cross industry collaboration: as in order for the market to enable investment in NbS, there needs to be a space for different financial sector representatives to come together. Therefore Lab workshop #2 was set up to create space for such collaboration to exist. As a result, asset owners/managers and banks joined the insurers to enrich discussions on innovative financing mechanisms. This meant that, for the purpose of the Innovation Lab, CISL was able to bring together three financial sector membership groups that it convenes around the topic of sustainability:

- ClimateWise[1] (insurers, reinsurers, brokers and professional bodies; 36 members at the time of writing),
- the Banking Environment Initiative[2] (BEI ; six members), and
- the Investment Leaders Group[3] (ILG; asset owners and managers ; 11 members).

In each of these groups, a subset of members take part in 'nature steering groups' (Box 1), one purpose of which is to contribute to, and provide feedback on, on-going nature-related finance research. These include the Innovation Lab run by CISL as part of the NATURANCE project.

So as to make the Innovation Lab relevant to all members of these financial sector groups, the topic of the CISL Lab was designed to be strategic and broader in scope (sector-level) than the more thematically focused other NATURANCE Labs (focused on risks linked to e.g. wildfire, urban heat, flooding, etc). This approach had the advantage of covering a wider array of topics, as well as being likely to produce an sector-wide relevant outcome that would nicely complement the other theme-based Labs under NATURANCE.

Through the creation of a space for collaboration, the **immediate** objectives of this Lab were to:

- investigate the role of the financial sector in facilitating investment in nature-based projects, and
- explore innovative financing methods to accelerate the adoption of investments in nature-based projects.

The **longer-term** objectives of this Lab were to:

- support the development of new insurance products,
- enhance existing ones, and
- find innovative ways to connect insurance with nature-based projects.

[1] https://www.cisl.cam.ac.uk/business-action/sustainable-finance/climatewise
[2] https://www.cisl.cam.ac.uk/business-action/sustainable-finance/banking-environment-initiative
[3] https://www.cisl.cam.ac.uk/business-action/sustainable-finance/investment-leaders-group

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The rationale for the Lab was presented, along with preliminary findings of workshop Labs #1 and #2, at the NATURANCE Finance Innovation Festival[4] in 2024. This helped shape some of the thinking, as well as sense checking findings with experts in NbS and finance.

Lab workshop #1: Understanding the landscape

Introduction and purpose (Workshop #1)

Lab workshop #1 had 16 participants: five CISL or affiliated staff and 11 ClimateWise members (Table 1). This workshop aimed to:

- gain a comprehensive understanding of the current state of the insurance industry's role in the context of nature, and
- determine areas where new products/innovations (i.e. solutions) are required to catalyse and leverage investments in nature-based projects (to then be further explored during subsequent Lab workshops).

This two-step approach is in line with the 'design thinking process', whereby observation of the status quo is followed by the exploration of the challenge (Rözer et al., 2024).

Table 1 ClimateWise members who took part in Lab workshop #1 (February 2024).

Company name	Sector
The Association of British Insurers (ABI)	Insurance
AON	Insurance
AXA XL	Insurance
Beazley	Insurance
Flood Re	Insurance
Howden Group	Insurance
Inigo Insurance	Insurance
Liberty	Insurance
QBE Insurance Group	Insurance
RenaissanceRe	Insurance
WTW[5]	Insurance

[4] https://www.naturanceproject.eu/events/finance-innovation-festival/

[5] Left ClimateWise December 2024

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The workshop opened with a scene-setting presentation by CISL on the importance of nature to global stability, and to the insurance sector in particular. This presentation included examples of nature-based projects and was used to help participants empathise with, and define, the problem to be addressed, as well as position the roles of each participant in the Lab. This was followed by two interactive discussions using Mural boards (online facilitation tool), focused on the two aims of:

a) mapping the insurance landscape and areas where new products are required, and

b) mapping the solutions.

To prompt and facilitate interactive discussion, a series of thematic questions were asked, by the facilitator, organised around the following **themes** (in bold font):

Aim a) Mapping the insurance landscape and areas where new products are required

Ecosystem gaps: o What are the existing gaps within nature-based insurance investments that present opportunities for new product development? o Are there specific ecosystems or biodiversity hotspots that are not adequately addressed by current insurance offerings?	**Global (nature) conservation trends:** o How can we analyse global conservation trends to identify areas where insurance products could play a crucial role in protecting ecosystems or supporting sustainable land use? o What types of ecosystems or species are likely to face increased risks or opportunities that can be addressed through innovative insurance solutions?
Biodiversity risks: o How can we identify and anticipate risks to biodiversity and ecosystems, and what do we need to think about to address these evolving environmental challenges?	**Regulatory environment for conservation finance:** o How might changes in the regulatory environment impact the field of conservation finance and nature-based insurance, and what new products can be developed to align with or take advantage of these changes?
Technological innovations in conservation: o In what ways can technology and data analytics be leveraged to monitor and mitigate risks to biodiversity? o Are there opportunities to integrate technologies such as satellite imaging, remote sensing, or blockchain into nature-based insurance offerings?	**Collaborative platforms for conservation finance:** o How can we create collaborative platforms that bring together insurers, conservation organisations, and governments to collectively address biodiversity risks and support nature-based projects? o Are there existing initiatives or partnerships that can be expanded or adapted to incorporate nature-based insurance?
Climate and environmental impact: o Are there untapped markets where insurance can play a role in promoting nature-based solutions for climate resilience?	

Aim b) Mapping the solutions

Innovative financing models for conservation: o What innovative financing models can be explored to make nature-based insurance more accessible to investors and project developers while ensuring	**Digital tools for conservation monitoring:** o In what ways can digital solutions and emerging technologies be harnessed to monitor and assess the impact of nature-based insurance on

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conservation goals are met? o How can nature-based insurance offerings be designed to attract private and public investments for sustainable conservation projects?	biodiversity conservation?
Flexible investment structures: o What flexible investment structures can be introduced to accommodate the varying financial capacities of different investors and project developers in the conservation sector?	**Technology for sustainable practices:** o How can technology be employed to promote sustainable practices within nature-based projects, ensuring that insurance solutions contribute to long-term ecological resilience?
Financial education for conservation investments: o What educational initiatives can be implemented to enhance financial literacy among potential investors and stakeholders in nature-based insurance projects?	**Community-led conservation initiatives:** o How can strategic partnerships with local communities, NGOs, and indigenous groups be formed to implement community-led conservation initiatives supported by nature-based insurance?
Incentivising conservation finance: o How can we design incentive structures that motivate investors and project developers to actively participate in nature-based insurance programs? o Are there non-financial incentives, such as recognition for biodiversity conservation achievements, that can encourage more investments in nature-based projects?	**Partnerships with conservation NGOs and governments:** o How might strategic partnerships with conservation-focused non-governmental organisations and government entities be formed to address biodiversity risks collaboratively? o Are there existing conservation programs or initiatives that can be leveraged to integrate nature-based insurance solutions?
Biodiversity risk pooling: o How can innovative risk pooling mechanisms be established to distribute the financial burden and make nature-based insurance more sustainable for diverse ecosystems?	

Outcome and results (Workshop #1)

Information gathered on the Mural boards was analysed and is summarised as follows:

Aim a) Mapping the insurance landscape and areas where new products are required

1. **Product Development and Market Positioning**
    - New product requirements vs. adaptation of existing products
    - Transitioning from niche/innovation to mainstream
    - Carbon Credit Insurance: "Nature Credentials" and reforestation requirement
    - Insurance for nature-positive/low carbon materials in the built environment

2. **Nature-based Solutions Financial Models and Investment**
    - Misalignment between finance sector requirements and NbS project size/insurance solutions
    - Integrating loss and damage funding for premium financing
    - Leveraging existing success examples for product catalogue
    - Designing financial models which can adequately capture all the beneficiaries of NbS
    - Early products emerging to measure biodiversity and study effects on agriculture

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3. **Regulatory and Policy Considerations**
    - High risk partnerships with government
    - Slow and unclear regulatory action
    - Nature-related Financial Disclosures (TNFD) requirements
    - Clarification needed on stacking rules for benefit streams

4. **Stakeholder Collaboration and Engagement (Partnerships)**
    - Collaboration among stakeholders for pilot projects and case studies
    - Sustainable Markets Initiative (SMI) as a platform/cross-industry partnership for NbS promotion
    - Education and Awareness on parametrics

5. **Environmental Impact Assessment (Risk Assessment and Mitigation)**
    - Remote sensing in Agri-space for real-time monitoring
    - Biodiversity risks and available proxies
    - Nature as part of risk control/mitigation assessment
    - Scenarios including tipping points and extreme climate scenarios
    - Importance of transitioning from grey to green infrastructure
    - Emerging products for biodiversity measurement and agriculture effects study
    - Limitations of flood maps for natural flood management

6. **Data, Technology Integration and Standards**
    - Minimum data requirements on core Sustainability metrics
    - Leveraging AI for uncertainty reduction in predictive analytics
    - Development of data and standards for NbS
    - Remote sensing in Agri-space for real-time monitoring

Aim b) Mapping the solutions

1. **Collaborative Partnerships and Co-development:**
    - Partner with banks and finance to co-develop insurance programs/products.
    - Working group collaboration with investment groups to structure insurance products to fit needs.
    - Leveraging alliances like Sustainable Markets Initiative, Insurance Development Forum (IDF) etc., for shared project development costs.

2. **Risk Understanding and Mitigation:**
    - Enhance risk assessment capabilities to better understand the underlying risks associated with NbS projects, enabling the development of tailored insurance products.
    - Explore the creation of mutualised risk pools dedicated to covering specific risk types inherent in NbS initiatives.
    - Promoting loss and damage funding for premium financing.
    - Reinstating with resilience measures and guiding farmers to take advantage of new green schemes (Build Back Better approach).

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3. **Financial Innovation and Blended Finance:**
    - Innovate financial instruments such as de-risked bonds and insurance-linked securities structures to attract investment for NbS projects.
    - Promote the concept of blended finance to mobilise private capital alongside public and philanthropic funding, thus closing the NbS funding gap.
    - Introduce innovative schemes leveraging carbon credits or biodiversity credits to offset insurance premiums and manage risks associated with NbS implementation.

4. **Value Assessment and Analysis:**
    - Conduct comprehensive cost-benefit analyses to quantify the economic and environmental value generated by NbS projects, incentivising investment from insurers.
    - Recogne short-term and long-term co-benefits of nature-based solutions simultaneously, aligning incentives to encourage investment in sustainable practices.

5. **Data Utilisation and Integration:**
    - Improve risk models and maps to better account for nature, leveraging both geospatial and in-situ data.

6. **Community Engagement and Empowerment:**
    - Foster community involvement in NbS projects by understanding local decision-making processes and financial motivations, thereby ensuring project sustainability and success.
    - Empower Indigenous Peoples and Local Communities (IPLC) to actively participate in NbS restoration and preservation efforts, leveraging their expertise and traditional knowledge.

The above results were then aggregated into **six areas of focus**, to be taken forward during Lab workshop #2:

- Collaborative Partnerships and Co-development,
- Risk Understanding and Mitigation,
- Data Utilisation and Integration,
- Financial Innovation and Blended Finance,
- Value Assessment and Analysis,
- Community Engagement and Empowerment.

Lab workshop #2: Exploring innovative financing models

Introduction and purpose (Workshop #2)

Lab workshop #2 had 34 participants: eight CISL or affiliated staff and 26 representatives from financial institutions (Table 2). Building on the six areas of focus from Lab workshop #1, Lab workshop #2 aimed to:

- explore in more details new products/innovations (i.e. solutions) that are required to

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catalyse and leverage investments in nature-based projects;

- identify which of these solutions would have significant potential to scale up and accelerate finance for nature.

Table 2 Members of ClimateWise, Investment Leaders Group, and Banking Environment Initiative who took part in Lab workshop #2 (March 2024).

Company name	Sector	Company name	Sector
The Association of British Insurers (ABI)	Insurance	Manulife Investment Management	Investment
AON	Insurance	Pensioenfonds PGB	Investment
AXA XL	Insurance	Rathbones	Investment
Beazley	Insurance	Robeco	Investment
Flood Re	Insurance	State Street Global Advisors	Investment
Howden Group	Insurance	Union Bancaire Privée (UBP)	Investment
Inigo Insurance	Insurance	Zurich	Investment
Liberty	Insurance	ABN-AMRO Bank	Bank
QBE Insurance Group	Insurance	Deutsche Bank	Bank
RenaissanceRe	Insurance	HSBC	Bank
WTW[6]	Insurance	NatWest Group	Bank
AON	Investment	Santander	Bank
Bridgewater Associates	Investment	Standard Chartered	Bank

Aside from ClimateWise representatives, Lab workshop #2 also brought along representatives from the Banking Environment Initiative, and the Investment Leaders Group (asset owners and managers). This was in direct response to one result from Lab workshop #1: the need to build collaborative partnerships with banks and investors, to co-develop and structure insurance products. Lab workshop #2 was a collaboration between two EU-funded projects: NATURANCE and A-Track[7], and it informed a key deliverable of the latter (CISL et al. 2024), that explored barriers to scaling (private commercial) finance for nature.

[6] Left ClimateWise December 2024

[7] Accelerating Transformation through Capitals Knowledge ; https://a-track.info/

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The workshop opened with a scene-setting presentation on nature finance and the current nature finance gap, followed by an overview of the outcome from Lab workshop #1, framed around the six areas of focus. Participants were then divided into breakout groups, and Mural boards were used to record information shared during the interactive discussions.

The following questions were used to frame the discussions:

- *What are the strengths of the six areas of focus that have come out of Lab workshop #1?*
  - *Have you seen elements of these operationalised within the market?*
  - *If so, what insurance products?*
- *What are the main challenges associated with these areas of focus?*
  - *What concrete actions could be taken to overcome these challenges? By whom?*
- *What are innovative models that finance can use to support the protection and restoration of nature?*
  - *How could those move from idea to execution?*
  - *What needs to be true for each stakeholder group represented today to play a role?*

Outcome and results (workshop #2)

Information gathered on the Mural boards was analysed and is summarised as follows:

Collaborative partnerships and co-development:

What works well? Discussions highlighted that collaborations with banks, investment groups, and Non Governmental Organisation leverage diverse expertise, a range of skills, and substantial resources to address nature finance gaps effectively.

What doesn't work well? The primary issues identified include a lack of transparency and scattered information, which impede effective collaboration and hinder progress. Additionally, there are potential scalability concerns as some collaborative structures may not grow with needs.

What would you change? To enhance the effectiveness of collaborations, the participants advocated for increased transparency and standardised approaches. Establishing common objectives and scaling partnerships could attract more investment. Sharing insights and learnings among partners can also improve scalability and effectiveness. It is important to note that competitive advantages can pose significant barriers to potential collaborations.

Risk Understanding and Mitigation:

What works well? Tailoring insurance products to the risks associated with nature-based projects provides financial security and stability. Engaging insurers across different portfolios and product lines can lead to the development of new insurance products.

What doesn't work well? Quantifying nature-related risks and dependencies is challenging, partly due to a lack of robust examples and standardisation of successful projects, which limits scalability.

What would you change? Further landscape pilots could improve understanding of nature-based project impacts on insurers. Collaboration with standard-setting bodies and academia to develop case studies on

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how physical and transition risks impact the insurance industry in practice would make these risks more tangible. Innovative risk pools and collaborations between insurers and investors can promote the development of nature-based insurance products.

Data Utilisation and Integration:

What works well? The development of standards and open-source data facilitates data utilisation and enhances cross-industry understanding. Standard-setting bodies or organisations play a crucial role in fostering innovation and driving meaningful insights from data-driven initiatives.

What doesn't work well? Data gaps arise primarily from the lack of standardisation, leading to inconsistencies in data formats, structures, and quality. The wide range of terminology used across sustainability further complicates data adaptation, hindering effective utilisation and accurate risk assessment and pricing strategies.

What would you change? Standardising taxonomies, addressing data gaps, and promoting open-source data could significantly improve data utilisation. Collaboration with local communities can also enhance data collection and monitoring.

Financial Innovation and Blended Finance:

What works well? Initiatives such as Debt for Nature Swaps - a form of finance that reduces countries' debts for environmental commitments (WEF, 2024; CISL and MS Amlin, 2024), and Biodiversity Net Gain (England) - a development regulation that ensures habitats for wildlife are left in a measurably better state than they were before the development, applying private sector finance to nature restoration (DEFRA, 2024), showcase the potential of innovative financing models in funding restoration efforts. These pilots integrate multiple environmental and social benefits into single projects, maximising return on investment and enhancing sustainability.

What doesn't work well? The lack of clear articulation of financial returns for nature-based projects, coupled with scepticism surrounding new markets such as carbon markets, presents significant barriers to widespread adoption. There is a need for standardised methodologies for valuing ecosystem services, and better acknowledgement of the extensive resources and advanced expertise required to operationalise them.

What would you change? Enhancing transparency and credibility in new markets for ecosystem services is crucial. Fostering greater collaboration among stakeholders can unlock new sources of capital for NbS projects. Clarifying stacking rules and promoting transparency can attract more investment.

Value Assessment and Analysis:

What works well? Initiatives like the Norfolk Water Fund (Water Resource East, 2024) illustrate the potential of nature-based projects to attract upfront investment by aggregating multiple projects under a unified framework. These projects can achieve economies of scale and protect physical assets from climate change and natural disasters, benefiting insurers.

What doesn't work well? The lack of comprehensive valuation methodologies for nature-based projects and varying perspectives on value assessment pose significant challenges. Without a standardised approach, it becomes difficult to capture the full spectrum of benefits derived from nature-based projects, leading to inconsistencies in valuation practices.

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What would you change? Developing robust valuation methodologies and integrating nature's value into overall financial returns can attract more investment. Quantifying the economic, social, and environmental value of nature-based projects can inform decision-making, prioritise investments, and ensure effective resource allocation.

Community Engagement and Empowerment:

What works well? Initiatives like the Norfolk Water Fund and Wyre Natural Flood Management Project (Wyre Rivers Trust, 2024) demonstrate successful community engagement and empowerment. Actively involving local communities in decision-making processes fosters a sense of ownership and stewardship over natural resources.

What doesn't work well? Lack of understanding of insurance value early in concept development and insufficient emphasis on community factors hinder effective implementation of nature-based projects. Failure to engage local stakeholders and uncertainties over land rights disconnect project objectives from community needs.

What would you change? Proactive collaboration between insurers, project developers, and communities is essential to ensure nature-based initiatives are financially viable, socially, and environmentally sustainable. Prioritising community engagement, understanding insurance value earlier in project development, and ensuring equitable outcomes can empower communities and enhance support.

Lab workshop #3: Crafting a roadmap for implementation of innovative financing models

Introduction and purpose (workshop #3)

Lab workshop #3 had ten participants: two CISL or affiliated staff and eight ClimateWise members. It aimed to collaboratively develop a roadmap for implementing innovative financing models, with the roadmap being intended to be used by those working on nature-based projects, or wishing to embark on such a project.

A draft roadmap was used as basis for discussion during Lab workshop #3, with the following elements being considered by participants:

- activities to be undertaken (including any supporting information),
- participants (classed as leads or contributors to the activities), and
- issues, barriers, caveats to achieve the activities.

A richer draft was then shared for additional input and feedback from members of the ClimateWise Nature and Insurance Steering Group, during the summer of 2024.

Outcome and results (workshop #3)

The resulting and enriched roadmap is presented in Table 3, noting that some of its steps are rightly sequential, yet some others might need to be iterative (e.g. activity 12. *Evaluate and Refine Pilot Outcomes*) and/or happen in parallel (e.g. activity 8. *Strengthen Community Engagement and Empowerment* need to span the full implementation).

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Much of the work undertaken across the NATURANCE work packages is relevant to the successful implementation of such a roadmap. For instance, Staccione et al. (2023) provides a very useful state-of-play (Deliverable D4.1) of methods for assessing and valuing the risk-reduction benefits and the co-benefits of nature-based solutions, of direct relevance to activity 4 *Improve Risk Understanding and Mitigation*. Another project Deliverable (D4.2 *Improved methods for the assessment of NbS performance*), due to be completed in March 2025, will be key to support activity 12 *Evaluate and Refine Pilot Outcomes*. Similarly, Linnerooth-Bayer et al. (2023; Deliverable D3.1) can inform activity 10. *Develop a Regulatory and Subsidy Framework for Support*, through its stock take of the existing literature and practice of governance and policy for NbS, with a focus on the enablers and barriers. Finally, NATURANCE's work package 1 (*Connecting networks and dialogues*) oversees, coordinates and reports on activities linked to the 'network of existing networks'[8], which is relevant to activity 3 *Enhance Collaborative Partnerships and Co-development*. NATURANCE has indeed worked to connect existing major 'knowledge networks', so as to foster crossdomain knowledge-sharing and support the development of project outputs.

[8] https://www.naturanceproject.eu/objectives/#obj1

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Table 3 Roadmap for implementation of innovative financing models.

Phases	Activities	Leads (Contributors)
Phase 1: Initial Assessment	1. Establish a Multi-Stakeholder Task Force	Insurance, academia, sustainability experts, policymakers
	2. Conduct Comprehensive Needs Assessment	NbS developers, investors, insurance, policymakers (academia, sustainability experts)
Phase 2: Design and Strategic Planning (Assessment from Lab workshops #1 and #2)	3. Enhance Collaborative Partnerships and Co-development	NATURANCE consortium, policy actors (insurance, NGOs, academia, banks and investors)
	4. Improve Risk Understanding and Mitigation	Academia, insurance
	5. Standardise Data Utilisation and Integration	Data holders/owners, academia (data users, standard-setting bodies, policymakers)
	6. Foster Financial Innovation and Blended Finance	Insurance, bankers, investors, policymakers (academia)
	7. Develop Robust Value Assessment and Analysis	Academia (insurance, bankers, investors, NGOs)
	8. Strengthen Community Engagement and Empowerment	Academia, associations, memberships, NGOs (insurance, bankers, investors)
Phase 3: Pilot Implementation and Evaluation	9. Launch Pilot Projects	Insurance, bankers, investors (academia, NGOs)
	10. Develop a Regulatory and Subsidy Framework for Support	Policymakers (academia, insurance)
	11. Promote Transparency and Standardisation	Academia, insurance (policymakers, NGOs)
Phase 4: Scaling and Long-Term Support	12. Evaluate and Refine Pilot Outcomes	Academia (insurance, banks, investment firms, NGOs)
	13. Scale Successful Models	Insurance (academia, NGOs)
	14. Commit to Best Practices	Policymakers, insurance (everyone else)
Phase 5: Continuous Improvement	15. Promote Continuous Improvement and Adaptation	Academia, associations, memberships, NGOs (everyone else)
	16. Advocate and Share Knowledge Globally	Academia, associations, memberships, NGOs (everyone else)

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Overall outcomes

This Innovation Lab had a strategic, sector-level focus compared to other NATURANCE Innovation Labs, which were more thematically focused (focused on risks linked to e.g. wildfire, urban heat, flooding, etc). This Lab instead considered sector-wide change, through the central question *"how can insurance be an enabler to catalyse investment into nature-based projects?*", which is crucial to catalyse action. Our approach focused on cross-industry collaboration (exemplified through Lab workshop #2), by bringing together several branches of the financial sector to productively discuss how the insurance sector can overcome barriers and become an enabler within the wider operating ecosystem.

The outcomes of Lab workshop #1, which aimed to understand the current insurance landscape and where new product development is required are summarised around six areas of focus, as shown in Figure 2. These areas of focus were then taken forward during Lab workshop #2, which aimed to explore innovative financing models (as a cross-industry collaboration), to accelerate investments into nature-based projects. The outcomes of Lab workshop #2 are summarised in Figure 3 and Table 4, the latter collating 20 examples of nature-based projects in which the innovative role(s) of insurance (and of the financial sector more broadly) is/are highlighted. Some of these examples were sourced from previous NATURANCE work (e.g. Linnerooth-Bayer et al., 2023), whilst others were mentioned during the Lab workshops, or suggested during the development of this document by NATURANCE project partners and by members of the ClimateWise Nature and Insurance Steering Group. It is hoped that these concrete examples will help bring to life the roadmap for implementation of innovative financing models (Table 3, resulting from Lab workshop #3). We believe that the roadmap will be particularly useful to practitioners working on nature-based projects, or exploring this area of the insurance landscape. These examples are also shared with a view to demonstrate what is already possible, and for the purpose of catalysing investment in similar and potential future nature-based projects. To summarise the progress of this Innovation Lab, a scorecard is provided in Annex 1.

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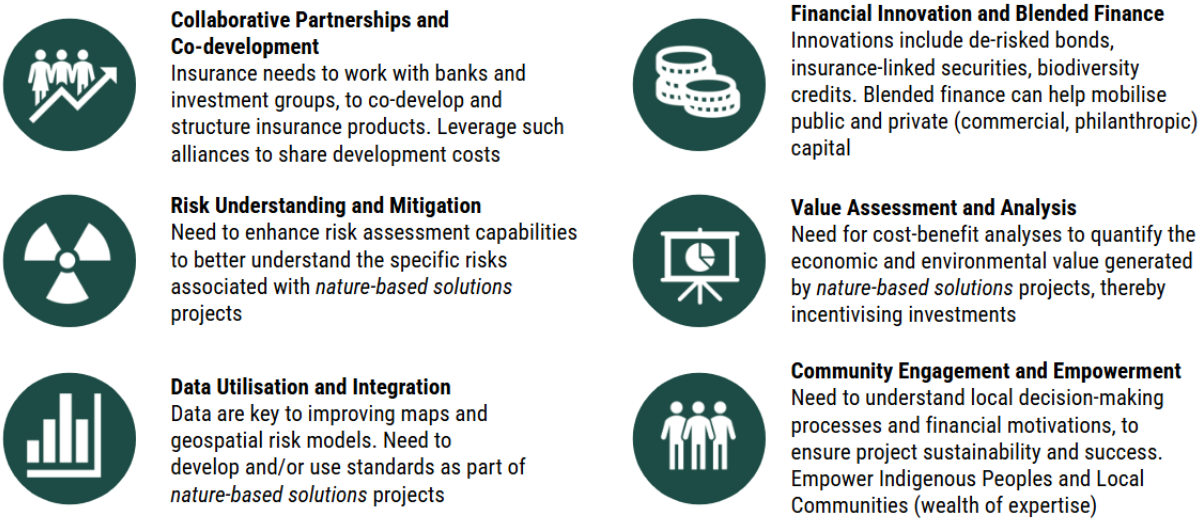

Figure 2 The outcome of Lab workshop #1 was six areas of focus, taken forward during Lab workshop #2.

	What works well?	What doesn't work well?	What would you change?
Collaborative Partnerships and Co-development	Diverse expertise and resources	Transparency, scatter information and scalability	Standardisation and common objectives
Risk Understanding and Mitigation	Tailoring products and wider engagement	Quantifying nature and lack of examples	More landscape pilots and case studies
Data Utilisation and Integration	Standards and open-source data	Lack of coherent and structured data	Standardisation and engage with locals
Financial Innovation and Blended Finance	Biodiversity initiatives and stacked benefits	Lack of measurable and clear financial returns	Enhance transparency and credibility of emerging markets
Value Assessment and Analysis	Upfront investment by aggregating projects	Diverse views and lack of clear methodologies	Integrate nature's value into financial returns
Community Engagement and Empowerment	Involve local communities	Lack of understanding of insurance's value	Collaborate at all levels and stages of projects

Figure 3 Summarised outcome for Lab workshop #2, articulated around the six areas of focus (from Lab workshop #1).

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Table 4 Examples (20) of nature-based projects and the role(s) (as highlighted in the sources) of insurance, and of the financial sector more broadly, in these projects.

Name (source)	Short description	Role of insurance (and the financial sector more broadly)
Nature's remedy: Improving flood resilience through community insurance and nature-based mitigation (Munich Re and TNC, 2021)	The report explores the potential benefits of combining nature-based flood mitigation with a community-based flood insurance product (in which the insurance product would be sold to an entire community or subset of a community)	Insurer quantified how widening the path for the Missouri river to flow would reduce flood risk, and how insurance premiums could decrease over time
Innovative post-hurricane protection for endangered Mesoamerican Coral Reef goes live with insurance carrier confirmed (MAR Fund et al., 2021)	Coral reefs bring benefits to local communities and resilience to their economies. This initiative works with local conservation organisations and government agencies to put in place plans for early response and to train and equip specialist "brigades" to execute immediate reef-saving activities	Insurer provides fast-paying parametric hurricane insurance to enable restoration of reefs with protected status. The cover was arranged by a parametric broking specialist firm. Support for the insurance placement was provided by a fund set up through a public-private partnership
Supporting the Prince Hendrik Sand dyke project (Swiss Re, 2019)	Prince Hendrik Sand Dyke on Texel Island, the Netherlands, needed to adapt to rising sea levels, after having experienced heavy wave action that resulted in it no longer meeting safety standards	Insurance supported the 2019 construction-related risks of a nature-based solution to protect the island and the habitat of the adjacent World Heritage site against rising sea levels.
Insurance underwriting with nature: how mangroves can transform the climate strategy of companies, cities and re/insurers (Earth Security, 2022)	Report sets out a simplified quantitative model and approach to illustrate the protection value of mangroves against tropical cyclones in the Philippines	Re/insurers could factor the protection value of mangroves into risk underwriting (itself acting as an incentive for their protection)
Aon and Revalue Nature to Accelerate Global Decarbonization Efforts (Aon and Revalue Nature, 2022)	A collaboration between a professional services firm that offers a range of risk-mitigation products and a developer of nature-based solutions, to reduce relevant risks associated with carbon offset transactions. This collaboration, in the context of the Voluntary Carbon Market (VCM), aims to deliver climate mitigation benefits, improve biodiversity and benefit local communities	So as to attract potential investors, the insurer de-risks assets from damage and destruction by natural perils and other pertinent risks. These assets, restored/protected forests and mangroves (in Africa, Latin America and Asia-Pacific), underlie future carbon credits

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Name (source)	Short description	Role of insurance (and the financial sector more broadly)
First-Ever Coral Reef Insurance Policy in the US (The Nature Conservancy, 2022)	Natural disasters represent a major risk to coral reefs. State Senate passed a resolution in 2021 requesting a reef insurance evaluation, which was followed by a 2020 Bank of America-supported feasibility study	A parametric insurance that provides funding for rapid coral reef repair and restoration across Hawai'i immediately following hurricane or tropical storm damage
Parametric solution protects Belize's blue bond debt servicing from climate disasters (WTW, 2022)	Natural disasters are disproportionately affecting the economies of small coastal and island nations such as Belize - disaster response is costly and public debt servicing (along with sovereign credit rating) can be negatively affected. As Belize's economy strongly relies on natural assets for tourism and fisheries, a blue bond was developed aiming to reduce the country's debt burden as well as conserve its marine ecosystems	A risk transfer insurance solution to cover regular debt servicing needs after severe hurricane events (in which case the payment is waived). The solution is linked to a debt restructuring bond set up by a non-governmental conservation organisation, the bond being purchased by investors via an investment bank
Insurance to cover liability for prescribed burns (in Linnerooth-Bayer et al., 2023; p. 65)	Prescribed burns aimed at reducing the spread of wildfire carry unintentional risks to lives and properties	A liability insurance was developed aimed at qualified practitioners planning or conducting prescribed burns across much of the US
Insurers model NbS for preventing wildfire in Tahoe National Forest (in Linnerooth-Bayer et al., 2023; p. 67)	Wildfire insurance companies can incentivise NbS by offering reduced premiums to properties if the surrounding forests are fire-adapted, for instance, with ecological forestry as an NbS	Reduced insurance premiums for wildfire could be offered for properties if the surrounding forests are fire-adapted through ecological forestry (e.g. prescribed fire/burns, strategic thinning, grazing by animals), thereby reducing risk. Forest management could additionally be financed by insurance premium savings
Insuring mangrove forests to increase resilience and generate carbon credit revenue streams (in Linnerooth-Bayer et al., 2023; p. 63)	Mangroves are threatened ecosystems that are important for biodiversity and climate resilience of coastal communities, as well as serving as carbon sinks. An insurance product is being developed to strengthen mangrove conservation and restoration through a social enterprise project (Restoration Insurance Service Company, RISCO)	The product would cover the loss and damage to mangroves from unexpected natural and weather-related events that result in reduced carbon benefits. Premiums would be partly paid with carbon credits and geared mainly towards public clients
Nature-related financial opportunity use case: The role of mangroves, coral reefs and seagrass beds in	Use case explores how insurance can help protect natural assets (mangroves, coral reefs and seagrass	Insurance for designated marine protected areas ; insurance for ocean warming events leading to coral

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Name (source)	Short description	Role of insurance (and the financial sector more broadly)
supporting and protecting near-shore fisheries in Bolinao, the Philippines (CISL and Howden, 2024)	beds) that support near-shore fisheries, and more broadly the long-term sustainability of the region in terms of tourism and coastal storm protection	bleaching ; insurance for storm damage to coral reefs, mangroves, seagrass beds ; incentivising resilience building through insurance premium reduction
Nature-related financial opportunity use case: Debt-for-nature swap supported by credit insurance for marine conservation (CISL and MS Amlin, 2024)	Use case describes the roles of financial institutions in a scheme in which Ecuador exchanged debt restructuring for commitments to preserve its marine ecosystems	Reinsurance coverage ; coordination of the issuance of a 'blue'bond ; investment in sovereign debt ; provision of guarantees and insurance
Quintana Roo Reef Protection (Green Finance Institute, 2024)	The policy aims to protect the Yucatan Coastline in Mexico, and hence the reefs from storm damage, and by extension the populations that depend on them	A parametric insurance policy (payment triggered when hurricane wind speeds reach a pre-agreed level)
Through the Wilderness: The Role of Insurance in Unlocking Nature Finance (Howden and Pollination, 2024)	Report sets out priority interventions of the insurance sector to help develop solutions that can reduce barriers to investments into nature	Risk transfer to mobilise capital; Protecting natural assets; Enabling trading in environmental markets; Governance (e.g. incentivise clients' performance, integrate nature into underwriting criteria, etc)
Asset protection with mangrove restoration (in Howden et al., 2024a; p. 21)	A wind power infrastructure in Pakistan was at risk of high maintenance costs due to environmental hazards such as tidal erosion, and storm surges and typhoons. These risks were worsened by the degradation of local mangroves, less able to act as a natural barrier	A hybrid solution integrating mangrove restoration with asset protection insurance. Saved maintenance costs justified reduced insurance premiums, whilst mangrove restoration was estimated to generate increased local fishing revenues for the community
First carbon credits warranty and indemnity insurance policy (Howden et al., 2024b)	The demand for high-quality credits is strong. Insurance can help increase the integrity and value of the carbon credits, by demonstrating to buyers that their credits have met the highest levels of environmental, social and financial diligence, and are backed by an insurance policy that guarantees their provenance	Insurance cover on the sale of carbon credits for the reafforestation project of degraded forest lands. The policy aims to improve trust in the quality of carbon credits and has the potential to unlock a wave of capital into the carbon market
Harnessing England's Biodiversity Net Gain legislation to amplify urban flood risk management (Sherry and Kassian, 2024)	Biodiversity Net Gain (BNG) is an approach to development and land management that aims to leave the natural environment in a measurably better state than before. BNG enables nature, and nature is good for flood risk management, e.g. through the creation of	The insurance sector can play an important role by developing innovative insurance solutions designed to protect biodiversity and its maintenance/restoration over time – essentially de-risking investments in BNG/natural flood risk management

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Name (source)	Short description	Role of insurance (and the financial sector more broadly)
	urban green spaces, parks and wetlands, and the restoration of natural waterways	
Kita insures Marex's investment in mangrove carbon credit project (Kita, 2024)	Supported by an investor group, the Global Mangrove Trust restores and conserves coastal mangrove ecosystems, from which carbon credits are derived	Insurer provides a Carbon Purchase Protection Cover to the project's carbon credits, so as to add a layer of security, thereby acting as a stamp of confidence on the quality of the project itself
New insurance product to support Ecological Restoration (SCOR, 2024)	Ecological restoration aims to support the integrity and resilience of ecosystems, which provide vital ecosystem services to the planet and its people. However, there can be reluctance to finance restoration initiatives due to the inherent unpredictable and dynamic nature of ecosystems	A de-risking insurance product to bridge the "gap" between the need and the desire to finance ecological restoration projects, thereby supporting ecological restoration projects whose planned recovery trajectories have been adversely impacted by pre-defined perils
Mass timber: Insuring the future of sustainable construction (Zurich, 2024)	Building with mass timber (a family of engineered wood components) could reduce the carbon footprint of a large commercial building by up to 40 percent – provided the timber is sourced from sustainable forestry. Many building code regulators and insurance companies remain skeptical of its safety with regards to fire-resistance properties	New insurance policies, one providing coverage for the construction risks of one-off mass timber buildings, and the other for multiple mass timber buildings via a Master Builders Risk programme. This helped the insurer become the market-leading commercial insurer of mass timber projects

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Next steps/future work

The roadmap will be incorporated in an upcoming NATURANCE deliverable (D2.5 - *Training modules derived from business case analysis*, due September 2025) that aims to collate essential materials linked to all waves of NATURANCE Innovation Labs.

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Financing for heat action plans at city-level in Europe

By Willis Towers Watson (WTW)

Executive Summary

Urban heatwaves present an escalating climate risk across Europe, with events like the 2003 heatwave causing over 70,000 excess deaths, and subsequent extreme heat events in 2019, 2022, and 2023 highlighting the need for improved risk management. However, a critical gap remains: the absence of dedicated financing for preparing and responding to extreme heat. To address this, WTW hosted three sessions in their Innovation Lab to explore these financial challenges and the potential use of trigger-based financing, such as parametric insurance, as a solution to bridge this funding gap, focusing on beneficiary groups and natural assets/Nature-based Solutions.

The first session identified three key barriers to obtaining finance: (1) financing barriers, for example, where funding is available for "resilience" but not for longer-term "adaptation"; (2) data barriers, such as the lack of granular, hyper-local data to inform local responses and difficulties in selecting appropriate metrics for heat-related impacts; and (3) governance barriers, notably the lack of a central funding pool or a single governance body responsible for addressing heat risks, unlike other perils such as flooding. In London, a major challenge across both people and natural assets is proving the return on investment for heat risk management actions, as strong evidence of financial benefits is essential to secure funding.

The first session also explored the applicability of trigger-based financing[9] for financing preparedness and response measures for (i) beneficiary groups and (ii) natural assets/NbS. Key findings showed that various beneficiary groups, such as the homeless, elderly in care homes, and inmates, could benefit from additional finance to prepare for and respond to heatwaves. However, each group requires different risk information to assess their specific vulnerabilities, leading to the recommendation for future labs to focus on one specific group for further exploration.

Regarding natural assets/NbS, participants noted that trigger-based financing is less suitable due to the need for long-term investment rather than more immediate financing typically provided by these instruments. While some suggested that trigger-based financing could be useful for maintaining or restoring natural assets after heatwave impacts, its primary relevance appeared to be for beneficiary groups.

Building on the feedback from the first session, the second focused on two specific use cases:

[9] Trigger based financing instruments can trigger a pay-out once a pre-defined threshold of hazard (e.g. temperature) has been exceeded in a pre-defined area.

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The application of trigger-based financing to the pre-existing Hot Weather Severe Weather Emergency Protocol (H-SWEP) funding for rough sleepers during extreme weather conditions in London.

H-SWEP, developed in 2023 in response to extreme heat in 2022, aims to prevent harm to rough sleepers by activating funding during amber or red UK Security Health Agency (UKSHA)heat-health alerts. The funding is used for various response measures, including advisory services, sun-cream provision, and relocation to cool spaces. Key findings included concerns about the granularity of hazard data that would be used to underpin such product. There were concerns that widely recognized datasets like ERA5[10], although familiar to the insurance industry, may be too coarse and could lead to basis risk. Participants recommended the use of temperature data for locations where homeless people reside, such as under bridges, and to collaborate with academic initiatives, such as those at Oxford University, which are developing more granular climate data. On further discussion with Oxford University, an outstanding task for this dataset to be operational includes the quantifying uncertainty within this dataset. The key takeaway was the need for further exploration of suitable datasets. It is important to note that some degree of basis risk may be unavoidable, and that a suitable dataset must effectively balance historical depth, insurance market acceptance, and local micro-climate accuracy.

Another important finding was the need to establish a clear value proposition of trigger-based financing for the H-SWEP fund, for example, whether its primary benefit lies in the speed of payment or the flexibility of funding. Participants recommended that we work closely with stakeholders involved in H-SWEP funding to refine this. A holistic approach was also emphasised, prioritising risk reduction measures before/alongside emergency response financing from insurance. Further engagement with H-SWEP stakeholders was recommended to understand existing financing inefficiencies/challenges, and whether trigger-based financing could address them.

The use of risk information and associated analytics for managing the impact of urban heatwaves on green spaces in London.

Key findings fell into three categories: (i) data, (ii) policy and funding priorities, and (iii) further engagement. In terms of data, collaboration with satellite companies was seen as valuable for identifying "dry spots" or areas at risk due to insufficient greening. This could help prioritise interventions in critical locations, ensuring resources are directed effectively. Overlaying data on vulnerable populations would also allow for targeted interventions, ensuring these groups have access to cooling and shade. Regarding policy and funding, it was noted that the focus should be

[10] ERA5 is a Reanalysis dataset by the European Centre for Medium-Range Weather Forecasting and provides hourly estimates of a large number of atmospheric, land and oceanic climate variables. The data cover the Earth on a 31km grid and resolve the atmosphere using 137 levels from the surface up to a height of 80km. Available from: https://www.ecmwf.int/en/forecasts/dataset/ecmwf-reanalysis-v5

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on indoor temperatures and people's well-being before addressing the impact of extreme heat on green spaces. There was concern that green spaces/NbS are not cost-effective and could increase indoor heating when dried out. Additionally, there is a current ban on green walls in London due to fire risk concerns. Again, further engagement with relevant stakeholders was recommended to address these challenges.

Based on the feedback, the first use-case (H-SWEP) was deemed most appropriate to take forward and evaluate as a "Business Case". The final Innovation Lab discussed this Business Case in detail with the Head of St. Mungo's homeless charity in London. While the discussion primarily highlighted limitations relating to the winter SWEP, there were also valuable insights relevant to H-SWEP, offering broader lessons on the use of trigger-based financing for emergency response for rough sleepers in extreme weather conditions. The key takeaways were: (i) cold weather is more of a costly issue due to the need for bed space, and therefore this is more likely to suit additional financing than hot weather, (ii) structural inefficiencies exist, which could potentially override the benefits of a trigger-based financing structure. For example, regional advisors make final spending decisions, sometimes overriding borough priorities and (iii) the timely distribution of financing is lacking. This often leads to a reactive and last-minute response, with lack of prior planning on the use of funds.

This suggests that trigger-based financing, applied to existing funds rather than insurance, could be more beneficial for the H-SWEP / SWEP and the insurance could be more appropriate (if at all) for cases of overflow in winter. By providing a structured approach to the release of funds, trigger-based financing could help manage and address the inefficiencies within the current framework. To fully assess the feasibility of applying a trigger-based financing model to H-SWEP, engagement with the following groups was recommended: (i) rough sleeping leads in local authorities, (ii) outreach teams, particularly those involved in hot-weather response, (iii) local authorities, to understand their funding constraints and (iv) sub-regional coordinators, who influence spending decisions at a regional level.

In conclusion, our Business Case scored 65% with considerable evidence being shown in the 'Problem statement, Current baseline & Innovation' evaluation. The 'Impact', 'Implementation and Execution' and 'Finance' evaluations require further engagement to take this use case forward from concept to product development and placement.

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Introduction and purpose of the Innovation Lab

Innovation Labs are safe spaces that offer a collaborative environment where different agents are joined together for the purpose of innovating and generating new solutions (Arrighi et al, 2016).

Why do we want to address in the Innovation Lab: The Challenge

Following the devastating impacts of the 2003 European heatwave, which resulted in over 70,000 excess deaths across twelve countries, including England, Spain, France, and Germany, heatwaves are increasingly recognised as a growing climate risk across Europe (Robine et al., 2008). In response to this event, governments across Europe, including the United Kingdom, began developing national risk planning strategies for extreme heat. For example, the UK introduced the National Heatwave Plan in 2004 (NHS, 2009).

Since then, Europe has experienced several extreme heatwaves, most notably in 2019, 2022, and 2023. The 2022 heatwave was particularly significant for the UK, as it was the first time the Met Office issued a red extreme heat warning. This event highlighted the need for improved heatwave risk management, leading to the development of the Adverse Weather and Health Plan in April 2023, which replaced the previous Heatwave Plan (UK Government, 2024). In a similar vein, several European cities, including Cologne, Paris, and Vienna, have developed heat(-health) action plans (HAPs) at national and sub-national levels. These plans outline how to prepare for, respond to, and mitigate the impacts of heatwaves through short-, medium-, and long-term measures. Many incorporate references to investments in nature-based solutions and green infrastructure as part of their long-term adaptation strategies.

Despite progress in heatwave planning, a major limitation across all cities is the lack of dedicated financing mechanisms for preparing and responding to extreme heat. This gap is evident in several ways:

Absence of funding commitments: In 2023, the National Audit Office (NAO) found that the UK Government could not provide any examples of funding or investments specifically allocated to managing heatwave risks (Howarth et al., 2024). Additionally, in HAPs for cities like Cologne, Paris and Vienna, although distinct responsibilities and measures are outlined to adapt to heat, there is lack of clarity on how these would be funded.

Policy gaps in financial strategies: For example, while the UK Green Finance Strategy acknowledges the need for adaptation to heat risks, it lacks concrete commitments to developing new financing mechanisms for heat resilience (HM Government, 2023).

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Significant investment shortfalls: For example, a £976 million funding gap has been identified in the provision of accessible green and blue spaces across the UK, which are crucial for mitigating urban heat effects.

Lack of support for city and municipal governments: City and municipal governments frequently highlight the need for government support in adapting and responding to climate change, including heatwaves.

The objectives of WTW's Innovation Lab's

Given these challenges, WTW's Innovation Lab sought to investigate **why this financing shortfall exists and explore potential solutions to overcome it.** To fulfil this aim, we had the following objectives:

To understand financial barriers: Identify the financial challenges associated with preparing and responding to urban heatwaves, with a particular focus on different beneficiary groups and natural assets.

To explore trigger-based financing instruments as a key solution to overcome the financial gap by assessing the feasibility of using risk information and risk-informed, trigger-based financing tools, such as parametric insurance, to support proactive heatwave risk management, for beneficiary groups and natural assets.

Overview of approach

Cross sector collaboration and perspective is critical to develop a consensus on the feasibility of specific actions to manage the impacts of urban heatwaves. As such, WTW hosted a series of three workshops throughout 2024 and 2025, each session bringing together specialists from various sectors involved in heat disaster risk management, including but not limited to: urban heat, nature-based solutions, public policy, government policy, and finance. Various formats were used to promote open discussion, including presentations, break-out groups, and plenary sessions.

In addition to these sessions, WTW also arranged a series of one-to-one calls with experts in heat risk management. These included experts from: London School of Economics Grantham Research Institute, ICLEI and University of Oxford ZERO Institute.

Details of Innovation Lab

Operational Details of Workshops

WTW hosted three workshops, two virtual and one in-person in London. A total of 30 experts participated, representing various organisations. Many of these organisations were engaged in pre-discussions as well as the sessions themselves. Table 5 provides an overview of the participating organisations and the fields of expertise of their attendees.

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Table 5 An overview of the organisations that were represented in the Innovation Labs, along with their descriptions and the areas of expertise of those attending from that organisation

Organisation	Description	Representatives Areas of Expertise
ARUP	ARUP is a global collective of designers, engineers and consultants dedicated to development of a more sustainable world. Attendees from ARUP specialised in urban extreme heat planning and were part of the project team who created the Uheat tool, to give insights into where hotspots in the city are, to assist with urban planning and greening efforts.	Environmental physics, microclimate modelling and engineering, urban heat specialists, heat hazard data, climate change projections
Greater London Authority	The Greater London Authority (GLA) is the regional government body responsible for governing Greater London. It oversees key strategic areas including transport, policing, economic development, housing, environment, and planning. The GLA consists of the Mayor of London, who leads the authority, and the London Assembly, which scrutinises the Mayor's decisions.	Climate change adaptation, climate policy, heat adaptation policy, London strategy,
ICELI	Local Governments for Sustainability is a global network working with more than 2500 local and regional governments committed to sustainable urban development. They influence sustainability policy and drive action for zero emission, nature-based, equitable, resilient and circular development.	Economics, equitable climate change policy, insurance, natural assets
Independent Consultant	An individual consultant with 14 years of experience in disaster risk finance, heat and public policy and economics.	Economics, heat modelling, disaster risk finance, public policy
International Institute for Applied Systems Analysis (IIASA)	The International Institute for Applied Systems Analysis (IIASA) is an international research institute that advances systems analysis and applies its research methods to identify policy solutions to reduce human footprints, enhance the resilience of natural and socioeconomic systems, and help achieve the Sustainable Development Goals.	Urban resilience, urban planning and climate change adaptation
London Borough Council (Southwark)	One of the collective local governments in London. London Councils' shared ambitions have been set by their Leaders' Committee, which comprises the Leaders and directly elected Mayors of the boroughs and the Chair of the Policy and Resources Committee at the City of London Corporation. Their Leaders' shared ambitions focus on many aspects including: London's Future: Climate Adaptation & Net Zero: Supporting boroughs to deliver a net zero and resilient London.	Climate change, London council perspective

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Organisation	Description	Representatives Areas of Expertise
London School of Economics (LSE) Grantham Research Institute	A world-leading multidisciplinary centre for policy-relevant research and training on climate change and the environment. The institute brings together international expertise from across LSE and beyond, including on economics, finance, geography, the environment, science, law, international relations, development and political science. The specific teams we engaged with were focussed on heat policy and risk in London, including being authors of the London Climate Resilience Review and the Turning Up The Heat report.	Climate adaptation and resilience, climate policy, heat policy, sustainability,
Oxford University (Net Zero Institute)	A platform that is informed by leading climate researchers and hosted by the University of Oxford, bringing together principles and policies, practical tools, and progress tracking to help businesses and policymakers achieve net zero emissions.	The use of hyper-local climate data for urban risk analysis
Shade the UK	A London based company which strives to adapt the built environment and public spaces to protect the vulnerable against a changing climate	Environmental design, M&E Engineering, Sustainability Certification, Dynamic Software Modelling, Air Quality, Acoustics and Daylight analysis.
St. Mungo's	A London based homeless charity, that works directly with people experiencing or at risk of homelessness, providing them with services to find paths away from homelessness for good. They also influence policy makers to make positive changes. They provide rough sleeping support, emergency accommodation, and skill and training services to get people into work,	First responder perspective on the inefficiencies of financing to help homeless people through extreme weather events
United Nations University's Institute for Environment and Human Security (UNU-EHS)	The United Nations University's Institute for Environment and Human Security (UNU-EHS), located in Bonn, is a think tank focusing on advancing human security and well-being by reducing current and future risks from environmental hazards and climate change.	Sustainable urban and regional development, green and grey infrastructure, adaptive social protection and loss and damage, with a focus on marginalized population groups.

Workshop 1

The first session took place virtually on the 26th November 2024. The aim was two-fold:

(i) To discuss the key challenges associated with urban heatwaves, specifically those challenges standing in the way of obtaining financing for preparedness and response actions and protection and resilience-building for NbS/natural assets.

(ii) To canvass potential solutions to financing the various actions required to manage urban heatwaves

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Approach

Part (i)

WTW gave a short presentation which introduced the "Problem Statement". We know there have been numerous heatwave events over the last ~20 years across Europe, most notably the 2003 European heatwave and more recently, the 2020 European heatwave. These heatwaves have had various impacts on different sectors, of which we focused on (i) people and communities, (ii) built environment and infrastructure, (iii) blue-green infrastructure and (iv) the economy.

To provide some framing for the canvassing of potential solutions, WTW presented examples of different solution categories, drawn from the literature. For example, risk assessment actions, awareness raising and public education, climate adaptation and disaster risk reduction, national heat risk planning, hard and soft infrastructure investments, nature-based solutions, preparedness and emergency response planning. We also referenced the Disaster Risk Management (DRM) cycle, noting that different actions are required at different stages of this cycle. This provided some common basis for discussion during the first breakout session. The key challenge in an urban heat risk management context, which is well established in literature, is the **lack of financing of these solutions and actions.** This set the scene for the first breakout room where two breakout rooms discussed the following theme and sub-questions (Box 2).

Breakout Room 1

"The key challenges associated with urban heatwaves, specifically those challenges standing in the way of obtaining financing for preparedness and response actions and protection and resilience-building for NbS/natural assets"

- How is heat risk management currently financed at the city-level and what are key solutions/actions?
- What are the **challenges in financing** these solutions/actions?

Box 2 The discussion theme and sub-questions for breakout room 1.

Part (ii)

WTW gave a short presentation which introduced the importance of risk information in urban heatwave management, and its critical role for heatwave risk management. We introduced examples of different financial instruments (e.g. budget allocations, disaster prevention funds, loan/debt instruments and trigger-based financing) and how different instruments can be used to finance (i) different risk management actions (e.g., preparedness, response, reconstruction) and (ii) different severities of heatwaves.

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This presentation highlighted that any of these financial instruments can be made to be "trigger-based", which means that the instrument can trigger a pay-out once a pre-defined threshold of hazard has been exceeded. This has many advantages when managing urban heatwaves, including, but not limited to guaranteed cash flow, fast payment and use-cases of the payment are flexible.

A thorough understanding of the indices used to measure heat hazard is critical to ensure that financing is made available to implement risk management actions in response to urban heatwave events. Certain heat hazard indices are more appropriate for certain types of impact. For example, if you are trying to develop a trigger-based finance instrument for targeting human health, then a hazard index incorporating variables like relative humidity, solar radiation as well as air temperature would be more appropriate than purely using air temperature as the trigger.

In addition to having a thorough understanding of the hazard, we emphasise the importance of identifying beneficiary groups/units for the finance, for example people, critical infrastructure services and natural assets, as well as identifying what actions are needed, and their cost. These actions enable the development of meaningful financial cover.

The presentation concluded with two different case studies of how trigger-based risk financing products are currently being used to address urban heat risk, one in India (Ebrahimi, 2024) and one in Viet Nam (German Red Cross, 2019) (Figure 4).

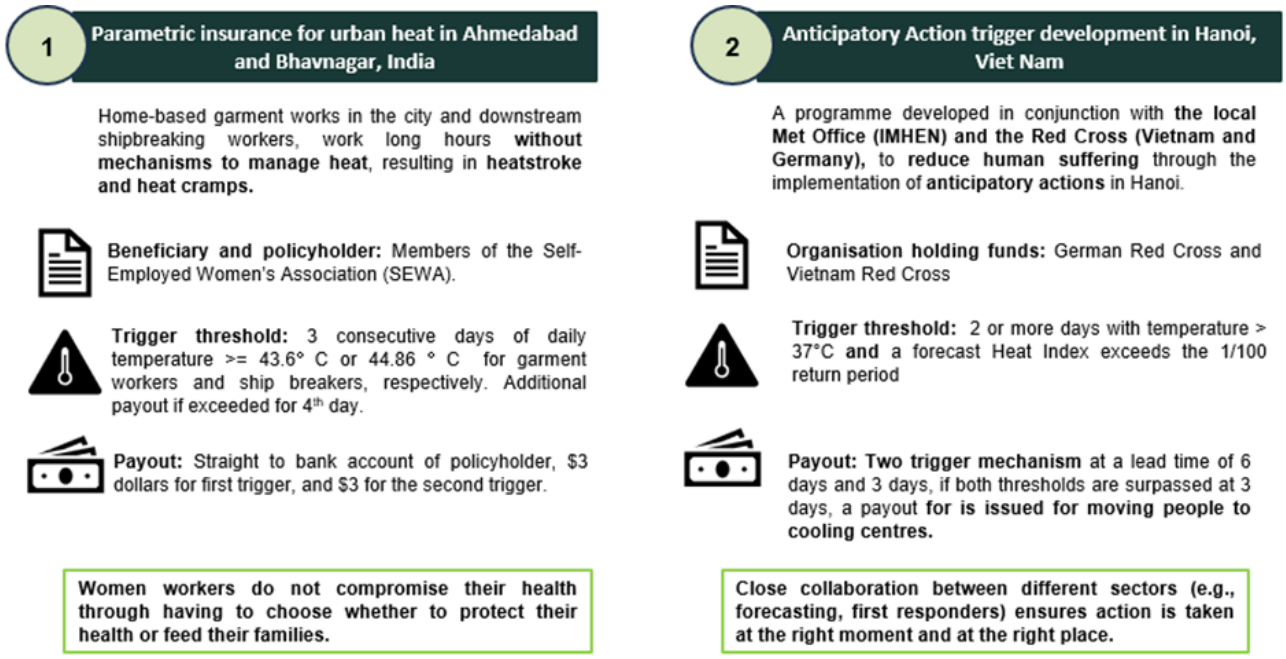

Figure 4 An overview of two trigger-based financing products in (1) India and (2) Viet Nam.

This set the scene, to get participants thinking about how trigger-based risk financing could be deployed to support urban heatwave risk management in their respective cities. We split into two

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breakout rooms. Breakout Room 2a and 2b discussed the following themes and sub-questions (Box 3).

Breakout Room 2a

"Identify priority population segments, required hazard information, and preparedness and response actions in the context of heatwaves and related information needs/gaps."

- **Which beneficiary groups should be the focus,** what risk information do we need to define trigger thresholds and what are relevant preparedness and response actions?

Breakout Room 2b

"Identify critical natural assets, required hazard information and preparedness and response actions in the context of heat-waves as well as related information needs/gaps."

- **Which natural assets should be the focus,** what risk information do we need to define trigger thresholds and what are relevant preparedness and response actions?

Box 3 The discussion theme and sub-questions for breakout room 2a and 2b.

Workshop 2

The workshop took place in-person at the WTW offices in London, on the 4th February 2025. The overall aim of this lab was to deep-dive into solutions to manage urban heatwaves in London, with a focus on financing and natural assets. Based on the outcomes from the previous session (see section 3.1 for more detail), we focussed on two specific use cases:

(i) The application of trigger-based financing to the pre-existing Hot Weather Severe Weather Emergency Protocol (H-SWEP) funding for rough sleepers during extreme weather conditions in London.

(ii) The use of risk information and associated analytics for managing the impact of urban heatwaves on green spaces in London.

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Approach

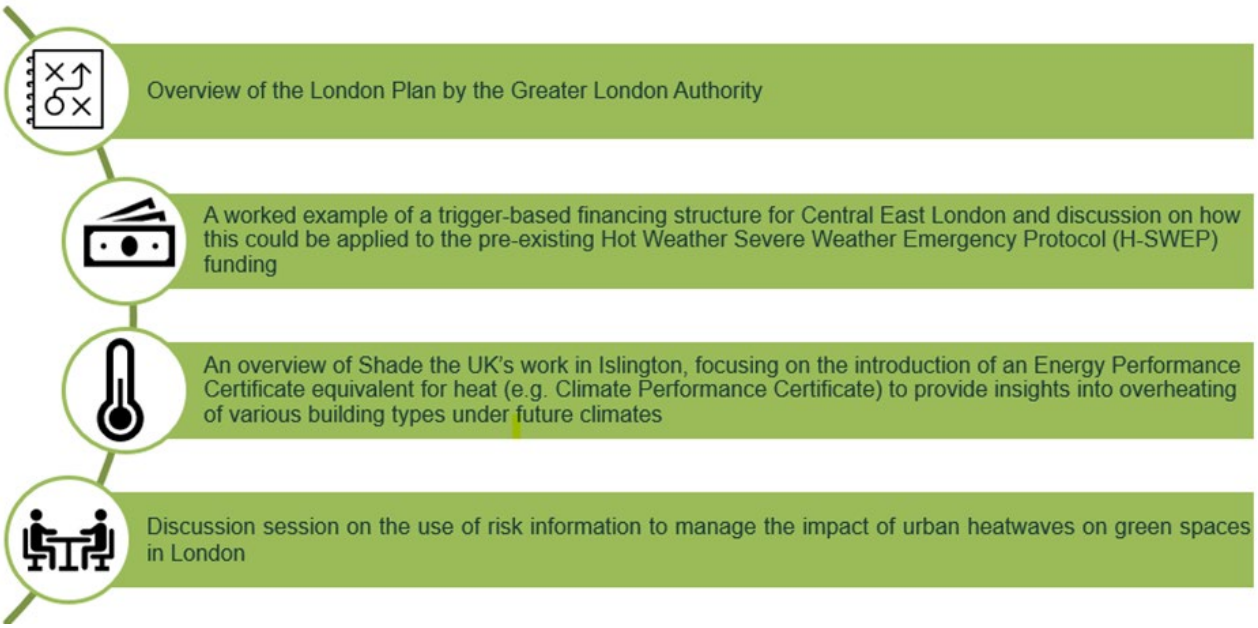

Figure 5 The key components of Workshop 2.

Overview of the London Plan by the Greater London Authority

Four colleagues from the Greater London Authority set the context of the session by presenting the 'London Plan 2021'. The London Plan is a Spatial Development Strategy for Greater London. It sets out a framework for how London will develop over the next 20 – 25 years, and the Mayor's vision for Good Growth. The London Plan is part of the statutory-development plan for London, meaning that the policies in the Plan should inform decisions on planning applications across the capital.

The presentation focussed on policies relevant to overheating including:

Design (e.g., optimising design of new developments to be heat resilient and housing quality and standards)

Sustainable infrastructure (e.g., managing indoor overheating whilst also reducing reliance on active cooling, and minimising impacts of the Urban Heat Island (UHI) effect)

Green infrastructure (e.g., urban greening and making sure it is planned, designed and managed in an integrated way)

A worked example of a trigger-based financing structure for Central East London and discussion on how this could be applied to the pre-existing Hot Weather Severe Weather Emergency Protocol funding

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Overview of the application of a trigger-based financing structure to the pre-existing Hot Weather Severe Weather Emergency Protocol

The H-SWEP aims to prevent loss of life and harm to rough sleepers during extreme hot weather conditions. H-SWEP was developed in 2023, after the extreme temperatures in summer of 2022, and the recognition that probability of extreme heat is increasing and that this presents a significant risk to rough sleepers. H-SWEP is activated when an amber or red UK Security Health Agency (UKSHA) Heat- Health alert is issued in partnership with the UK Met Office. There are various preparedness and response actions associated with the H-SWEP (Figure 6).

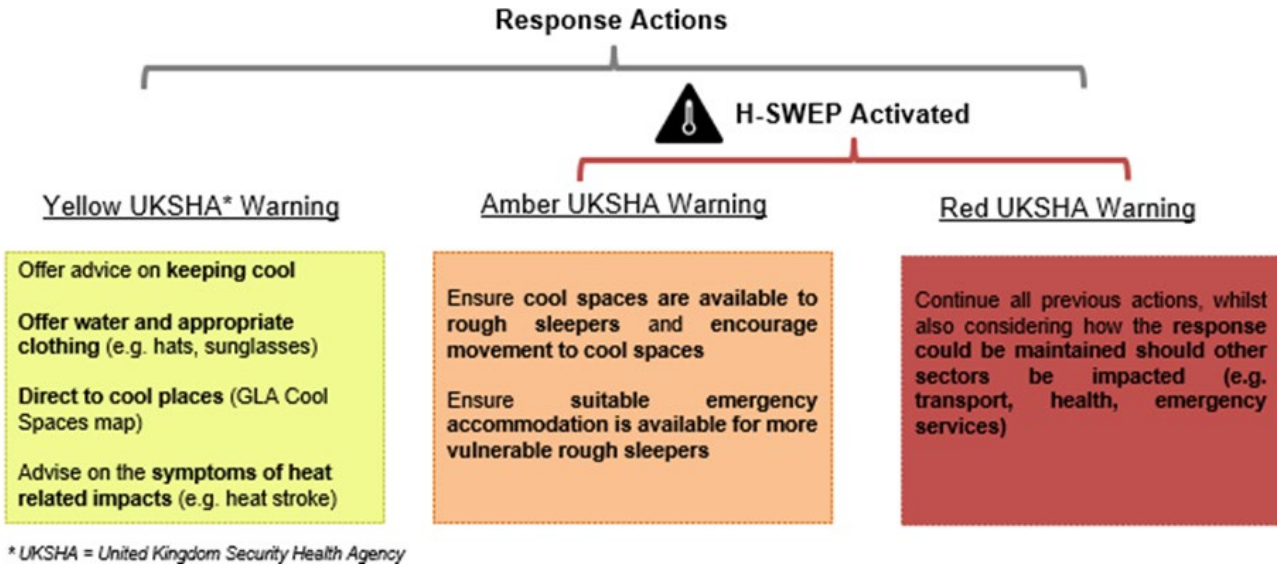

Figure 6 An overview of the key response actions to be undertaken by responders during extreme weather events, to reduce the impact of the conditions on rough sleepers in London.

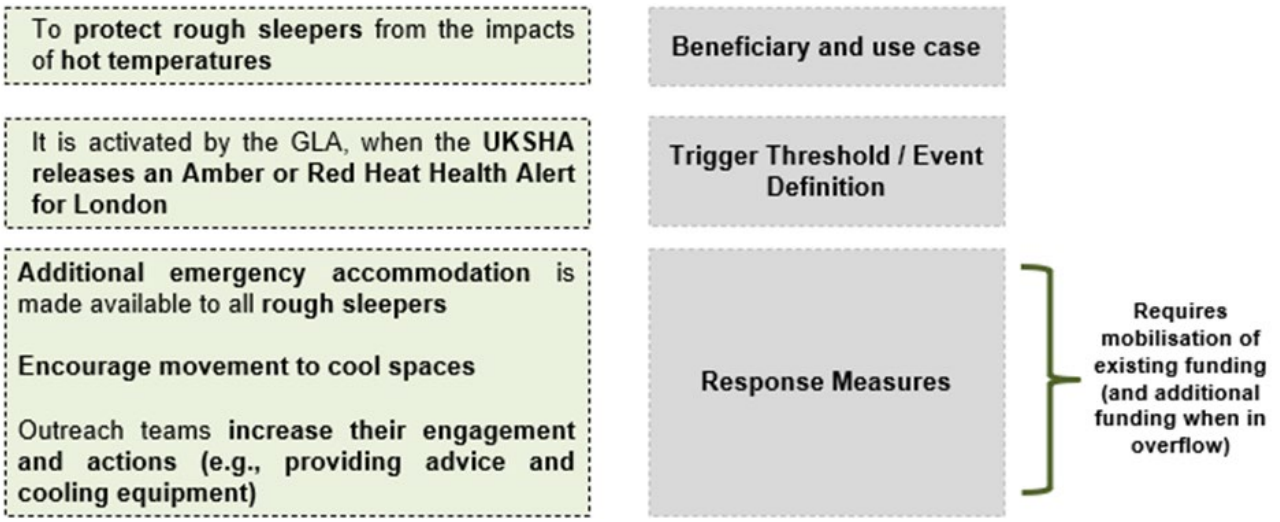

Figure 7 An example of how each of the elements of the H-SWEP fit into the key components required for a trigger-based financing structure.

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The trigger threshold / event definition could be linked to the UKSHA alerts. So, for example, a 20% payout could be issued for yellow warning, 60% for amber, 100% for red. The key here would be to establish temperature thresholds associated with these warnings, the UKSHA already attempts to give indicative temperatures. (e.g. 30 degrees for a few days for amber, 32 degrees for red). The response measures (as well as preparation measures), require funding. This funding appears to already be available, though frequently it is mentioned in the protocol that should the H-SWEP go into "overflow", i.e., demand outweighs capacity, then additional accommodation should be sought, and finances will be reimbursed.

Two clear use cases for applying trigger-based financing to the H-SWEP were discussed amongst the attendees.

Use case 1: Apply a trigger-based financing structure to the already existing funds, which would create a framework under which funds are released and would give certainty on release of funds should the predefined thresholds be met.

Use case 2: Create a parametric insurance "back-stop". This is particularly relevant for extreme events, where additional funding could be beneficial (e.g. those overflow events). This could be tailored in many ways, but an example could be that existing funding is used, unless extreme events occur, in which case additional funding could be released as insurance to assist emergency response efforts.

Overview of the worked example

Trigger-based financing products, specifically parametric insurance, pay out once a pre-defined threshold of hazard (e.g., temperature) is exceeded. The insurance pay out can be used to pay for the response measures required to assist the impacted exposure units (e.g., vulnerable people).

WTW developed an example of a parametric insurance structure, using historical outdoor wet bulb temperature[11] data for Central Eastern London (Figure 8) with the aim of emphasising how these types of structures can be applied to use cases in London.

[11] Outdoor wet bulb temperature is an estimate of how heat is felt by humans. It incorporates air temperature, dew point temperature and surface pressure.

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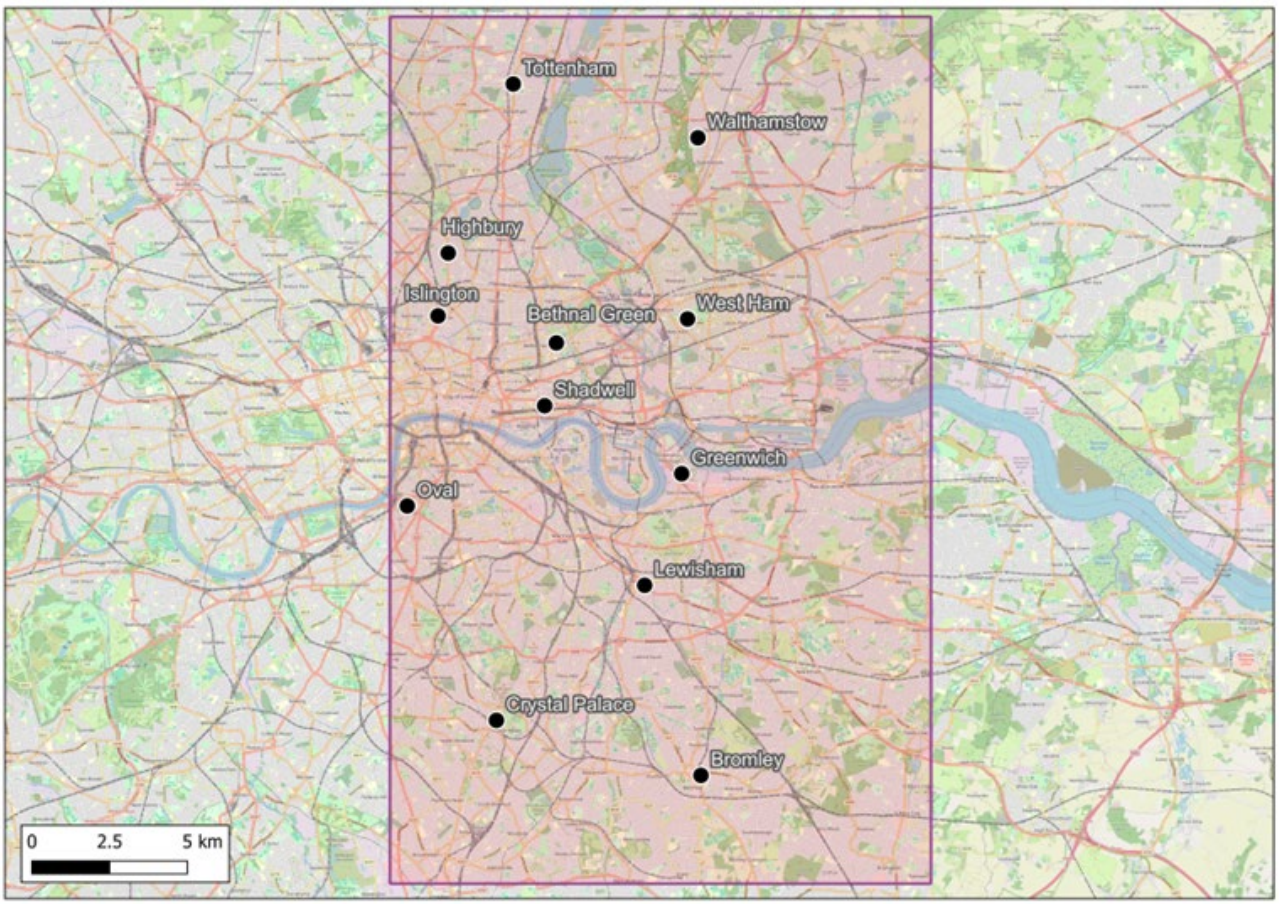

Figure 8 The study area over which the parametric insurance structure was developed. In other words, historical hazard data from the figure shown above is the input to the parametric insurance structure

We took the attendees through the key input metrics to the parametric insurance structure (Table 6) and discussed their influence on the output risk metrics from the structure (Table 7), which ultimately determines the pricing of the insurance.

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Table 6 An overview of the input metrics to a parametric insurance structure and their definition.

<table>
<tr><th>Input Metric</th><th>Definition</th></tr>
<tr><td>Heatwave Event</td><td>Three days or more where the outdoor wetbulb temperature exceeds 28 degrees</td></tr>
<tr><td>Annual Limit</td><td>The maximum amount of financing released in a policy year</td></tr>
<tr><td>Event Limit</td><td>The maximum amount of financing released per heatwave</td></tr>
<tr><td>Payout Matrix</td><td>Defines the total financing to be released, once the Heatwave Event definition has been met. The amount depends on the maximum temperature reached within the heatwave.</td></tr>
<tr><td>Payout</td><td>The total financial payout for a given Heatwave Event. This is calculated by multiplying the parametric loss in the Payout Matrix by the Event Limit.
<table>
<tr><th colspan="3">Payout Matrix</th></tr>
<tr><th>Lower Temp</th><th>Upper Temp</th><th>Parametric Loss</th></tr>
<tr><td>-10.00</td><td>28.00</td><td>0%</td></tr>
<tr><td>28.00</td><td>29.50</td><td>5%</td></tr>
<tr><td>29.50</td><td>30.50</td><td>20%</td></tr>
<tr><td>30.50</td><td>31.50</td><td>50%</td></tr>
<tr><td>31.50</td><td>50.00</td><td>100%</td></tr>
</table>
</td></tr>
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Table 7 An overview of the output risk metrics from a parametric insurance structure and their definition.

Output Risk Metric	Definition
Triggering Event	The total number of heatwave episodes in a year which meet the criteria for a "Heatwave Event".
Annual Burn Cost	The total financial loss from heatwaves that can be expected in a policy year.
Total Number of Losses	The total no. of years in the historic record which would have generated a pay-out.
Probability of First Loss (PFL)	The probability of having a triggering event in the first year of cover.
Expected Loss (£)	The total expected financial loss from heatwaves in a policy year, using the Event and Annual limits.
Standard Deviation	A measure of uncertainty around the Expected Loss (CoV * EL)
Coefficient of Variation	A measure of volatility / variability around the Expected Loss (S.D / EL)
Risk Load	Used as a multiplier to the Expected Loss. This is decided by the underwriter and is informed by aspects, including but not limited to: internal costs, profit margins and uncertainty in data.
Premium	The total cost of the (insurance) policy.
Rate on Line (RoL)	The premium as a percentage of the Annual Limit.

For example, in Scenario 1 below, if the temperature threshold within the pay-out matrix is increased, and all other variables are kept the same as the baseline scenario, this leads to a reduction in premium, as the number of Heatwave Events which surpass that trigger threshold decreases. This means the payouts are less frequent, and therefore less money Is required, on average, to cover the losses (Figure 9).

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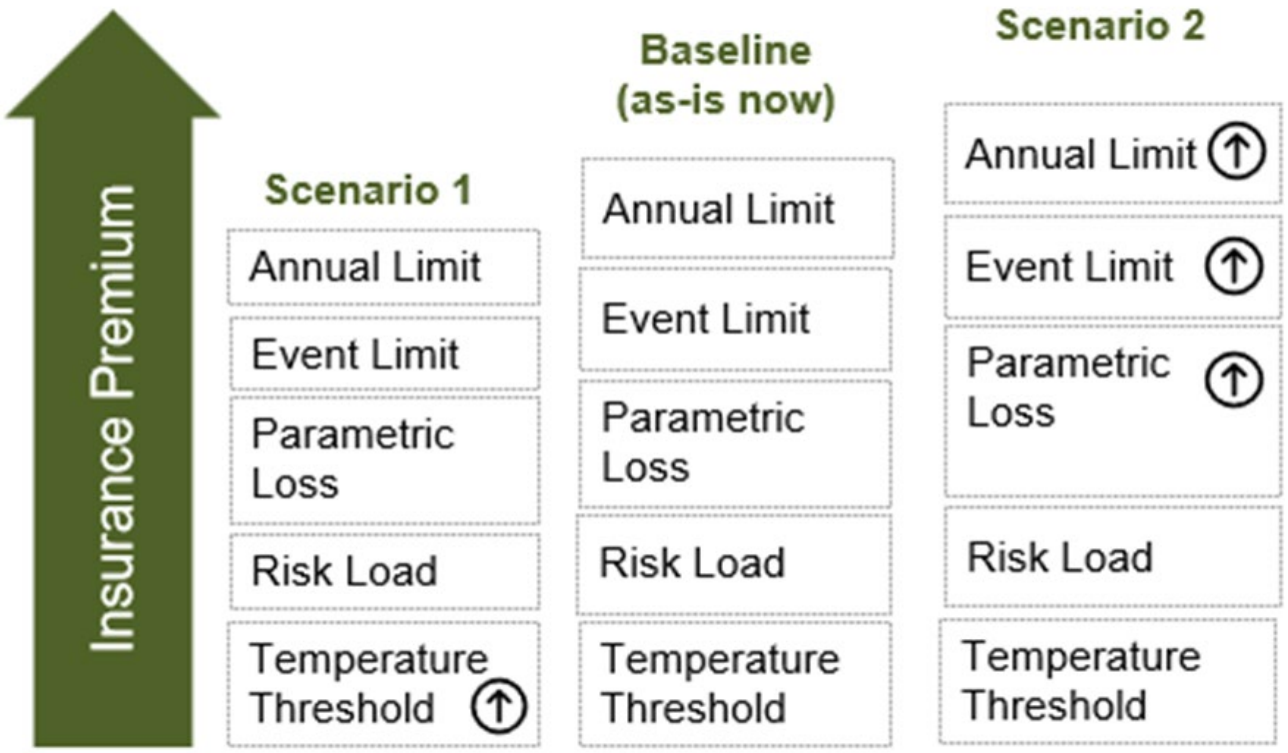

Figure 9 A visual showing how changing the input metrics to a parametric insurance model, influences insurance pricing.

In scenario two, if the Annual Limit, the Event Limit, and the Parametric Loss are increased, either individually or collectively, in comparison to the baseline scenario, the premium increases. By increasing these variables, you are directly increasing the magnitude of payouts. This means over a given period of time, your payouts will be larger, and therefore more premium is required to support this.

In addition to these metrics, we discussed the importance of validating the triggering events generated by the parametric structure against real-world experience or literature. For example, if the structure triggers a 100% payout for August 2003, it is essential to assess whether this aligns with the client's expectations. This validation is crucial for minimising basis risk, defined as the possibility that a significant heatwave occurs but fails to trigger a payout, or conversely, that a payout is made without a genuinely impactful event.

Lastly, we highlighted that while our example framed the underlying structure as insurance, it can also be applied to internal budgetary funds. The same principles would apply whereby changes in key variables would influence the frequency and intensity of payouts, but there would be no premium costs. Our key takeaway for attendees was to determine whether existing funding is sufficient but requires a structured mechanism for release or if additional funding is needed. In the latter case, parametric insurance could provide a viable solution.

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An overview of Shade the UK's work in Islington

A local company called "Shade the UK", who aim to adapt the built environment and public spaces to protect the vulnerable against a changing climate, presented on a project they are undergoing in Islington in London, to build an indoor overheating index to explain how different building types, including jails, hospitals, high rise and low rise residentials, care homes and primary schools, are exposed to indoor heat. Their aim was to develop a certification like the current Energy Performance Certificates (EPC), that shows the climate performance of a building and how much hotter they will be in the future due to factors like size, building material and aspect.

Discussion session on the use of risk information to manage the impact of urban heat waves on green spaces in London

A key takeaway from workshop 1 was that longer term investment is required to increase the coverage / quality of green spaces in London, whereas the role for shorter-term trigger-based risk financing was less clear. As such, we concluded with a discussion session on how risk information and associated analytics could be used to manage the impact of heatwaves on green spaces. The questions below were used to prompt discussion amongst attendees:

- What types of risk information are currently available / being used for monitoring urban heatwaves and their effects on green spaces?
- What are the most effective technologies (e.g. satellites, AI) for monitoring and predicting heatwave impacts on urban spaces, and which metrics are most appropriate (e.g. NDVI)?
- Are there any specific stakeholders who benefit from / or use exposure data (e.g. mapping of parks) in combination with hazard data (e.g. temperature) to predict and manage urban heatwaves?
- Are there any key gaps in data for understanding the vulnerability of green spaces to heatwaves?
- How can risk analytics be used to quantify return on investment, for promoting the funding of green spaces?
- Who currently funds maintenance of green spaces in London?
- Based on today's overview of an example trigger-based finance structure, are there any other specific use cases in London where this could be applied?

Workshop 3

The final workshop took place on the 27th February 2025, and featured an in-depth discussion of our business case (see Section 4) with the Head of Rough Sleepers at St. Mungo's, a London-based homeless charity, who provided valuable insights from a frontline perspective. St Mungos represents a potential end beneficiary for this business case, enabling us to gain a sense of the opportunities for implementation, alongside potential challenges.

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Outcome/Results

This section provides an overview of the main findings from our discussions with the key experts in each Innovation Lab.

Workshop 1 Results

WTW provided an overview of their view of the key actions and solutions required to manage the impacts of urban heatwaves (Figure 10).

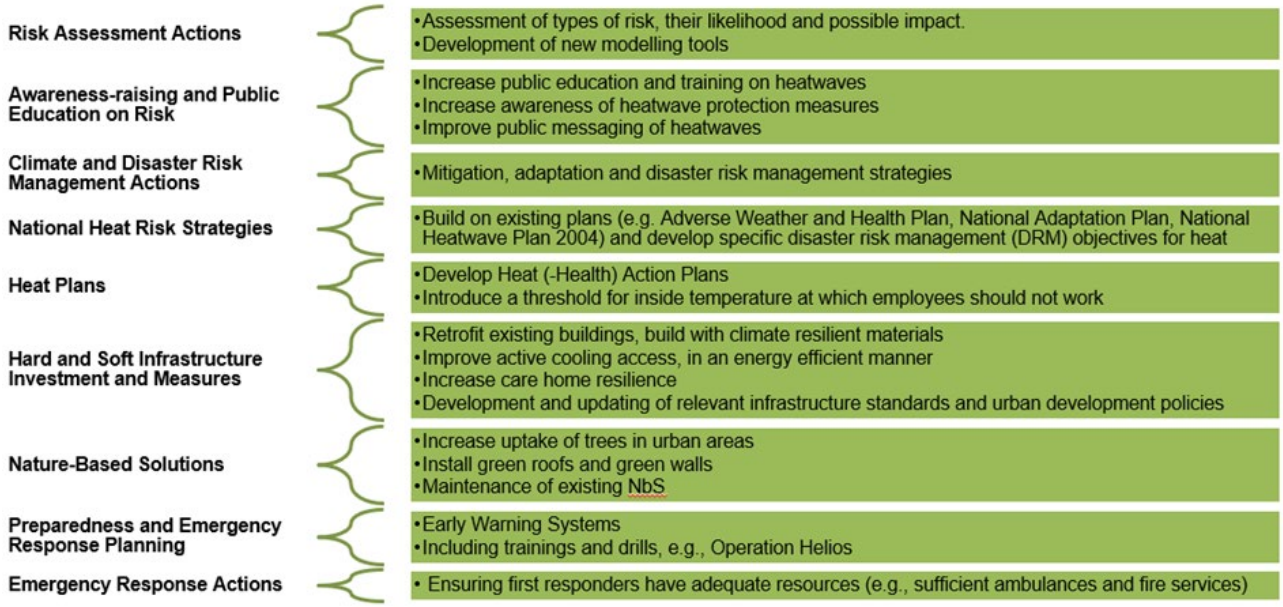

Figure 10 An overview of the key actions and solutions required to manage the impacts of urban heatwaves.

Attendees provided feedback on these recommendations, indicating their level of agreement and suggesting additional actions or solutions for consideration. A summary of the feedback is detailed below:

"It is hard to assess what solutions are needed, this needs to be decided before they can be financed".

> For example, should there be financing to mitigate the impact of people being less productive in the heat or should there be training given to healthcare providers/carers for how to look after patients in the heat?

There are so many impacts and potential interventions that it *"makes for a very tricky decision problem".*

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An attendee suggested adding heat metrics as an emerging action category.

An attendee suggested that forecast-based market instruments may be less relevant in wealthier European cities. These solutions are especially relevant in developing countries where people lack resources to fund basic response action; however, these solutions may be less relevant in Europe; nonetheless, trigger-based funds could still be relevant for preparedness / anticipatory actions.

Attendees suggested additional heat solution examples based on European cities. For example, the Vienna water sprayer system and the Zurich river-based water-cooling system.

Multiple attendees noted that there are a multitude of solutions, we should focus on one good solution and cost it properly. In the past a lot of policy proposals have wanted to do too much and not achieved what they set out to do.

Following this, we discussed the key challenges in financing these actions/solutions. These challenges fell into three main categories: (i) financing, (ii) data and information and (iii) governance. Table 8 summarises the key points within each category.

Table 8 An overview of the key challenges associated with financing the preparedness and response actions for managing urban heatwaves.

Challenge	Key points
Financing	§ **Funding is available for certain actions and not others.** In London, boroughs have access to funds for "resilience" but no money for "adaptation" which is seen as a longer-term issue. Furthermore, it is difficult to quantify the benefits of adaptation which makes it difficult to make a case for investment. § The scale of adaptation needed in cities is extremely large, it needs to bring together various stakeholders and finance. There would also be ongoing costs for any nature-based solutions put in place. § The interventions needed are hard to apply, for example the National Health Service (NHS) would be unlikely to look for insurance against heat related losses/impacts. Similarly, a likely solution in care homes would be to employ more staff and would be incredibly hard to assign finance to insure this solution.

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	§ Many of the costs associated with extreme heat are “knock-on” or secondary. In the case of the NHS, additional costs are invisible – they are just absorbed.

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Data and information challenges	§ **Difficulty in selecting an appropriate metric to assess impact of heat on exposure units (e.g., vulnerable people).** For example, excess mortality (or avoided excess mortality) is a frequently used metric when assessing impact of heat on the population, but this only captures one type of impact. Additionally, there is less information on environmental impacts, making it difficult to select an appropriate impact metric. § There is a challenge in **quantifying the impacts of a heatwave,** for example, how many extra people will be admitted to hospital. The costs need to be quantified properly before government or local authorities will put aside finance for long-term planning/solutions. § When it comes to heat impacts, **attribution is a challenge.** Unlike for flood impacts where the cause-effect is relatively obvious, "impacts cannot be neatly tagged to a heat event". Impacts on the physical environment are one thing, but we also need to think about the "social infrastructure". § Similar to the above, one can **describe heat impacts as "diffuse" and occurring in a range of settings which include buildings** (e.g., care homes, hospitals), the built environment / community (e.g., emergency services / interruption to key services), and individuals (e.g., vulnerable populations). § **We need more data on how different communities are affected by heat.** Currently there isn't a granular analysis of the people most at risk. § **Data plays an important role in developing heat actions, yet it remains a challenge**: There is a general lack of hyper-local granular data to inform local response; municipalities also face capacity challenge in understanding and managing such data. Even if the data was available at high level, there is no framework that translates this data into actions on the ground. There is not enough financing for this data.

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Governance	§ **Lack of central funding pot and absence of a single responsible governance body**: Unlike flood, there is no central funding scheme with heat management sitting across different governance bodies; this is partially due to the multi-sector nature of heat impact, making coordination and management inherently challenging § **Cities could fill the vacuum in governance and financing:** However, this requires (1) close coordination with central government; (2) awareness of city-level heat management actions (e.g., NbS); and (3) capacity to use and manage heat data § **Current framing of heat as a co-benefit:** Heat is often delivered as a co-benefit of other climate actions (e.g., new-built energy efficiency, green drainage, rain garden); this approach creates challenges in tagging and tracking heat funding; however, there is opportunity to flip this framing – heat measures having co-benefits for other urban agenda § There is often **a short-term focus on financing climate related events**, for example if there is a flood, finance is often provided straight away to help mitigate the impacts of the event. A main challenge is to encourage a long-term focus on financing at the government or local level that would be used to plan and adapt for heatwaves. § Sometimes the issues arise due to more systemic drivers. For example, hospitals may be located in highly exposed areas, because they are public buildings and the land in these exposed areas is cheaper. It may be difficult to intervene on just a small part of the problem. § Lots of policies try to do too much, which creates uncertainty meaning that ultimately, decision makers choose to not do anything. There is political risk and very little opportunity for gain. Given this wider context, it would be best to **"do one thing and make the case for it well."**

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Following WTW's presentation on the use of risk information and trigger-based financing to support key actions in managing urban heatwaves, attendees discussed the critical beneficiary groups and natural assets that should be prioritised, as well as the necessary risk information and response measures for each.

Key beneficiary groups and related risk information

A major theme of the discussion was the diversity of vulnerable groups that must be considered, along with concerns about adequately characterising their specific vulnerabilities.

Key beneficiary groups identified included: People on zero-hours contracts who cannot work in extreme heat, outdoor workers, homeless populations, immobile individuals (of all ages), people with learning difficulties who may struggle to interpret heat warnings and take protective action, older people in care homes, those in prisons and carers of vulnerable individuals (both private carers and family members).

One attendee highlighted that significant work has already been undertaken on interventions in care homes in London, including cost-benefit analyses of different solutions and staff training on protecting residents during extreme heat. However, despite these successes, the broader challenge of inadequate funding and resources for care homes remains a major barrier to progress.

In relation to the risk information required for beneficiary groups, it noted that age alone is not a sufficient proxy for vulnerability, and that clinical risk factors also need to be considered given the compounding impacts of heat with underlying conditions. For example, the mental health of inmates in jails, combined with heat stress.

Natural assets and related risk information

Similar concerns were raised regarding the challenge of defining priority measures for protecting natural assets. Attendees emphasised the need for a multi-hazard approach, as these assets must also address risks beyond heatwaves, such as flooding. Rather than identifying a single priority natural asset, it was suggested that priority sectors for implementing heat risk reduction measures should be the focus.

To facilitate practical discussions, many attendees recommended using a tangible example as a "strawman" case study—such as exploring how to manage heat risks in an urban park throughout the year.

Rather than discussing the key risk information that would be required in order to develop a trigger-based financing instrument for NbS / natural assets, attendees raised their concerns with regards to using trigger-based financing for natural assets.

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A key reflection was that trigger-based financing is less applicable to natural assets due to their need for long-term investment rather than the more immediate financing typically provided by such mechanisms. Some attendees suggested that while trigger-based financing could potentially be useful for the maintenance and restoration of natural assets after heatwave impacts, its application appears far more relevant to beneficiary groups.

Similarly, attendees noted that parametric insurance could be more suitable in non-urban European settings, such as protecting agricultural yields against extreme temperatures, rather than for urban natural assets. Additionally, they questioned whether insurance would be a cost-effective solution, given the relatively low cost of financing for major cities like London or Frankfurt.

A data scientist suggested that we should shift our focus away from NbS to reduce heat. This is because in their research they have found that: (i) NbS is not cost effective, particularly for reducing indoor heating and that (ii) dried NbS is detrimental to reducing heat, especially during night.

Instead of focusing on trigger-based insurance solutions, attendees suggested that using data to trigger action plans or release pre-arranged funds could be more effective. One example provided was the UK's rail industry's winter management plan, which deploys workforce and resources at a predefined trigger point to prevent cold-weather disruptions. A similar system could be applied for heatwave preparedness, with insurance acting as a top-up for resource pools rather than the primary funding mechanism.

Finally, attendees highlighted a critical challenge in securing financing for NbS / natural assets. The ecosystem co-benefits of these measures, such as reducing health impacts and improving biodiversity, are difficult to quantify and monetise, making them unattractive to private investors. Additionally, because these benefits are public goods, they do not generate direct financial returns, further limiting their appeal for investment.

A key challenge, relevant to London, across both exposure types (people and natural assets), was the need to prove return on investment for any financing for heat risk management. Without strong evidence of financial benefits, securing funding remains difficult in London.

Workshop 2 Results

Taking into account the feedback from workshop 1, our focus of the second workshop on two specific use cases:

(i) The application of trigger-based financing to the pre-existing Hot Weather Severe Weather Emergency Protocol funding for rough sleepers during extreme weather conditions in London.

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(ii) The use of risk information and associated analytics for managing the impact of urban heatwaves on green spaces in London.

Use Case 1: The application of trigger-based financing to the pre-existing Hot Weather Severe Weather Emergency Protocol funding for rough sleepers during extreme weather conditions in London.

Following WTW's presentation with regards to Use Case 1 (See 2.3.1 for more detail), we had an extremely useful brainstorming session on the feasibility of this case. The feedback fell into three main categories: (i) data, (ii) selection of financial instruments and (iii) the need for further engagement.

Data

Attendees emphasised the importance of developing a trigger-based product using hazard data (e.g., temperature data) that balances granularity with insurance market acceptability. Granularity is essential to capture temperatures reflective of local micro-climates. However, there were concerns that widely recognised datasets such as ERA5, while familiar to the insurance industry, may be too coarse, potentially leading to basis risk events.

One attendee highlighted the need for precision by noting that rough sleepers are often "under bridges," where temperatures can differ significantly from surrounding areas. At the same time, it was acknowledged that a long-term dataset is necessary to capture the full range of temperature extremes rather than relying on a limited subset of data. In this regard, ERA5 was recognised as one of the best options due to its extensive historical records.

To improve accuracy, it was recommended that academic initiatives, such as those at Oxford University, which are developing climate data reflective of hyper-local micro-climates, should be leveraged. Following this workshop, discussions with Oxford University highlighted that, while the methodology is innovative and provides greater granularity, several challenges remain before the dataset can be published. A key issue is the need to quantify uncertainty within the dataset. Additionally, it is unlikely that the dataset would be accepted by the insurance industry in its current form, nor is it ready for use in post-event calculations for parametric insurance. However, we believe this dataset could be valuable in assessing the feasibility of an urban heat parametric insurance product in London.

Another key suggestion was to install temperature recording stations at heights where people "actually feel temperature", such as "1.5 metres above ground level". Additionally, one attendee proposed analysing station data within the city, though this was acknowledged to be incomplete and would require "careful processing."

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The key takeaway was the need for further exploration of suitable datasets. It is important to note that some degree of basis risk may be unavoidable, and that a suitable dataset must effectively balance historical depth, insurance market acceptance, and local micro-climate accuracy.

Selection of financial instrument

Attendees emphasised the need to clarify the value proposition of trigger-based financing for the pre-existing H-SWEP fund. For instance, would its primary benefit be the speed of payment or the flexibility of funding? This should be defined in collaboration with stakeholders more directly involved in H-SWEP funding. Unfortunately, none of these stakeholders were present at the discussion, though colleagues from the Greater London Authority had previously indicated in a prior to a workshop that this use case had potential.

A holistic approach was recommended, prioritising other risk reduction measures before considering insurance. Attendees stressed the importance of assessing the cost-benefit of different measures before transferring any risk. WTW supported this view, emphasising that insurance should only be used to cover risk that remains after other risk reduction measures / strategies have been explored. WTW reiterated that parametric insurance would be most appropriate for severe, unprecedented events, such as the extreme heat in London in July 2022, or situations of “overflow” as outlined in the protocol document, whereby existing cool spaces, accommodation and funding is insufficient to meet the required response.

Further engagement

Further engagement was recommended with the relevant H-SWEP stakeholders to understand the inefficiencies in their current protocol and whether trigger-based financing could fill those gaps.

Use case 2: The use of risk information and associated analytics for managing the impact of urban heatwaves on green spaces in London.

Feedback for our second business case fell into three main categories: (i) data, (ii) policy and funding priorities and (iii) the need for further engagement.

Data

We discussed that climate risk information can help prioritise implementation measures for heat stress, particularly with new technologies like satellites and artificial intelligence. One attendee noted that collaboration with satellite companies could be highly valuable in identifying "dry spots" or areas at risk of scorching due to insufficient greening in real-time. This could help prioritise interventions in critical locations days to months in advance, ensuring resources are directed effectively. In addition, overlaying the residence of vulnerable populations would allow for targeted efforts, ensuring these groups have the best opportunities to access cooling and shade.

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It was noted that for green spaces in London, longer-term lack of rainfall (drought) may be a more appropriate measure of impact than acute heat stress. This reiterates the importance of engaging with those scientists who work specifically with natural assets to understand the most appropriate hazard index to monitor heat stress with.

Policy and funding priorities

A recurring theme in this Lab, also reflected in the London Plan (which talks about ensuring that new developments are heat-resilient), is the need to implement actions to manage indoor temperatures and the well-being of people before considering the impact of extreme heat on green spaces.

Additionally, the Greater London Authority highlighted that London currently has a ban on green walls due to fire risk concerns, which are deemed a greater threat than acute heat risk. While this policy does not directly relate to the protection of green spaces, it underscores the city's stance on the prioritisation of NbS. This ban represents a significant barrier to the wider adoption of this particular type of NbS in London.

Participants recommended that further engagement with organisations responsible for managing green spaces is required to refine a future business case, as they will have the best understanding of pain points in terms of heat impact and lack of finance.

Lastly, one attendee noted that across both use cases, there still seems to be a broader lack of public awareness around the issue of extreme heat and its impacts in the UK. They suggested that "a coordinated communication strategy (either through insurers or government) could help highlight the importance of these initiatives, and that building public support and engagement ahead of anything being developed is critical, otherwise, it's effectiveness will be lacking."

Workshop 3 Results

We discussed our business case with the Head of Rough Sleeper Services at St Mungo's homeless charity in London. St Mungos represents a potential end beneficiary for this business case, enabling us to gain a sense of the opportunities for implementation, alongside potential challenges.

Discussion with St Mungo's

St Mungo's rough sleeping hubs, act as emergency entry points for individuals coming directly off the streets. These hubs, likened to "A&E for rough sleeping," provide basic safety rather than accommodation. St Mungo's provides overflow SWEP provision once local borough resources are full, following activation by the Greater London Authority (GLA). While the discussion primarily highlighted limitations relating to the winter SWEP, there were also valuable insights relevant to

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H-SWEP, offering broader lessons on the use of trigger-based financing for emergency response for rough sleepers in extreme weather conditions.

A key limitation noted was that there is no standardised requirement for local authorities to provide SWEP, which leads to:

- Lack of planning: *"You would hope that in August they would predict how much they need for winter, but in reality, it happens in November when the boroughs panic."*
- Severe funding constraints: *"Every system is overcrowded, funding is short."*
- A reactive rather than proactive approach: When extreme weather events such as the 'Beast from the East' occur, emergency funds are rapidly injected into the system, rather than planned in advance.

It was emphasised that while hot weather does create risks, it does not require accommodation, unlike cold-weather SWEP. Key summer interventions include:

- Providing cool spaces (e.g., train stations, shopping centres, libraries). However, it was noted that these come at minimal cost, and rather the cost for SWEP is for providing accommodation, which is more relevant in a winter SWEP.
- Distributing sun cream, water bottles, vitamins, and advice, which also comes at minimal cost.

When asked about what the inefficiencies were in relation to financing, the following points were raised:

- Winter SWEP is already built into existing contracts that St Mungo's bids for.
- Boroughs often release last-minute funding for SWEP, making planning difficult.
- The GLA and No Second Night Out (NSNO) are not underfunded, but boroughs struggle due to poor funding timing, rather than a lack of funds.

When asked about inefficiencies in the delivery of H-SWEP and SWEP, several structural challenges were highlighted as key barriers to service delivery and financial sustainability. These include:

- SWEP space remains a major challenge: "Finding SWEP provision space is always a challenge."
- Funding distribution is unclear:
- St Mungo's has its own funding, but boroughs must request funds through the Ministry of Housing, Communities and Local Government (MHCLG).
    - Regional advisors make final spending decisions, sometimes overriding borough priorities.
- Short-term funding cycles disrupt long-term planning:

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- The Rough Sleeping Initiative (RSI), which funds many rough sleeping services throughout London, only provides funding lasting 3–6 months, leading to uncertainty: *"Drip-feeding is painful… there is no structure."*

Potential Role for Trigger-Based Financing

Despite these challenges, it was acknowledged that forecasting heat risk and using anticipatory finance could be beneficial, particularly if funds could be allocated before heatwaves occur. However, several key questions remain:

- Would local boroughs actually act on anticipatory funding?
- How do rough sleepers respond to early SWEP activations? For example, the St Mungo's experience suggests that the first few SWEP activations are often underutilised, as rough sleepers initially resist coming indoors.
- Who decides how emergency funds are spent?
  - Sub-regional coordinators determine funding priorities and should be key stakeholders in further discussions. It was agreed that there was no value in having these kinds of structures in place if decisions are still overridden by the sub-regional coordinators.

This discussion gave extremely useful insights to our business case, with the key takeaways being: (i) that in St Mungo's opinion, cold weather is more of a costly issue due to the need for bed space, and therefore this is more likely to suit additional financing and (ii) the structural inefficiencies that exist, which could potentially override the benefits of a trigger-based financing structure.

This suggests that trigger-based financing, applied to existing funds rather than insurance, could be more beneficial for the H-SWEP / SWEP and the insurance could be more appropriate (if at all) for cases of overflow in Winter. By providing a structured approach to the release of funds, it could help manage and address the inefficiencies within the current framework. To fully assess the feasibility of applying a trigger-based financing model to H-SWEP, engagement with the following groups was recommended:

1. Rough sleeping leads in local boroughs.
2. Outreach teams, particularly those involved in hot-weather response.
3. Local boroughs, to understand their funding constraints.
4. Sub-regional coordinators, who influence spending decisions at a regional level.

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Though the need for heat health action is undeniable, impacts related to heat are intermittent, albeit with severe spikes in demand for support occurring in 2004 and 2022. It is anticipated that this frequency will increase.

Typically, local authorities might prepare plans for a range of intermittent problems and worry about funding specific issues from contingency funds such as they exist, as and when needs arise. Risk managers resource and plan cold weather interventions which occur more or less annually as and when they occur. Potentially financing might be arranged to cover hot and cold extremes of temperature.

Finally, there is no specific statutory requirement for local authorities to manage heat health related problems. Additionally, the funding environment for local government in the UK is challenging.

Concluding reflection on the business case and next steps

Following workshop 2, we believe Use Case 1 (applying a trigger-based financing structure to the already existing funds) has a stronger likelihood of implementation than Use Case 2 (a parametric insurance “back-stop” for extreme events, where additional funding could be beneficial). Several challenges to use case 2 were raised, including the lack of funds to pay insurance premiums, the need to prioritise longer-term investment (in both the built environment and green spaces), and lack of institutional understanding on parametric risk financing. Addressing this gap will require extensive research and stakeholder engagement. Therefore, we have completed the ‘Scorecard’ for Use Case 1 to assess its feasibility as a Business Case. We note that further engagement with the H-SWEP team and relevant stakeholders is required to understand whether trigger-based financing could be a sustainable and appropriate mechanism to support them in managing the impact of urban heatwaves on homeless populations.

Following the conclusion of our workshops, we are confident that attendees now have a solid understanding of how trigger-based financing can support preparedness and response actions in managing the impacts of urban heat. We have identified the key elements that must be defined to develop a robust use case, ensuring that if opportunities arise in the future where trigger-based financing could serve as a valuable instrument for the client, they will be well-positioned to engage and collaborate.

However, several challenges remain that must be addressed before progressing from concept to product development. One critical aspect is the availability of hazard data that accurately reflects the impact of heat on a given exposure. Should an opportunity emerge, further stakeholder engagement, particularly with the right groups of people, will be essential to test the feasibility of a potential product and refine its design. By addressing these factors, we can ensure that any future developments are both impactful and viable.

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	Summary The application of trigger-based financing to the pre-existing Hot Weather Severe Weather Emergency Protocol (H-SWEP) funding for rough sleepers during extreme weather conditions in London.	**Scale (1 to 5,** **0 in case question cannot be assessed)**	**Score**
Problem statement, Current baseline & Innovation	How well does the developed business case: - Identify the challenge/need for innovation regarding the link between nature and insurance? **While this business case does not establish a direct connection between nature and insurance, trigger-based financing payouts can facilitate the relocation of vulnerable rough sleepers to 'cool spaces', which often include green spaces and tree-covered areas within the city. This highlights an indirect but important link, suggesting that there should be an incentive to maintain and enhance these natural cooling areas.** - Provide a solution to the identified challenge? **This business case would provide additional funding to respond to the vulnerable homeless people in extreme temperatures, and targets those instances of "overflow" mentioned in the protocol document, whereby demand for cool spaces / accommodation exceeds the supply and therefore more funding is required.** - How new and innovative is the developed business case solution? **As far as publicly available information goes, this business case is the first-of-its-kind in London as well as wider Europe. The principles have been applied in developing countries like Viet Nam and India, however there were no examples found in European cities.**	3 4 5	12/15

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Implementation & Execution	How well does the developed business case (max. 5 points per question): - Identify the key groups and stakeholder that are needed for implementation? **From our discussions, the key groups and stakeholders identified include: rough sleeping leads in local boroughs, outreach teams, local boroughs, sub-regional coordinators, vulnerable rough sleepers, and the H-SWEP team within the Greater London Authority. Further conversations the H-SWEP team would confirm any additional stakeholders that should be considered.** - Outlines the implementation strategy? **The business case acknowledges that further discussions with the H-SWEP team are necessary to determine whether trigger-based financing is a suitable solution for addressing inefficiencies in their current financing model. While immediate implementation is not feasible without substantial additional investigation, particularly around identifying appropriate data sources, the business case does outline the necessary steps for progressing from concept to product development and eventual placement, should the client choose to proceed.** - Outlines and addresses risks surrounding the implementation? **Various risks associated with implementation were discussed. These could be further investigated and refined at a later stage , focusing on: price of premium, obtaining adequate insurance coverage from the market and establishing a clear and efficient process for managing and distributing payouts to maximise their impact.**	3 2 4	9/15

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Finance	How well does the developed business case: - Demonstrate the ability to get financed? **This business case identifies existing sources of finance, which could be deployed more quickly / efficiently, and potentially scaled up, through the implementation of trigger-based financing.** **At this stage, the business case remains a concept and has not yet been fully developed or presented to prospective (re)insurers. Therefore, we cannot yet assess its specific ability to secure financing.** **However, we do know that parametric insurance products are available in the London market, though they are primarily used for agricultural risks and business interruption coverage. Further engagement with the insurance market would be necessary to determine the feasibility of applying a similar model to this use case, should the concept be taken forward.** - Describes the need, use and source of funding? **In Innovation Lab 2, we clearly outlined how this business case aligns with the structure required for a trigger-based financing product. The need for funding is based on evidence from the protocol document; however, further discussions with the H-SWEP team are required to determine whether current funding is sufficient. According to the document, in cases of "overflow," responders are instructed to secure additional accommodation and then request reimbursement. This is where insurance could play a crucial role—both in covering overflow situations and responding to extreme events, such as the summer of 2022.** **The intended use of the funding is clear: it is designated for supporting rough sleepers exposed to extreme temperatures.** **As for the source of funding, we propose two potential options (i) Internal Funding – If existing funds are adequate but require a more structured disbursement mechanism; (2) Insurance – To cover overflow cases and extreme weather events where additional financial support is needed.** - Outlines sustainable financial expectations? **The business case has not yet fully outlined sustainable financial expectations, though this was discussed at length. At this stage, further work is needed to assess long-term financial viability, including:** **Cost-Effectiveness: Ensuring that premiums and payouts align with the financial capacity / expectations of the stakeholders.** **Scalability: Evaluating whether the concept can be expanded or adapted for other extreme heat covers within the Europe.** **Funding Stability: For example, identifying reliable funding sources to ensure ongoing financial sustainability, whether through internal funds, insurance, or a combination of both.**	3 4 2	9/15

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Impact	How well does the developed business case (max. 5 points per question): - Show how the innovation can lead to a positive impact for nature? **The business case does not establish a direct link between the innovation and nature. However, it acknowledges that trigger-based financing could help relocate rough sleepers to 'cool spaces,' which often include green areas. This suggests an indirect incentive to maintain and protect urban green spaces.** - Show how the innovation can have a positive impact for the insurance sector? **The business case introduces a new application of parametric insurance within the London market, which has primarily focused on agriculture and business interruption. If developed further, this concept could create new opportunities for insurers by expanding the use of parametric products into the humanitarian and urban resilience sectors. However, since the case has not yet been tested with (re)insurers, its market acceptance remains uncertain. Further engagement with the insurance industry is required.** - Show that the innovation can lead to a positive impact for society and communities including climate resilience, equity and participation? **The business case has a strong societal impact, as it directly addresses the protection of rough sleepers, who have been identified in our Innovation Labs as one of the most vulnerable groups during extreme hot weather events. By securing timely funding for emergency interventions, the innovation enhances climate resilience, promotes equity, and ensures that financial support reaches those most in need. Further stakeholder engagement would further strengthen its impact and would unlock how communities might be able to participate.**	2 3 4	9/15
Total			**39/60**

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Boosting flood resilience in Italy through controlled flooding, community insurance and nature-based solutions

By Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC)

Overview and executive summary

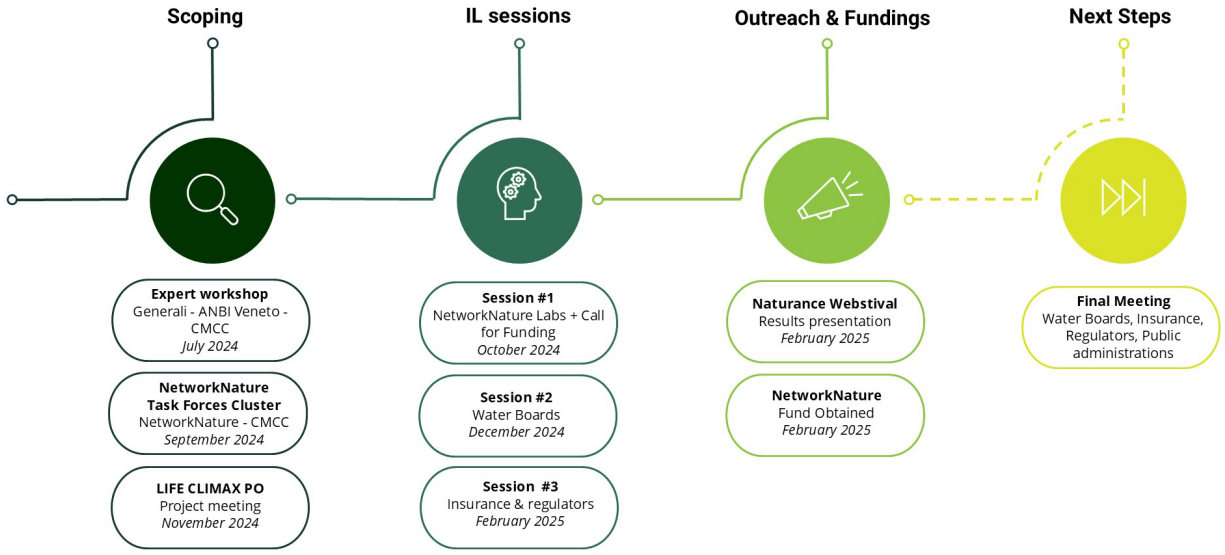

Figure 11 - Overview of IL workflow and process, from the ideation to next steps

CMCC has established an Innovation Lab designed to integrate controlled flooding, a novel community insurance scheme, and Nature-based Solutions for flood risk management in Northern Italy. The IL focuses on assessing the operational, regulatory, and financial feasibility of the proposed scheme, as well as its potential commercial appeal to insurers within the complex legislative and governance framework of flood management. The primary targets are the regional associations of water boards from the most flood-prone areas of the Po River Basin District and insurance companies - as intended beneficiaries and providers. Additional stakeholders include public administrations, such as the regional governments of the affected areas, and regulatory bodies, including representatives from the Institute for Insurance Supervision.

Prior to the IL kickoff meeting, CMCC conducted several preparatory activities, engaging potential stakeholders and experts at international, national and local level. The IL process unfolded in distinct meetings. The first meeting discussed the IL proposal with academics and climate risk experts to establish a scientific basis and develop a funding proposal to explore scaling opportunities. The second meeting targeted public sector stakeholders, particularly flood risk managers, to assess their willingness to participate and identify potential legal or procedural challenges. The third meeting engaged the private sector, including insurers and regulators, to evaluate the scheme's technical feasibility. Discussions have highlighted key challenges and opportunities for in implementing the scheme:

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- Regulatory constraints: Governance fragmentation, coordination challenges between authorities, and the limited remit of water boards were identified as major obstacles. Policy and legislative adjustments are needed to allow water boards to finance insurance policies and manage controlled flooding within their regulatory scope.
- Insurance feasibility: The viability of an insurance product for controlled flooding was tested, highlighting challenges and ways to address the moral hazard, parametric policy design, and the unequal distribution of costs and benefits—with downstream urban areas benefiting the most while upstream rural landowners bear the burden.
- Land conversion and compensation: To address landowner resistance to land conversion, discussions emphasized the need for fair compensation for agricultural loss and additional financial opportunities to support NbS adoption.
- NbS integration challenges: While NbS are widely recognized as valuable for flood risk reduction, their adoption is hindered by limited financial incentives, regulatory uncertainties, and the need for standardized evaluation framework for ecosystem services to quantify risk reduction for insurance pricing or investments.

The IL has successfully conceptualized and refined the insurance-backed controlled flooding scheme by integrating insights from water boards, public administration representatives, regulators, and insurance operators. It has fostered cross-sectoral collaboration and helped break down institutional silos, laying the groundwork for more integrated flood risk management strategies.

This project has received funding from the European Union's Horizon Europe Research and Innovation Program under grant agreement No 101060464

Introduction and purpose of the IL

Background

Italy has historically been subject to high hydrogeological and flood risk. In recent years, this risk is escalating due to climate change intensifying precipitation patterns. The increasing frequency and probability of intense rainfall events is accompanied by a decrease in moderate precipitations in some areas. This trend heightens hydrogeological risk, leading to prolonged droughts alternated with concentrated and intense rainfalls, increasing floods and landslides (EEA, 2024). The extreme floods in the Emilia Romagna region between 2023 and 2024 exemplify this trend. In May 2023, unprecedented rainfall occurred in two episodes within 15 days, bringing a cumulative 400-450 mm precipitation. This led to the overflow of 23 rivers, with 13 reaching critical levels, causing 50 floods across 42 municipalities and over 370 landslides. The disaster caused severe damage to infrastructures, displaced 36.600 people and led to 17 fatalities. In some areas, the return period for these events exceeded 500 years[12]. However, just 16 months later, between September 17-19 cumulative rainfall of 150-300 mm, with peaks of 360 mm, was recorded in some locations[13].

Nearly 7 million residents (11,5% of Italy's population) live in flood-prone areas, while over 640.000 businesses (13,4% of the total) operate in high-flood-risk zones (Triglia et al., 2021). Despite this exposure and the rise of flood hazards, insurance coverage in Italy remains limited and fragmented. The majority of policies are optional add-ons to fire and property insurance. A recent report from the insurance regulator IVASS (2024) highlights that only a small fraction of businesses and households have flood insurance, and that the market is characterized by high premiums, numerous exclusions, and complex policy conditions that hinder accessibility. In response to the escalating risks and low market penetration, the 2024 Budget Law (DL 302/2024) introduced a mandatory insurance requirement for businesses, requiring them to secure coverage against catastrophic events, including floods, by March 31, 2025. As flood risk grows, traditional protection measures and infrastructures alone will not be enough. Additionally, properties in flood-prone areas may face non-affordable insurance costs, declining property values and increased default risk on mortgage loans (Gourevitch et al., 2023).

Structural flood defenses are becoming increasingly inadequate as extreme events exceed their design thresholds, exposing the fragility of artificialized watercourses. In this regard, strategic land-use planning and a shift toward controlled flooding measures and NbS that enhance natural water retention can offer an innovative, win-win approach to flood risk management. Dedicated rural areas can serve as natural buffers, protecting densely populated urban centres with high-value properties and critical infrastructures by absorbing excess water and reducing runoff. At the same time, if adequately planned, these measures can help preserve biodiversity and support sustainable

[12] https://www.arpae.it/it/notizie/anno-2023-estremi-climatici https://doi.org/10.1017/S1049023X23006404

[13] https://www.arpae.it/it/notizie/alluvione-19-20-ottobre-un-analisi-preliminare

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water and land use management through, for example, wetland restoration, artificial ponds, and levee setbacks. Building flood resilience requires allocating more space for nature, prioritizing river restoration, floodplain reconnection, and nature-based solutions over rigid artificial defences that, in the long term, exacerbate vulnerability[14]. However, in Italy, controlled flooding operations have been so far limited to structural flood defences, such as retention basins. Nevertheless, controlled overflow areas are now being considered as a key component of a €4 billion reconstruction plan in Emilia-Romagna led by the *Po River Basin District Authority* to mitigate hydrogeological risks in flood-prone areas[15]. The plan includes widening embankments, lowering floodplains to enhance river retention capacity, and compensating those farmers whose land will be designated as controlled flood zones. This marks a shift towards integrated solutions that combine engineered and nature-based approaches.

Therefore, there is a growing need to develop innovative solutions that both enhance the value of ecosystem services in addressing the increasing climate-related risks and reimagine the provision of insurance services to better meet community needs. In response to this challenge, the IL aims to explore how flood risk managers and the insurance sector can collaborate to reduce flood risk and strengthen the resilience of vulnerable territories and communities through the development of a tailored insurance product linked to controlled flooding operations and the renaturalization of designated lands.

Objective of the Innovation Lab

This innovation lab aims to test a community-based insurance scheme of controlled flooding combining NbS, by identifying potential challenges to the implementation and exploring ways to overcome them. The scheme has been developed and tested considering the plain area in Northern Italy within the Po River Basin District, which includes the regions of Piemonte, Lombardia, Emilia-Romagna, and Veneto (i.e. Padan Plain), focusing on its operational, financial, and regulatory feasibility within the existing legislative and governance frameworks. The Padan Plain is a crucial industrial and agricultural hub in Italy and Europe but faces significant environmental challenges due to past transformations, urbanization, and climate change. It is one of the most populated flood-prone areas in Italy, experiencing severe economic damages (ISTAT, 2022; Lastoria et al., 2021).

The proposed insurance scheme (Fig. 2) targets flood risk management authorities (e.g., water boards) as policyholders, and aims to reduce the financial and liability risk associated with controlled flooding operations and NbS adoption. This scheme follows a community-based insurance approach (Box 4). It introduces an *insurance-backed controlled flooding mechanism in which flood risk management authorities act as aggregators and purchase a collective insurance policy, funded by*

[14]https://europe.wetlands.org/to-reduce-the-effects-of-floods-in-italy-our-no-more-artificial-works-are-needed-but-a-fundamental-change-in-the-management-of-the-rivers-and-land/

[15] https://www.ilrestodelcarlino.it/ferrara/cronaca/piano-alluvioni-tracimazioni-controllate-qyt1xaao

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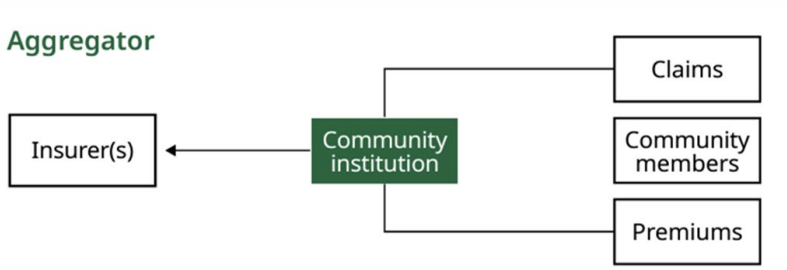
the community they serve, to cover controlled flooding costs. It represents a risk sharing mechanism designed to protect communities exposed to flood hazards.

Box 4: Community-based disaster Insurance (Marsh & McLennan, 2021)

Community-based insurance is a collective insurance model arranged by local governments, communities or government organizations to protect groups of people and property within vulnerable communities against specific types of risks. Unlike individual insurance policies, it is based on a risk-sharing mechanism, reducing costs and improving the accessibility of insurance coverage. It also incentivizes risk reduction measures at both individual and community levels. Community insurance complements the traditional insurance market by providing additional or alternative protection through models that can be customized for different communities. Among these models, the aggregator model presented in the image below, was used as a reference point for the scheme presented here. The aggregator model involves the community being represented by a structured entity with a pre-existing organization that can negotiate the terms of coverage with insurance companies. In this model, the institution representing the community directly purchases disaster insurance, funds it through taxes or other mechanisms, ensures that costs and benefits are equitably distributed, and actively participates in implementing protection and risk reduction measures.



The scheme aligns with and leverages existing and emerging governance and policy frameworks, as well as key regulatory and financial instruments:

- The EU Floods Directive (EC, 2007) and the Common Agricultural Policy (CAP) 2023–2027 (EC, 2023) requirement for 4% of arable land to be allocated to non-productive features and ecosystem preservation.
- Insurance mechanisms, acknowledging the potential for mandatory flood insurance to expand beyond businesses in the future, possibly including flood risk managers.
- Further development and consolidation of financial instruments, including biodiversity credits, payments for ecosystem services, and restoration funding, to compensate landowners contributing to NbS implementation and environmental restoration.
- Regulatory developments, such as the EU Nature Restoration Law (EC, 2024), which promote ecological restoration, floodplain reconnection, and adaptive water management.
- The potential evolving role of flood risk management authorities (e.g., water boards), which could transition from traditional flood risk managers to providers of ecosystem services. This would expand their mandate to implement, manage, and financially sustain NbS while ensuring compliance with water governance frameworks.

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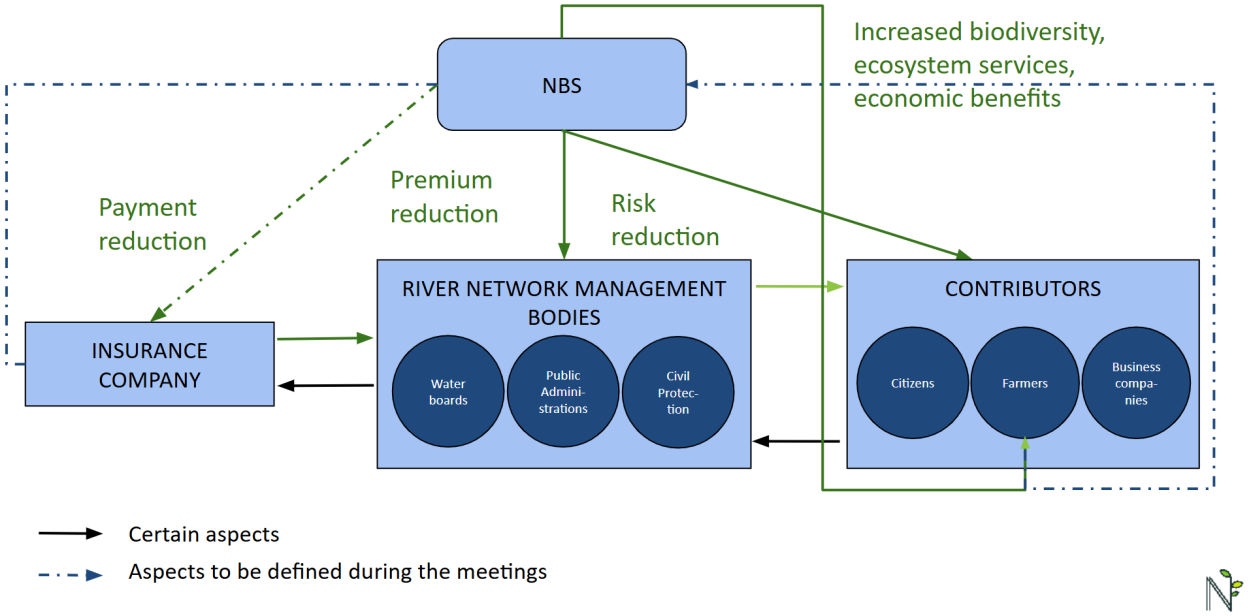

Figure 12 - The initial structure of the IL. Source: authors' elaboration, November 2024

The initially proposed scheme (Fig. 11) leverages two key legal provisions in Italy: the authority of water boards to impose and collect financial contributions from the communities they serve (Box 5), and the legal right to flood designated areas for public purposes, including flood risk reduction, without requiring prior authorization from landowners (Box 6).

Box 5 The Role of the Water Boards and the Classification Plan

The governance of water-related hazards in Italy is highly complex and multifaceted. While recognizing the need to involve various political and institutional actors, CMCC has focused on water boards, Consorzi di Bonifica in Italian, which already have a well-established structure particularly suited to implementing the proposed approach.

Water boards manage a wide range of water bodies to ensure hydraulic safety, water drainage, and irrigation of agricultural land. To fulfill these functions, they build and maintain hydraulic/river infrastructures, and, as public entities governed by private law, collect tributes from the communities/property owners that benefit from these services.

These contributions are calculated based on a "Piano di Classifica" (Classification Plan) of properties, which considers: i) the type and class of the property; ii) the benefit index received; iii) the proportionality of its size and characteristics.

Drafted by the water boards themselves, the classification plan determines the benefit each property receives from consortial activities. This system is particularly relevant for the following reasons:

- Practicality: The availability of structured information and the well-established procedures of water boards offer a significant advantage in implementing the proposed scheme, particularly in using this approach to collect funds for purchasing the insurance policy.
- Flexibility: The classification plans can be periodically updated to reflect changes in risk levels, local needs, and emerging opportunities.

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- Transferability: Since the data collected by water boards is public, it can be accessed by other institutions, enhancing the potential for replicating the mechanism across different water risk management entities.

Under this framework, water boards would charge an extra tribute on contributors (households, businesses, farmers, landowners), the revenue of which would be used to purchase an insurance policy that covers the costs the water board has to face in case of a flooding event. In fact, a water board facing a potential flooding event could exercise the right to perform controlled flooding on upstream agricultural or rural land in order to limit more severe damages from uncontrolled flooding, for instance to downstream urban areas. The insurance policy would thus reimburse the costs the water board has to face to put in place the controlled flooding, the repair of any damages to (infra)structures, the costs to clean the flooded land after the event, and the civil responsibility for the water board in case of unintended damages to third parties during the controlled flooding. The controlled flooding activity generates a benefit for the communities served by the water board in the form of a reduction in flood risk and damage, which would justify the collection of a tribute add-on to finance the purchase of the insurance policy. The land which is potentially subject to controlled flooding should be converted from productive to non-productive[16] and see the implementation of NbS to increase its water-retaining capacity and provide additional ecosystem services. Under this framework, water boards would move from being institutions that simply manage water resources, to institutions that manage land and the ecosystem services it provides.

Box 6: Governance levels and key actors in flood risk management in Italy and the Po basin district

In Italy, flood risk management operates in a multilevel and fragmented regulatory framework that integrates national legislation, regional regulations and European directives.

At the European level, the European Commission defines flood risk management strategies and requires member states to adopt Flood Risk Management Plans (FRMPs) according to Directive 2007/60/EC (Floods Directive). At the national level, the Ministry of Environment and Energy Security (MASE) and the Department of Civil Protection define national policies on flood risk management, coordinate emergency response, and oversee the implementation of European directives (Legislative Decree 152/2006, Environment Code; Legislative Decree 1/2018, Civil Protection Code; Civil Protection Law 225/1992). The national Environmental Code (Legislative Decree 152/2006) assigns regional and basin authorities the responsibility for hydraulic risk management, including the identification of hydrogeological risk areas, their perimeter and safeguard measures (Articles 67 et seq.), as well as the overall coordination of FRMPs in line the EU Floods Directive (2007/60/EC).

[16] Note that non-productive does not mean non-profitable. In fact, renaturalized land and NbS can generate economic benefits to the owner of the land, for example through payments of ecosystem services, by organizing recreational activities, or through the use of biodiversity or carbon credits.

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At the district level, the Po River District Basin Authority, together with other basin authorities, is in charge of developing and implementing FRMPs, identifying priority areas for flood mitigation, and monitoring the implementation of hydraulic risk reduction measures, in accordance with Directive 2007/60/EC.

At the regional level, the governments of Lombardy, Emilia-Romagna, and Veneto regions, in collaboration with their respective regional Civil Protection agencies, plan and manage flood defense infrastructures, authorize controlled flooding operations and emergency interventions, and provide financial incentives through Rural Development Plans (RDPs) (D.Lgs. 152/2006; D.Lgs. 1/2018, and specific regional laws: L.R. 31/2008 (Lombardy), L.R. 21/2000 (Emilia-Romagna), and L.R. 45/1980 (Veneto)).

At the local level, water boards and municipalities manage and maintain the minor water network and collaborating with regional and district authorities to implement the measures provided for in the FRMPs (L.R. 31/2008 (Lombardy); L.R. 7/2003 (Emilia-Romagna); L.R. 13/2002 (Veneto), as well as Provincial Territorial Coordination Plans (PTCPs) and to the Territorial Government Plans (TGPs)).

Finally, in the event of an emergency, the Department of Civil Defense, the Police Force, and the Fire Department are responsible for managing hydraulic emergency response operations. In high-risk situations, they have the authority to approve extraordinary controlled flooding operations as an exception to the normal provisions of FRMPs, as stipulated for in Legislative Decree 1/2018 (Civil Protection Code) and Law 225/1992. In this regard, the Presidential Decree 327/2001 regulates expropriation for public benefit, including the possibility of imposing easements or servitudes on properties to meet public interest needs. Article 44 stipulates that an indemnity must be paid to the owner of the servient estate, although the precise method of determination is not explicitly detailed. Established practice suggests that the indemnity is calculated as a percentage of the expropriation compensation, varying based on the extent of the constraints imposed on the property. Although no national law specifically regulates flood servitude, some Italian regions, such as Emilia-Romagna, have developed guidelines for its establishment and the determination of related indemnities to ensure fair compensation for landowners[17].

Structure and approach of the Innovation Lab

The Innovation Lab aimed to test the proposed scheme (see Fig. 2) by identifying potential challenges to the implementation and exploring ways to overcome them. It focused on defining the governance constraints and opportunities of controlled flooding, the features of the insurance policy that the water board would purchase to cover damages and costs of controlled flooding, as well as investigating how to incentivize landowners to implement NbS on designated land. To achieve these objectives, the innovation lab engaged representatives from expert organizations, flood risk and water management authorities (water boards, basin authority, public administrations), and insurance sector (insurance companies, regulators and financial institutions).

In the initial phase, a series of scoping meetings were conducted, with international, national and local stakeholders, to develop and refine the idea, better frame the problem and gauge the interest

[17]https://progeu.regione.emilia-romagna.it/en/life-rii/topics/documents/action-b9-additional-study-on-flooding-servitude

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in such a scheme. First, an expert workshop was held in person in Venice with local representatives from water boards and insurance companies. This workshop aimed to explore potential collaborations for the Innovation Lab and beyond, as well as facilitate knowledge sharing on climate forecasting, risk assessment, NbS and adaptation strategies, and insurance mechanisms and products. Next, international interest in this topic was examined within the framework of NetworkNature Task Force 3 on NbS and nature-positive approaches. Finally, in the Italian context, the idea was presented and discussed within the LIFE CLIMAX Po project, which focuses on promoting and supporting climate change adaptation strategies in the Po River Basin District. This engagement involved river basin authorities and regional water board associations to gauge stakeholder interest in a scheme that integrates controlled flooding, NbS, and insurance while ensuring their participation in the Innovation Lab.

Following this scoping phase, the lab involved 3 online sessions to discuss with relevant stakeholders. The first meeting explored the IL proposal with the academic community and experts working on climate risk adaptation at the international level. This was meant to define a scientific basis for the scheme and to design a joint proposal to submit for external funding, which would allow scaling out the scheme beyond the Italian context through international workshops and business cases. The second meeting was focused on the public sphere and potential target users of the insurance scheme. The focus of the discussion was on the willingness of flood risk managers to engage in the proposed scheme and the potential limitations they envisage from a procedural and legislative perspective. The third meeting addressed the private sector to explore the technical feasibility of the scheme with potential insurance providers and regulators. Detailed information is provided in the following sections.

As part of these key discussions, several ancillary outreach activities were carried out, helping to gather feedback and gauge interest, particularly at the international level. Among these, the NATURANCE Webstival was particularly significant not only for disseminating the idea and building consensus but also for gathering insights on financing strategies associated with the IL proposal. Additionally, the IL proposal was selected as a winner of the Network Nature Labs call for funding, securing support for further development of this concept beyond the NATURANCE project. This recognition not only validated the idea but also provided resources to expand its implementation and impact.

Details of the Innovation Lab Sessions

Organizations involved

The IL aimed to engage both the public and private sectors, which represent the key actors in the proposed insurance scheme, as beneficiaries and providers, respectively.

More specifically, key potential beneficiaries include water boards, which at the national and regional levels are represented by ANBI (National Association for Reclamation and Land

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Improvements) and its regional branches. On the private side, insurance companies operating in Italy are the primary providers. Therefore, water boards and insures have been considered the main targets of the IL.

Given the potential pilot area for the proposed scheme, additional relevant stakeholders were also involved. On the public side, administrative regions (as Veneto, Emilia-Romagna, Lombardia, and Piemonte) and the Authority of the Po River Basin District play crucial roles in the complex governance framework of flood risk management. On the private side, national regulators such as the Italian National Bank and the Italian Institute for Insurance Supervision (IVASS) are key actors in ensuring regulatory alignment and market feasibility.

Representatives from ANBI, regional administrations, and several insurance companies were invited to participate in the IL sessions. However, despite significant interest, not all stakeholders were able to attend the organized meetings. To address this, CMCC aims to engage these missing stakeholders in the next phases of development of the IL, through additional and/or bilateral meetings, while also keeping them informed, sharing relevant updates, materials and outcomes from the sessions.

More details about each organization actively participating in the IL are provided below.

Innovation Lab Leader

Euro-Mediterranean Centre on Climate Change (CMCC)

The Innovation Lab has been led by a team of researchers from the Euro-Mediterranean Centre on Climate Change (CMCC), an international research center dedicated to studying the interactions between climate change, the economy, and society. The team is part of the Risk Assessment and Adaptation Strategies division, based in Venice, Italy, which operates in close collaboration with Ca' Foscari University of Venice.

Innovation Lab Target - Water Boards representatives

Associazione Nazionale Bonifiche e Irrigazioni e Miglioramenti Fondiari (ANBI) – National Association for Reclamation and Land Improvements

The National Association for Reclamation and Land Improvements comprises 142 water boards among the Italian territories. It aims to ensure the maintenance and security of the territories by developing infrastructure, including 960 pumping stations and 231,000 km of canals. In 2020, it conducted a fact-finding survey for the IX Permanent Commission of the Senate of the Republic on Agriculture and Agri-Food Production. The objective was to enhance system efficiency to successfully address future challenges related to climate change, as well as the evolving EU regulatory framework on environmental protection, soil conservation, hydrogeological risk mitigation, and water resource management (ANBI, 2020). In the wide area of the Po river basin district, some Regions have experienced an increased water-related risk, with a higher frequency of

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flood events and, consequently, greater vulnerability. Priority was given to involving the regional associations of water boards in these regions. Below we report a description of those participating in the IL: Veneto, Emilia-Romagna, and Lombardia.

ANBI Veneto

ANBI Veneto is the association of 11 water boards in the Veneto Region, representing them at the institutional level. Its primary role is to promote the importance of water resource management among institutions, the education sector, and civil society, particularly within the Veneto Region, which is characterized by an abundance of wet areas and significant drainage challenges. ANBI Veneto fosters synergies with public and private partners to develop collaborative projects and share knowledge about the region. It also advocates for a shift from traditional irrigation practices toward the provision of ecosystem services. In 2024, Veneto Region and ANBI Veneto jointly published *"Ecosystem Services and Irrigation Activities"* a report summarizing the findings of a joint study conducted with the Veneto Region. The research highlights the positive environmental, landscape, and economic benefits generated by water flows managed by ANBI. It identifies and analyzes the various ecosystem services linked to irrigation, demonstrating the significant potential of water boards in delivering ecosystem services and co-benefits to the wider community, including high-quality agricultural production, energy supply, biodiversity conservation, and landscape enhancement (Regione Veneto, 2024).

ANBI Emilia-Romagna

ANBI Emilia-Romagna brings together and represents the water boards and other organizations involved in soil protection and water resource management across the region. Like ANBI Veneto, it fosters synergies with public and private stakeholders, facilitates resource and knowledge sharing, and enhances internal coordination among its member consortia. In a region that has experienced several extreme weather events in recent years due to intense precipitation, ANBI Emilia-Romagna plays a crucial role in hydraulic safety. It manages a network of 20,000 km of canals, 582 pumping stations, 2 dams, and 53 flood retention basins for rainwater management. Additionally, it serves as a key hydrogeological safeguard, overseeing hundreds of projects for land stabilization and the prevention of hydrogeological instability.

ANBI Lombardia

ANBI Lombardia groups together 12 water boards, 5 lake regulation consortia, and other entities that operate in the fields of reclamation, irrigation, and land protection. In recent years, it has carried out several projects, including the *"Alluvioni Project"*, in implementation of European Directive 2007/60/EC, aimed at mapping flood hazards and risks within the network managed by the water boards. Another notable project is *"Acqua Plurima per lo Sviluppo Sostenibile"* (AcquaPluSS), which aims to identify cycle-tourism routes with the goal of promoting the conservation and enhancement of the environment and landscape.

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Innovation Lab Target - Insurers

Assicurazioni Generali

Generali Italia is the leader in Italy's insurance retail market and one of the largest insurance companies worldwide. The company envisions its role in society as a "life partner," striving to be a reference point for social and environmental well-being. Generali has recently launched a Climate Change Working Group, reinforcing its commitment to managing climate-related risks with a particular focus on climate adaptation. The working group aims to establish a consistent approach across Generali's international operations. Its key objectives include: raising public awareness of climate risks, developing effective insurance coverage solutions, strengthening the social role of insurance, addressing the insurance gap to improve customers' resilience to increasing climate risks.

Innovation Lab Stakeholders - Public administrations

Po River Basin District Authority (AdBPo)

A non-economic public entity, operating under the surveillance of the Ministry of the Environment and Energy Security since 2015, which operates in the whole Po river basin area, coordinating and promoting synergies between several local institutions, and enhancing preservation and development.

Regione Lombardia

The Lombardia Region is actively committed to environmental protection across multiple sectors, including air quality monitoring, sustainable housing and energy management, environmental acoustics, waste management, and the reclamation of contaminated areas. Given the region's diverse landscape, encompassing both river basins and wetlands, as well as urban and metropolitan areas, Lombardia has recognized the pressing need to address climate change. It has therefore prioritized public awareness initiatives to foster collective action (Regione Lombardia, 2018). In 2024, the region approved a collaboration with the Lombardia Environmental Foundation, integrating research, training, and environmental education across various thematic areas. Additionally, the institution is engaged in a partnership with the Regional Scholastic Office to establish a regional network for environmental education, reinforcing its commitment to sustainability through knowledge-sharing and community engagement.

Innovation Lab Stakeholders - Regulators

Banca d'Italia

The Bank of Italy is the central bank of the Italian Republic and a member of the Eurosystem, alongside other national central banks and the European Central Bank. It plays a fundamental institutional role, ensured by its broad autonomy and independence, while maintaining a

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commitment to transparency and public accountability. The Bank leverages multidisciplinary expertise to better address complexity and societal change. As a central bank, the Bank of Italy actively contributes to the transition towards sustainability by strengthening the financial system's resilience to environmental, social, and governance (ESG) risks. It collaborates with national and international authorities and institutions to promote sustainable finance and is a member of the G20 Sustainable Finance Working Group and the Task Force on Climate-related Financial Risks (TFCR). During Italy's G7 presidency, it co-led the Climate Change Mitigation Working Group. Additionally, the Bank is part of the Network for Greening the Financial System and the Financial Stability Board. The Bank of Italy conducts research on the economic and financial impacts of climate change. As a member of the Eurosystem, it is committed to developing EU-standard climate-related indicators as part of a broader climate action plan. These efforts aim to enhance the assessment of climate risks to the financial system and foster a deeper understanding of the challenges and opportunities in transitioning to a greener economy.

Istituto per la Vigilanza sulle Assicurazioni (IVASS) - Institute for Insurance Supervision

IVASS is the authority responsible for ensuring the adequate protection of policyholders and the transparency and integrity of insurance companies. As part of its broader commitment to societal welfare, the institute is also engaged in environmental conservation efforts. In February 2025, IVASS issued a letter recommending that insurance companies develop long-term strategies for climate-related insurance products. This guidance is based on the increasing number of claims resulting from the rising frequency of extreme weather events.

Events Organised

Three sessions have been organised to discuss and develop the scheme proposed in this Innovation Lab. Each session involved representatives of different stakeholder groups: (1) international academics and adaptation experts members of the Network Nature Task Force 3; (2) Italian water boards, flood risk managers and public administrations; (3) Italian insurers, financial and insurance regulators. The sessions took the form of online meetings. Session (1) was held in English, while Sessions (2)-(3) were held in Italian. Table 9 below provides details of these events, including date, duration, number of participants.

Table 9: Events organised in the Innovation Labs

	Session 1: 25 October 2024	Session 2: 12 December 2024	Session 3: 3 February 2025
Group	Academics and adaptation experts	Water boards, flood risk managers, public administrations	Insurance companies, financial regulator, insurance regulator
Organizations	Aarhus University, International Institute	ADBPO, ANBI Veneto, ANBI Emilia-Romagna,	Assicurazioni Generali, Banca d'Italia, IVASS

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	for Sustainable Development (IISD), Global Infrastructure Basel Foundation (GIB-Foundation)	ANBI Lombardia, Regione Lombardia	
No. of participants	4 (excluding CMCC members)	10 (excluding CMCC members)	8 (excluding CMCC members)
Type of event	Online	Online	Online
Duration	1 hour	1.5 hours	1.5 hours
Language	English	Italian	Italian

Outcome of the Innovation Lab Sessions

Session 1 - Academics and adaptation experts

The meeting took place on the 25h of October, 2024. It included participants from the academic community and experts working on climate risk adaptation, involved in various Horizon Europe projects. In particular, 4 members of the following organizations were present: Aarhus University, IISD, GIB-Foundation.

The aim of the meeting was to follow up on the discussion introduced in a preliminary scoping meeting in Brussels (during the Network Nature Task Forces Cluster meeting) and begin brainstorming a proposal to jointly present to the Network Nature Labs funding call. As such, the meeting explored the key elements and functioning of the proposed scheme, as well as the activities to propose for the funding call.

The meeting defined that the key elements of the scheme are: controlled flooding on upstream rural or agricultural land to reduce the risk on downstream communities, a community insurance policy to reimburse the costs connected to controlled flooding, a tribute/tax collected by the institution that implements the controlled flooding to purchase the insurance policy. During the meeting it was also discussed which activities should be conducted to explore such a scheme, so as to define the proposal for the Network Nature Labs funding call. Such activities include:

- Developing new material for future capacity-building workshops
- Exploring business cases through surveys
- Partnering with outside experts
- Organizing capacity-building workshops to stress-test and further develop the proposed scheme

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The participants were interested in the proposal and expressed their availability to proceed with the submission to the Network Nature Labs funding call.

Session 2 - Water boards, flood risk managers and public administrations

The meeting took place on the 12th of December, 2024. It included participants from Italian water boards, other flood risk managers and public administrations. In particular, 10 members of the following organizations were present: ADBPO, ANBI Veneto, ANBI Emilia-Romagna, ANBI Lombardia, Regione Lombardia.

The aim of the meeting was to present the proposed scheme, which integrates controlled flooding, community insurance and NbS, to the stakeholders managing flood risk in Italy (with a specific focus on the Po River Basin District and the related Regions). As such, the meeting focused on the normative, administrative and governance aspects of the scheme to identify challenges and gaps affecting its feasibility and acceptability.

The meeting started with a brief introduction about the historical and geographical context in which the proposal originates, as well as the NATURANCE project and the scope of the Innovation Lab. Subsequently, CMCC presented the proposed scheme to integrate controlled flooding, community insurance and NbS to reduce the flood risk and improve the resilience of the affected territories.

The following discussion was structured to gather feedback on the scheme and insights from past experiences on controlled flooding, potential regulatory and mandate constraints affecting water boards, and key barriers as well as supporting mechanisms for the scheme's applicability. Some relevant questions were formulated to guide the discussion, identify key challenges and brainstorm possible solutions:

- What feasibility aspects should be considered in the context of controlled flooding?
- What regulatory and legislative barriers could hinder the implementation of the proposed scheme?
- What are the main social concerns that citizens or stakeholders might have regarding its applicability?

The participants expressed a favourable view of the initiative and the proposal. A useful and informative discussion followed, where several important points were raised by the participants which helped to improve the scheme. An overview of the main discussion points is reported below.

Operationalization of controlled flooding

The participants have highlighted that the owners of the land subject to controlled flooding should be provided with adequate compensation for the damages that this would generate. There are some past examples of reimbursement schemes being given by water boards to landowners for controlled flooding activities, as well as studies conducted by ANBI and the University of Bologna. A related

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aspect that emerged regards the conversion of the land subject to controlled flooding from agricultural use to a more natural state. Some of the participants suggested that this would mean that a lower compensation will be provided to the landowner following the controlled flooding, which could undermine the implementation of the scheme by creating resistance from the landowners. However, it has been reminded that non-productive does not mean non-profitable. It will thus be important to effectively identify and communicate to the landowners the range of benefits they can derive from the renaturalization of the fields (conversion to NbS), and explore financing mechanisms (public funds, biodiversity credits, payment for ecosystem services, etc.).

Legislative framework and remit of the water boards

The participants have reminded that the water boards' remit (i.e., type and extension of the water bodies they manage) varies across the different Regions. It has thus been highlighted that it would be important to involve the Regions and other public administrations (e.g., municipalities) to develop and implement the proposed scheme. In some cases, since there are specific boundaries within which the water boards can operate, it may be necessary to modify the regional legislation to allow them to carry out the activities foreseen in the proposed scheme (collection of an additional tribute to purchase the insurance policy, implementation of controlled flooding). Connected to this, the water boards have clarified that what they collect from the communities they serve is a tribute ("contributo" in Italian), not a tax. And this is calculated according to the benefit that each of the contributors derives from the activity of the water board, based on a classification plan ("piano di classifica"). Therefore, it is important to establish a clear link between the controlled flooding, the flood risk reduction this generates for various contributors and the tribute add-on that is collected from them. As a consequence, not all the landowners in the territory served by the water board should be subject to the tribute-add on, and the participants emphasized the need to take into account justice and redistribution considerations. Some participants raised the issue of a potential insolvency, or the fact that some contributors might not pay the tribute, which would create problems to pay the insurance premium. Finally, certain participants stated that the main task of water boards should remain the management of water resources and flood risk on the territory. While the proposed scheme involves the purchase of an insurance policy, this is intended to cover the costs connected to the controlled flooding activity, which is perfectly in line with the traditional remit of water boards.

Acceptability of the scheme

The participants highlighted that the people targeted in the scheme are also those land and property owners who are already paying a tribute for the water boards' activities. Therefore, a scheme that involves an additional tribute and a (potential) loss of land could be subject to resistance and generate discontent. It is thus of paramount importance for the success of the proposed scheme that these people and communities are adequately and effectively communicated why this initiative is important and which benefits it generates for them. Some participants also reflected on the necessity to consider a redistribution mechanism that could involve discounts or exemptions for landowners who might lose productive land while already paying higher tributes to water boards,

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so as to address the unequal distribution of costs and benefits. Consequently, engagement and communication campaigns are essential to inform and discuss with communities about how controlled flooding ensures flood risk and damage reduction by the, how the avoided loss compares to the tribute add-on, how this tribute is calculated in order to ensure an equitable distribution of costs and benefits, the economic benefits that landowners can derive from a conversion of the land to NbS, which funds are available to finance this conversion and how they can be accessed. In connection to the implementation of NbS, some participants have suggested to link it to the CAP requirement of devoting 4% of agricultural fields to greening, and potentially rethink this requirement on a provincial or district base, rather than by farmland. In this way it might be possible to concentrate the land to be re-naturalized in specific areas which offer greater flood risk reduction potential, which could be managed by the water boards in exchange for an adequate compensation to the respective landowner(s). While such a possibility was seen favorably, it might require further normative adjustments to be implemented.

Session 3 - Insurance companies, financial and insurance regulators

The meeting took place on the 3rd of February, 2025.It included participants from an Italian insurance company, and the Italian regulators of the financial, banking and insurance sectors. In particular, 8 members of the following organizations were present: Assicurazioni Generali. Banca d'Italia, IVASS.

The aim of the meeting was to present the proposed scheme, updated with the elements that emerged during the previous meeting with the flood risk managers, to the stakeholders from the insurance and financial sectors. As such, the meeting explored particularly the technical and financial aspects of the scheme, with a focus on the insurance policy.

The meeting started with a brief introduction about the historical and geographical context in which the proposal originates, as well as the NATURANCE project and the scope of the Innovation Lab. Subsequently, CMCC's proposed scheme to integrate controlled flooding, community insurance and NbS to reduce the flood risk and improve the resilience of the affected territories was presented.

The discussion points and questions for the meeting were designed to structure the conversation around key aspects of the proposed scheme, covering:

- The practical feasibility of the scheme
- Additional benefits or challenges in the model
- Connections between insurance and financing NbS

The meeting aimed to explore the marketability of the insurance product and potential challenges in the insurance policy design, the regulatory feasibility, the best approach between parametric and indemnity-based policies; benefits and challenges of the model, including envisaged advantages for the insurance sector and whether land conversion/NbS could be integrated into pricing models or insurance involvement in its financing. As in previous events, the participants expressed a

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favourable view of the initiative and the proposal. A lively discussion followed and evolved organically, without strictly following predefined questions, with many relevant remarks and suggestions which allowed us to further refine the scheme. The discussion addressed the identified points and extended beyond them, offering valuable insights into additional important aspects that should be considered. An overview of the main discussion points is reported below.

Limits to insurability

The participants warn that a policy that covers water boards against the costs of controlled flooding might lead to moral hazard, undermining their incentives to (continue to) conduct their risk reduction and prevention activities. In order to limit such a risk, it is suggested to foresee the involvement of the Civil Protection ("Protezione Civile") with the role of guarantor, which would set clear rule to determine the events in which the water boards can operate controlled flooding activities (namely define clear rules regarding the amount and frequency of precipitation which require a controlled flooding), as well as the guidelines to implement them. In this way, there would be an external guarantor that ensures water boards do not indiscriminately implement controlled flooding without carrying out the appropriate risk reduction activities, thus reducing the risk of moral hazard. Another point raised by the participants regards the randomness of the loss event. Since the policy would cover the costs of the controlled flooding procedure rather than the damage of a meteorological event, the randomness of the loss would be violated, which is one of the key criteria for insurability. While it is true that the policy covers the cost of the controlled flooding, the implementation of this depends on the meteorological event. In fact, the water boards, in light of their expertise with the infrastructure they manage (which in many cases is meant to protect against events with a return period of 20-40 years) and with the territory they serve, know when the meteorological conditions will require the controlled flooding activity to be implemented. Participants suggest that this could be further regulated by the Civil Protection. Therefore, even though the policy would cover an intentional activity, the cause of the loss is still the meteorological event that required the implementation of such an activity, which is random.

Typology and characteristics of the insurance policy

It was suggested that designing the policy as a parametric product would further help to alleviate the potential limitations to insurability mentioned above. A parametric insurance would link the payment to the (intensity of the) meteorological events and not to the actual loss/costs suffered for the controlled flooding activity. This would remove moral hazard and would ensure that the randomness requirement is met. Thus, participants highlighted the need to identify an effective and meaningful trigger and to develop a robust model to integrate the meteorological conditions into a pricing scheme and an insurance product. The trigger might be composite and not depend only on the precipitation amount (e.g., combining precipitation levels, exceeding critical river thresholds, hydrological response of the soil based on prior conditions such as prolonged droughts). In any case, it will have to be determined together with water boards (and, potentially, the Civil Protection), so the insurance policy will not be a shelf product but should be tailored to the specific needs of each water board. Moreover, the policy could be designed as a sort of business interruption policy. In

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fact, when the weather conditions require the water board to implement controlled flooding, this limits its ability to normally conduct its other activities, which is akin to a business interruption.

Justice considerations

The participants noted that the main beneficiaries of the scheme are the contributors located in downstream urban areas, while those in upstream rural areas bear most of the burden (e.g., by making the land available for controlled flooding). It was thus reiterated the necessity to carefully evaluate justice and fairness considerations connected to the proposed scheme. In particular, it was suggested that the tribute add-on to finance the purchase of the insurance policy should be collected primarily from the contributors in downstream urban areas. In this regard, the use of the classification plans ("Piano di Classifica") to estimate the tribute could help. The plans include a quantification of risk to estimate the benefit derived from the water board's activities. As such it ensures that the amount of the tribute add-on to finance the insurance policy is proportional to the reduction in flood risk generated by the controlled flooding. In addition, the contributors that see their land flooded in the controlled flooding should be exempted from the tribute add-on, and, as aforementioned, adequately compensated. In this way, it should be possible to ensure an equitable and just distribution of the costs and benefits of the proposed scheme.

Conversion of the land to NbS and integration into insurance pricing

The participants highlighted the lack of reliable and standardized quantifications of risk reduction measures, both technical (such as wet or dry waterproofing) or natural (NbS). This implies that even though the lands subject to controlled flooding were converted to NbS, which, as we know, present a higher flood risk reduction potential than "productive" land, such a potential could not be accounted for in the pricing scheme and would thus not generate lower insurance premiums. All participants have confirmed the need for more reliable quantifications of (flood) risk reduction, based on sound and robust methodologies and that considers a multitude of scenarios and contexts. Contextually, these would have to be translated into official standards by supranational authorities (such as EIOPA) to ensure that insurers can confidently integrate them into pricing schemes. Participants suggested that this should be accompanied by the creation of standardized templates and guidelines for data collection and disclosure, to facilitate the production of risk reduction estimates and their translation into official standards. Moreover, it was mentioned that public authorities and regulators should incentivise the adoption and diffusion of biodiversity credits in the insurance sectors, as this would allow the internalizations of wider public and social benefits (such as those deriving from the renaturalization) which would otherwise not enter their investment and business decision because not directly monetizable. In addition, some participants also suggested that land owners should be provided with detailed information about the benefits of the conversion of their land to NbS (both for them and for the wider community), about the compensation they will receive following the controlled flooding, as well as about the opportunities to finance the conversion. While water boards are not legally allowed to directly finance the creation of NbS on the land subject to controlled flooding, they should engage in communication and awareness raising campaigns to provide landowners all the relevant information (for instance about the availability of

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Regional or EU funds for renaturalization and the procedure the access them). It was mentioned that a similar activity could also be conducted by insurance companies, with some examples in this sense being considered in some European countries.

Incentives for insurance companies and remit of the water boards.

Some participants mentioned that the proposed scheme would be particularly beneficial for the insurance companies if a considerable share of the contributors in downstream communities also held a private insurance policy from them. A potential extension of the proposed scheme in this sense could see the water boards doing a bulk purchase of policies that guarantee a minimum level of coverage for the contributors in the territories they serve (who would then be free to independently purchase additional private policies for full coverage), which would be financed through the same approach envisaged here (namely with a tribute add-on calculated according to the classification plan). While this option is extremely interesting and presents many advantages for the whole society, there are a number of factors that currently limit its applicability. Firstly, water boards are strictly regulated in their activity, in how much funds they can collect from the communities they serve and what they can do with such funds. In particular, the tribute collected has to be used to conduct water resources and flood risk management activities. Currently, the collection of a tribute to purchase insurance coverage on behalf of the contributors is not permitted. This implies that modifications to regional or national legislations might be required to enable such an option. In addition, some water boards are still quite traditional institutions, which might have some resistance to such an innovative change of role. However, as aforementioned, water boards are not the only institution managing flood risk on the Italian territory. Therefore, such a scheme might be adopted by one of these other institutions, like municipalities or Regions. There would be, however, the risk of a double contribution being imposed on the communities, which would require careful planning to avoid the creation of an excessive burden on contributors and discontent.

Concluding reflection on the business case

This Innovation Lab investigated a scheme to improve the resilience to flood risk of Italian communities and incentivise the adoption of nature-based solutions. The scheme, which is initially developed focusing on the Po River basin district, revolves around the implementation of controlled flooding activities by water boards to reduce potentially more severe damage from uncontrolled flooding. The water boards should purchase an insurance policy to cover from the costs and liability connected to said activities. The purchase of this policy should be financed through a tribute add-on that the water boards should collect from the contributors in the communities they serve, proportional to the benefits these derive in terms of reduced risk and damage from the controlled flooding. The land designated to be inundated during the controlled flooding, should be converted to NbS to lower the impact of such an activity and produce a number of additional co-benefits. The final version of the scheme proposed in the IL is reported in Fig. 3.

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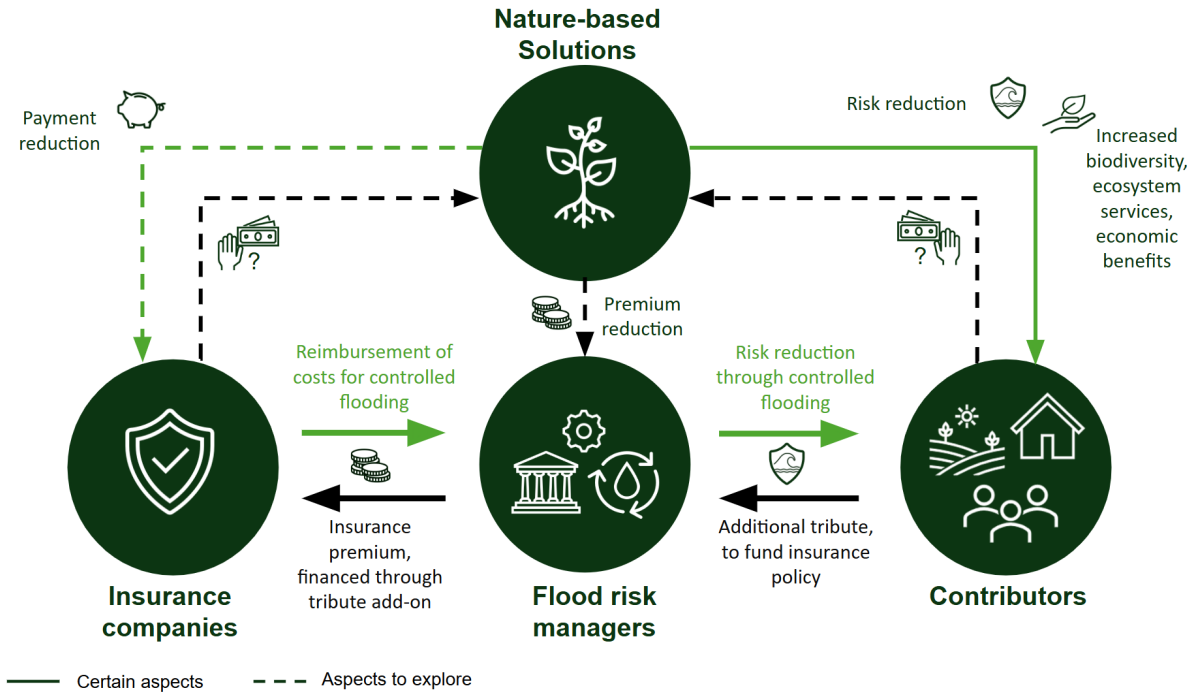

Figure 12 - The final version of the IL scheme. Source: authors' elaboration, January 2025.

Throughout the various sessions and meetings organised during the lab, the scheme was refined and developed beyond its original conceptualization, arriving at a more coherent and comprehensive formulation. In fact, the discussions with the stakeholders identified some aspects of great relevance which were not fully developed in the initial proposal. For instance, it was clarified the complexity of the flood risk management framework in Italy, which implies that in order to implement the scheme in practice, other institutions will have to be involved, not only water boards. These can be the Civil Protection, the district basin authorities, the regions and the municipalities, which can participate either as flood risk managers (so implementing controlled flooding and purchasing insurance coverage), or as regulators (defining the guidelines for controlled flooding or implementing the necessary legislative updates to enable the application of the scheme). In addition, it was evidenced the need to guarantee adequate compensation to the owners of the land that will be designated for the controlled flooding, and to ensure that the scheme follows the principles of fairness and justice. This implies that the extra tribute to purchase the insurance policy should be collected primarily from the contributors located in downstream urban areas, which derive the greatest benefit from the controlled flooding activities. The discussion also highlighted the importance of raising awareness among the communities involved. This implies adequately conveying information about the risks and benefits for the various stakeholders to effectively communicate the importance of the scheme and ensure the support from market, political and community actors. Once again, this will likely require an active involvement of several institutions and stakeholders, not just water boards, to ensure a widespread and effective communication campaign and deliberation. Another aspect that was consolidated throughout the discussion regards the technical characteristics of the insurance policy. The meeting with the stakeholders from the insurance and financial sector particularly helped in refining these points. What emerged is that

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a parametric product should allow violations of insurability criteria to be avoided, which would be further guaranteed by the intervention of an external independent actor, such as the Civil Protection, to regulate the conditions for implementing controlled flooding. Moreover, the insurance provider should work closely with the water boards (or other flood risk managers) to define a reliable trigger that is based on context-specific characteristics and needs of the territory.

While the scheme was originally developed with a specific territory (the Po River basin district) and stakeholder (water boards) in mind, it can have a much wider scope. Firstly, water boards operate across the whole Italian territory, not only in those regions considered here. Moreover, while the water boards of each region have different remit based on the specific regional law and agreements, they all elaborate a classification plan of the communities they serve, used to assess the benefits each contributor derives from the board's activity and calculate accordingly the tribute they collect. Therefore, the scheme that has been conceptualised and developed for the water boards of the Po River basin district can be directly applied to all water boards in Italy. Secondly, it can also be easily translated to be used by other flood risk managers different from water boards (such as municipalities or Regions). In fact, the key element for the application of the scheme, namely the classification plans to calculate the tribute for the purchasing of the insurance policy, are publicly available (together with all the ancillary pieces of information to produce them). This implies that other flood risk managers can adopt the same procedure to finance the purchase of insurance coverage as outlined in the scheme. In this case, since these institutions do not commonly adopt such a procedure in their habitual activities, the application might initially require extra time and use of resources to gather the information and develop the knowledge and expertise. However, after this initial phase they will be able to perform the task in the same way as water boards. Therefore, the proposed scheme has the potential to be implemented throughout the entire national territory and by all the institutions in charge of managing flood risk. Potential extensions beyond the Italian framework are possible, and should be carefully adjusted and tailored to the specific legislative and governance framework in each country.

The IL has facilitated cross-sectoral collaboration and helped break down institutional silos, providing a foundation for more integrated flood risk management strategies. Discussions have highlighted key challenges in implementing an insurance-backed controlled flooding mechanism, offering insights into policy feasibility, the need for a standardized evaluation framework for ecosystem services within the insurance market, and the evolving role of water boards in addressing climate change-related risks.

The findings and discussions from the IL provide a number of insights that can benefit flood risk managers and the insurance sector. For water boards and flood risk managers, the IL has provided a solid idea of how insurance policies can help mitigate the financial risk associated with controlled flooding. It also highlighted the potential of the new role water boards can perform in the future: no longer exclusively managers of water resources, but managers of the territory and the ecosystem services this provides. Therefore, the IL insights can be used to refine governance arrangements and financial mechanisms, and advocate for policy changes to enable controlled flooding, NbS

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implementation and this change of role. Additionally, the IL has highlighted key windows of opportunities that are creating momentum for nature-based approaches to flood resilience (e.g., CAP requirements, Nature Restoration Law, etc.). The insurance sector could leverage these preliminary discussions and insights for R&D exploring new business models that could expand the insurance market penetration through collective insurance schemes, or insurance policies that can be designed for risk reduction measures.
In terms of impacts, the IL has laid the groundwork for systemic change in flood risk management by initiating dialogue and bridging the gap between insurance providers and (unusual) beneficiaries. Such discussion could result in pilot small-scale applications based on IL findings (e.g. linking to existing initiatives such as the reconstruction plan in Emilia Romagna region) to test the feasibility of controlled flooding insurance models and inform policy adjustments to address regulatory gaps, refine legal and financial instruments, and allocate resources for NbS for flood mitigation. The proposed insurance-backed controlled flooding scheme could be a feasible and scalable model in the long term.

Next steps and future work

The activities of the Innovation Lab will continue in the upcoming months with the aim of further developing the scheme, translating the results into accessible formats for broader audiences, testing its extension to other national contexts, and exploring collaborations to boost outreach and impacts.

Firstly, CMCC aims to organize at least one more meeting with the stakeholders involved so far (plus some that could not participate before), bringing them at a joint discussion table. This will allow a further development of the scheme, and will put the basis for a fruitful collaboration between the parties involved to translate it into an actionable solution.

The application to the Network Nature Labs funding call was successful. These funds will be used to investigate the applicability of the scheme in an international context. This will be achieved through the following activities:

- Development of new material for future capacity-building workshops
- Exploration of international business cases through surveys
- Partnering with international experts
- Organization of capacity-building workshops to stress-test and further develop the scheme

Additionally, it has been proposed that the IL could engage with the G20 Sustainable Finance Working Group to explore synergies. In fact, there is significant alignment of the topics explored in the IL with ongoing G20 discussions under the current and upcoming presidencies, particularly as regards the development of new financial instruments for risk reduction and climate adaptation. For instance, the report “Toolbox on Financing Nature-based Solutions” (Brasil-Leigh et al., 2024), developed during the Brazilian Presidency of the G20, closely aligns with the core objectives of the IL and could serve as a reference point for positioning the IL’s findings and methodologies within global financial discussions. Moreover, one of the key priorities of the South African presidency is

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"financing adaptation", which includes a strong focus on NbS. This provides a direct opportunity to connect the IL's approach with broader global efforts to enhance financial mechanisms for climate resilience.

A further avenue for integration involves the creation of a pool and market for ecosystem services, a strategy that would allow for their capitalization and linkage to financial flows. One potential mechanism for this is the establishment of Natural Asset Companies, which could formalize and enhance the financial value of ecosystem services, enabling investment in NbS at a larger scale.

In general, to further enhance the impact and utility of the project it will be important to engage policymakers, providing them with specific, policy-related outcomes and recommendations, including guidance on where investments should be prioritized.

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Annexes

Annex 1. Scorecard for CISL's Innovation Lab

Problem statement, Current baseline & Innovation

- **Identifies the challenge/need for innovation regarding the link between nature and insurance**
    - The first stage of this innovation lab focused on defining the need, understanding the current baseline, and identifying the challenges related to the link between nature and insurance. This was conducted in a multi-stakeholder environment, establishing a collaborative and co-creative space for all participants to ensure that practical, real-world challenges were the primary focus of the business case, which was successfully achieved. **(5/5)**

- **Provides a solution to the identified challenge**
    - The business case proposed a series of solutions to the identified challenges through the creation of an action plan that outlines these solutions and suggests the necessary stakeholders to be involved in their implementation. Identifying the stakeholders supports the primary objective of the innovation lab, which is to establish how insurance can serve as an enabler to catalyse investment in nature-based projects. **(5/5)**

- **Innovativeness of the developed business case solution**
    - The business case proposes several novel solutions. The range of existing innovative solutions presented in Table 4, supported by real-world pioneering examples of existing nature finance in nature-based projects, offers tangible, actionable, and innovative steps for the insurance sector to adopt and catalyze investment in nature-based projects. **(4/5)**

Total Score for Problem Statement: 14/15

Implementation & Execution

- **Identifies key groups and stakeholders needed for implementation**
    - The business case identified the key groups and stakeholder needs for implementation, and this informed the structure of Lab workshop #2, where a diverse range of financial institutions, including those from other financial sectors, were invited to take part in the business case development, so as to fully consider the opportunities and challenges in implementation. **(5/5)**

- **Outlines the implementation strategy**

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- The output of Lab workshop #3 was the development of an implementation roadmap. This provides an overview of the implementation strategy as the output of the extensive consultation process throughout the innovation lab. The next steps would be to identify collaborating partners to take ownership for this implementation, which would be an opportunity area. (**4/5)**

- **Outlines and addresses risks surrounding the implementation**
  - The barriers to implementation were considered as part of Lab workshop #2, yet addressing the risks surrounding the implementation of the overall process could be further enhanced within this business case. (**3/5**)

Total Score for Implementation & Execution: 12/15

Finance

- **Demonstrates the ability to get financed**
  - The purpose of this innovation lab was to foster greater finance flows to nature-based solutions through understanding the role, and existing landscape, of the insurance sector and, as such, this section is challenging to score. Based on the inclusion of real world examples throughout each of the Lab workshops and their subsequent analysis, we have demonstrated the ability and likelihood of the insurance sector to finance a range of nature-based solutions. **(5/5)**

- **Describes the need, use, and source of funding**
  - Throughout the development of this Lab, we have supported each stage with real world examples of financing of nature-based solutions, highlighting for all audiences the need, use and potential sources of funding. **(5/5)**

- **Outlines sustainable financial expectations**
  - The lab has considered current challenges to driving finance towards NbS and therefore looked at the way forward through these challenges. This helped set realistic expectations of what might be financeable through the road map and through examples included in Table 4, provide examples of where this has previously worked. **(4/5)**

Total Score for Finance: 14/15

Impact

- **Positive impact for nature**

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- The innovation lab focused on increasing understanding of nature-based solutions and actionable financing mechanisms already in place which may be implemented by a number of the lab participants, this should increase positive action for nature and hence impact. **(4/5)**

- **Positive impact for the insurance sector**
  - The positive impacts on the insurance sector from this business case are multiple including; deeper understanding of the challenges, the barriers, building connections across financial institutions, as well as innovative finance mechanisms already underway that invest in nature-based solutions. **(5/5)**

- **Positive impact for society and communities, including climate resilience, equity, and participation.**
  - This was not a primary focus of the innovation lab and, as such, it is difficult to assess all the secondary impacts associated with enabling greater financial flows to nature-based solutions. For this reason, we have identified this as a weakness, as any assessment would involve secondary impacts that are challenging to attribute directly to the development of this innovation lab. **(2/5)**

Total Score for Impact: 11/15

TOTAL SCORE: 51/60

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Annex 2. Scorecard for WTW's Innovation Lab

Problem statement, Current baseline & Innovation

- **Identifies the challenge/need for innovation regarding the link between nature and insurance**
    - While this business case does not establish a direct connection between nature and insurance, trigger-based financing payouts can facilitate the relocation of vulnerable rough sleepers to 'cool spaces', which often include green spaces and tree-covered areas within the city. This highlights an indirect but important link, suggesting that there should be an incentive to maintain and enhance these natural cooling areas. **(3/5)**

- **Provides a solution to the identified challenge**
    - This business case would provide additional funding to respond to the vulnerable homeless people in extreme temperatures, and targets those instances of "overflow" mentioned in the protocol document, whereby demand for cool spaces / accommodation exceeds the supply and therefore more funding is required. **(4/5)**

- **Innovativeness of the developed business case solution**
    - As far as publicly available information goes, this business case is the first-of-its-kind in London as well as wider Europe. The principles have been applied in developing countries like Viet Nam and India, however there were no examples found in European cities. **(5/5)**

Total Score for Problem Statement: 12/15

Implementation & Execution

- **Identifies key groups and stakeholders needed for implementation**
    - From our discussions, the key groups and stakeholders identified include: rough sleeping leads in local boroughs, outreach teams, local boroughs, sub-regional coordinators, vulnerable rough sleepers, and the H-SWEP team within the Greater London Authority. Further conversations the H-SWEP team would confirm any additional stakeholders that should be considered. **(3/5)**

- **Outlines the implementation strategy**
    - The business case acknowledges that further discussions with the H-SWEP team are necessary to determine whether trigger-based financing is a suitable solution for

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addressing inefficiencies in their current financing model. While immediate implementation is not feasible without substantial additional investigation, particularly around identifying appropriate data sources, the business case does outline the necessary steps for progressing from concept to product development and eventual placement, should the client choose to proceed**.** (**2/5)**

- **Outlines and addresses risks surrounding the implementation**
  - Various risks associated with implementation were discussed. These could be further investigated and refined at a later stage , focusing on: price of premium, obtaining adequate insurance coverage from the market and establishing a clear and efficient process for managing and distributing payouts to maximise their impact. (**4/5**)

Total Score for Implementation & Execution: 9/15

Finance

- **Demonstrates the ability to get financed**
  - This business case identifies existing sources of finance, which could be deployed more quickly / efficiently, and potentially scaled up, through the implementation of trigger-based financing.
  - At this stage, the business case remains a concept and has not yet been fully developed or presented to prospective (re)insurers. Therefore, we cannot yet assess its specific ability to secure financing.
  - However, we do know that parametric insurance products are available in the London market, though they are primarily used for agricultural risks and business interruption coverage. Further engagement with the insurance market would be necessary to determine the feasibility of applying a similar model to this use case, should the concept be taken forward. **(3/5)**

- **Describes the need, use, and source of funding**
  - In Innovation Lab 2, we clearly outlined how this business case aligns with the structure required for a trigger-based financing product. The need for funding is based on evidence from the protocol document; however, further discussions with the H-SWEP team are required to determine whether current funding is sufficient. According to the document, in cases of “overflow,” responders are instructed to secure additional accommodation and then request reimbursement. This is where insurance could play a crucial role—both in covering overflow situations and responding to extreme events, such as the summer of 2022.

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- The intended use of the funding is clear: it is designated for supporting rough sleepers exposed to extreme temperatures.
- As for the source of funding, we propose two potential options (i) Internal Funding – If existing funds are adequate but require a more structured disbursement mechanism; (2) Insurance – To cover overflow cases and extreme weather events where additional financial support is needed. **(4/5)**

- **Outlines sustainable financial expectations**
  - The business case has not yet fully outlined sustainable financial expectations, though this was discussed at length. At this stage, further work is needed to assess long-term financial viability, including:
  - Cost-Effectiveness: Ensuring that premiums and payouts align with the financial capacity / expectations of the stakeholders.
  - Scalability: Evaluating whether the concept can be expanded or adapted for other extreme heat covers within the Europe.
  - Funding Stability: For example, identifying reliable funding sources to ensure ongoing financial sustainability, whether through internal funds, insurance, or a combination of both. **(2/5)**

Total Score for Finance: 9/15

Impact

- **Positive impact for nature**
  - The business case does not establish a direct link between the innovation and nature. However, it acknowledges that trigger-based financing could help relocate rough sleepers to 'cool spaces,' which often include green areas. This suggests an indirect incentive to maintain and protect urban green spaces**. (2/5)**

- **Positive impact for the insurance sector**
  - The business case introduces a new application of parametric insurance within the London market, which has primarily focused on agriculture and business interruption. If developed further, this concept could create new opportunities for insurers by expanding the use of parametric products into the humanitarian and urban resilience sectors. However, since the case has not yet been tested with (re)insurers, its market acceptance remains uncertain. Further engagement with the insurance industry is required. **(3/5)**

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- **Positive impact for society and communities, including climate resilience, equity, and participation.**
    - The business case has a strong societal impact, as it directly addresses the protection of rough sleepers, who have been identified in our Innovation Labs as one of the most vulnerable groups during extreme hot weather events. By securing timely funding for emergency interventions, the innovation enhances climate resilience, promotes equity, and ensures that financial support reaches those most in need. Further stakeholder engagement would further strengthen its impact and would unlock how communities might be able to participate**. (4/5)**

Total Score for Impact: 9/15

TOTAL SCORE: 39/60

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Annex 3. Scorecard CMCC's Innovation Lab

The increasing frequency and severity of flooding events in Italy, combined with the limited diffusion of insurance coverage for this risk, underscores the need for innovative solutions that bolster the resilience of Italian communities to flooding. To address this urgent challenge, CMCC has launched an Innovation Lab focused on integrating controlled flooding, a novel community insurance model, and Nature-based Solutions for flood risk management. This was tailored for and tested in an exposed area of Northern Italy: the Po river basin district. The Innovation Lab involves key stakeholders—such as regional water board associations, insurance companies, public authorities, and financial regulators—to assess the operational, regulatory, and financial feasibility of the proposed model, as well as its potential commercial appeal to insurers within the complex legislative and governance framework of river management.

Through a series of meetings, the Innovation Lab has successfully conceptualized and refined a business case for an insurance-backed controlled flooding scheme that will reduce flood risk while promoting the adoption of NbS to strengthen community resilience. It revolves around the implementation of controlled flooding activities by water boards on upstream rural land to mitigate the impact of uncontrolled flooding in downstream urban areas. Water boards would then purchase insurance policies to cover the costs and liabilities associated with these activities. The cost of these policies would be funded through a surcharge collected from contributors proportional to the benefits they receive in terms of reduced flood risk and damage. The land designated for controlled flooding would eventually be converted into NbS to mitigate the impact of such an activity and generate additional co-benefits.

The Innovation Lab has fostered cross-sector collaboration and broken down institutional silos, laying the groundwork for more integrated flood risk management strategies. Discussions have highlighted key challenges in implementing the insurance-backed controlled flooding model, providing valuable insights into policy feasibility, the need for a standardized evaluation framework for ecosystem services in the insurance market, and the evolving role of Water Boards in addressing climate change-related risks.

Problem statement, Current baseline & Innovation

- **Identifies the challenge/need for innovation regarding the link between nature and insurance**
    - The business case highlights the growing flood risk and limited insurance coverage in Italy, emphasizing the need for innovative flood management strategies and financing opportunities. Within Italy's complex legislative and governance framework, the business case identifies the challenges of transitioning from traditional flood management to an ecosystem services-based approach, fostering synergies between public authorities and the insurance sector. **(4/5)**

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- **Provides a solution to the identified challenge**
    - The business case examines the potential of insurance-backed controlled flooding combined with NbS and leveraging community-based insurance schemes. It assesses the operational, regulatory, and financial feasibility of the proposed approach, along with its commercial appeal to insurers, within the complex legislative and governance framework of river management. **(4/5)**

- **Innovativeness of the developed business case solution**
    - The business case proposes a novel insurance coverage model for adaptation and NbS strategies. This approach enhances community and ecosystem resilience by mainstreaming adaptation measures that reduce emergency response and post-disaster costs. It advocates for redefining the roles of flood risk managers and insurers within an ecosystem-based framework to better address climate change and disaster risks. **(5/5)**

Total Score for Problem Statement: 13/15

Implementation & Execution

- **Identifies key groups and stakeholders needed for implementation**
    - The business case comprehensively identifies the heterogeneous stakeholders that are required for its implementation along with a detailed analysis of their roles within the scheme. These include the public authorities and agencies responsible for flood risk management (water boards, regional governments, municipalities, river basin authorities, civil protection agencies, and environmental authorities), land and property owners, insurance companies and regulators, and communities interested by land use changes and financial tributes **(5/5)**

- **Outlines the implementation strategy**
    - The business case outlines the Innovation Lab's process, including the engagement and analytical activities conducted to define the problem and design and test the solution with input from both the intended providers and beneficiaries. However, it lacks a fully developed roadmap for implementation, clarifying the steps required to operationalize the transition from conceptualization to execution. A set of next steps and activities has been planned for further developing the scheme and detailing the strategy for pilot implementations and assessing scalability (**3/5)**

- **Outlines and addresses risks surrounding the implementation**
    - The Innovation Lab identifies key risks, such as regulatory constraints, financial gaps, stakeholder coordination challenges, and social acceptability and justice trade-offs. These stem from the inherent innovation potential and complexity of the scheme,

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the fragmented governance in flood risk management, limited financial opportunities for NbS, and potential moral hazards and resistance of risk transfer mechanisms. However, the business case outlines a potential mitigation strategy to address these barriers and ensure the legal and financial feasibility of the scheme while promoting justice and legitimacy to secure the buy-in of stakeholders and affected communities (**4/5**)

Total Score for Implementation & Execution: 12/15

Finance

- **Demonstrates the ability to get financed**
  - The business case outlines the potential challenges to finance the purchase of the community insurance policy and the implementation of NbS. It identifies a suitable approach to finance the purchase of the insurance policy, which would allow the required funds to be collected in a reliable and equitable way. It also identifies opportunities for financing the conversion of lands to NbS. However, the full range of these options and their application have not been fully explored and demonstrated. **(3/5)**

- **Describes the need, use, and source of funding**
  - The needs for funding are identified in the purchase of the community insurance policy and the conversion of the lands designated for controlled flooding to NbS. The business case clearly identifies an effective strategy to finance the insurance purchase. This is represented by a tribute add-on based on the classification plan produced by the water boards. The business case also lists several potential sources of financing for the implementation of NbS. These include regional or European funds, payments for ecosystem services, biodiversity credits or carbon carbon credits. Additional potential sources might be available and should be explored in the future. **(4/5)**

- **Outlines sustainable financial expectations**
  - The business case develops an approach and financing strategy which are robust and reliable. However, most of the discussions have revolved around ensuring financial viability and sustainability in the current scenario. The long-term viability of the scheme (e.g., the amount of the tribute add-on under severe climate change, or continuing to meet insurability criteria under severe climate change) did not undergo in-depth stress-testing. **(2/5)**

Total Score for Finance: 9/15

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Impact

- **Positive impact for nature**
  - The greening strategy proposed by the business case facilitates the transformation of a portion of agricultural land into NbS, promoting biodiversity enhancement. It also promotes the adoption of blue-green solutions to address flood risk, offering a sustainable alternative to traditional grey infrastructure for flood risk management, thus contributing to long-term benefits for the riverine ecosystem, with a focus on ecosystem restoration. **(4/5)**

- **Positive impact for the insurance sector**
  - The proposed tailor-made insurance scheme allows insurance companies to take a leading role in providing coverage for vulnerable communities. Additionally, as such coverage may become mandatory for property and landowners in the coming years, similar to existing requirements for businesses, the scheme strategically positions insurers within an emerging business line poised for growth. At the same time, it expands the potential customer base for community insurance, encompassing both urban communities and agricultural stakeholders. **(5/5)**

- **Positive impact for society and communities, including climate resilience, equity, and participation.**
  - The business case aims to strengthen community resilience to flood risk in the long term and is designed to foster public-private partnerships with the shared goal of improving both human well-being and ecosystem biodiversity through the provision of multiple ecosystem services. However, potential challenges related to the fair distribution of costs and benefits must be carefully addressed. **(4/5)**

Total Score for Impact: 13/15

TOTAL SCORE: 47/60

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