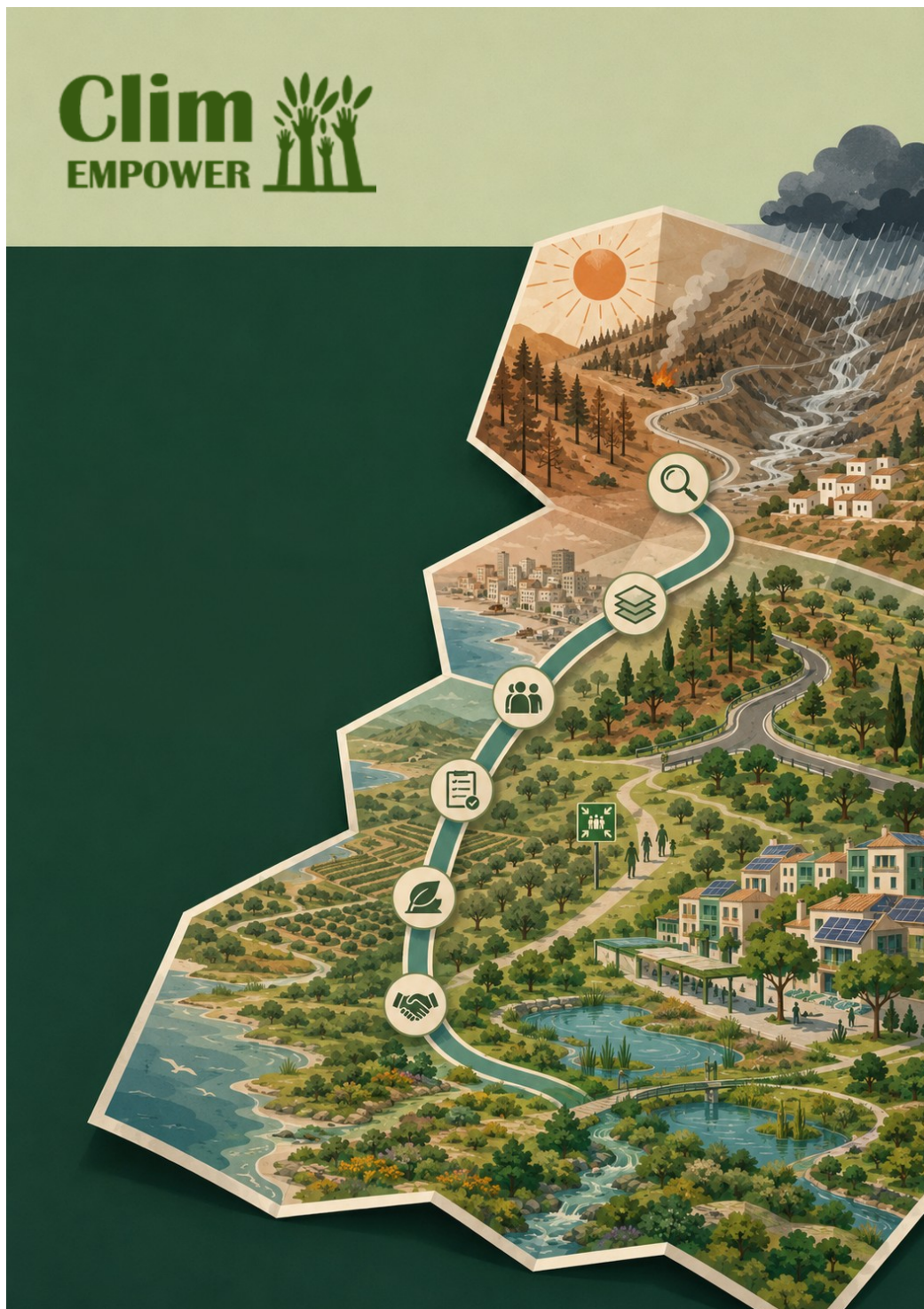




Converting Climate Risks into Actionable Land-Use Plans

A Concise Guide for Regional Decision-Makers

Part of ClimEmpower educational library

Project information	
Project name:	Project ClimEmpower: User Driven Climate Applications Empowering Regional Resilience
Grant Agreement No.	101112728
Start date:	01/09/2023
Duration:	36 months
Coordinator:	Denis Havlik, Scientist AIT Austrian Institute of Technology Giefinggasse 4, 1210 Vienna, Austria
	Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.
Deliverable details	
Report name	Converting Climate Risks into Actionable Land-Use Plans: A Concise Guide for Regional Decision-Makers
Target audience	Senior policymakers, mayors, regional directors, lead planners, technical officers, and other public-sector decision-makers involved in climate adaptation and land-use planning.
Description:	Part of the ClimEmpower Educational Library, this concise guide introduces the Hazard–Sector Translation Framework (HSTF) as a practical method for converting climate-risk information into traceable land-use recommendations. It helps regional and local authorities connect climate evidence with planning instruments, responsible organisations, implementation requirements, investment priorities, safeguards, and measurable resilience objectives.
Estimated reading time	Approximately 60 minutes, excluding annexes and references.
Learning level	Introductory to intermediate – no climate-modelling expertise required.
Prerequisites	Basic familiarity with climate-change impacts, public administration, or land-use planning is helpful but not required.
Keywords	Climate adaptation; climate resilience; land-use planning; spatial planning; Hazard–Sector Translation Framework; hazard pathways; governance readiness; Blue-Green Infrastructure; regional decision-making
Downloadable from	• ClimEmpower web site: https://climempower.eu/results/edu • Zenodo: 10.5281/zenodo.22282940
Version:	Final Version
Publication date:	03/09/2026
Dissemination level:	PU = Public
Editor:	Havlik, Denis, AIT Austrian Institute of Technology GmbH, Austria
Author(s):	Havlik, D. (AIT Austrian Institute of Technology GmbH, Austria), Austria Xekalakis, G. (Frederick University), Cyprus

Recommended citation

Xekalakis, G., and Havlik, D. (2026). *Converting Climate Risks into Actionable Land-Use Plans: A Concise Guide for Regional Decision-Makers*, in *ClimEmpower educational library*, ed. Havlik, D., URI: <https://climempower.eu/edu/>, DOI: 10.5281/zenodo.22282940.

Revision history

Date	Version	Contributor/Reviewer	Description
14/09/2026	First public release	Havlik, D. and Xekalakis, G.	Condensed decision-maker edition retaining the principal HSTF methodology, implementation guidance, Troodos application, key reflection questions, and practical planning worksheets.

Legal Disclaimer

All information in this document is provided "as is" and no guarantee or warranty is given that the information is fit for any particular purpose. The user, therefore, uses the information at its sole risk and liability. For the avoidance of all doubts, the European Commission and CINEA have no liability in respect of this document, which is merely representing the authors' view.



This document is published under the terms of the Creative Commons “CC BY-NC” 4.0 license. That is, the ClimEmpower

Consortium and document authors explicitly permit redistribution and the creation of derivatives, such as translations, provided that the material is not used for commercial purposes, appropriate credit is given to the authors (BY), and the user indicates whether the publication has been changed (NC). **Please contact the document editor and/or the authors if you wish to use this material for commercial purposes or if you are unsure whether your intended use is permitted under the licence.**

Please note that the scope of the license granted by Consortium is limited to own work and that the document can also contain materials attributed to a third party, such as tables, figures, or images. Users wishing to reuse such materials are responsible for determining whether permission is needed for that reuse and for obtaining permission from the copyright holder. The risk of claims resulting from infringement of any third-party owned component in the work rests solely with the user.

© 2026 by ClimEmpower Consortium

Table of Contents

Table of Contents	4
List of Figures	6
List of Tables	6
List of Acronyms	7
Glossary	7
About this document	9
1 Introduction.....	10
1.1 Why should I read this manual?.....	10
1.2 The challenge: turning information into action.....	10
2 Concepts, methods, and approaches	12
2.1 From hazard inventories to hazard pathways.....	12
2.1.1 Why a list of hazards is not enough	12
2.1.2 Understanding a hazard pathway	13
2.2 The Hazard-Sector Translation Framework.....	14
2.2.1 Step 1 — Identify the hazard pathway	15
2.2.2 Step 2 — Identify the affected territorial system.....	16
2.2.3 Step 3 — Select the relevant land-use domain	17
2.2.4 Step 4 — Select a recommendation family	17
2.2.5 Step 5 — Identify the active planning instrument.....	19
2.2.6 Step 6 — Define the expected resilience function	20
2.2.7 Completing the sequence and checking traceability	21
2.3 Shared land-use resilience domains	22
2.3.1 The five shared domains	22
2.3.2 How to select the appropriate domain	24
2.4 Multifunctionality and Blue-Green Infrastructure.....	25
2.4.1 Why multifunctionality matters	25
2.4.2 Assessing multifunctional measures.....	26
3 Practical considerations and lessons learnt	28
3.1 From a technically sound recommendation to implementation	28
3.1.1 Governance as an implementation condition	29
3.1.2 Governance readiness.....	29
3.2 The three governance transition points.....	30
3.2.1 Transition Point 1 — Institutional responsibility	31
3.2.2 Transition Point 2 — Legal authority and funding.....	32
3.2.3 Transition Point 3 — Support, maintenance, and monitoring	32
3.2.4 Summary of the transition points	33
3.3 Applying the HSTF under different planning conditions	34
3.3.1 Matching the application to regional conditions.....	35

3.3.2	Confidence and low-regret action.....	35
3.3.3	A proportionate-use rule	36
3.4	Ethical considerations and policy trade-offs	36
3.4.1	Preventing maladaptation and unfair cost burdens	37
3.4.2	Participation, accountability, and ethical screening.....	38
4	Key messages and next steps	41
4.1	A focused HSTF application process	41
4.2	Implementation, monitoring, and review.....	42
4.3	Key messages and next steps	44
5	References.....	47
	Annex 1: Integrated HSTF planning exercise.....	48
A1.1	Exercise 1 – Define a decision-relevant hazard pathway	48
A1.2	Exercise 2 – Complete the six-step HSTF sequence.....	50
A1.3	Exercise 3 – Test governance readiness and proportionality.....	52
A1.4	Exercise 4 – Apply the ethical and equity screen	54
A1.5	Exercise 5 – Prepare the implementation and monitoring record	56
A1.6	Final recommendation-readiness checklist	58

List of Figures

Figure 1: From climate information to local action.	9
Figure 2: From a hazard inventory to a hazard pathway.	14
Figure 3: The six-step Hazard-Sector Translation Framework (HSTF).	15
Figure 4: Multiple benefits of Blue-Green Infrastructure.	26
Figure 5: Governance transition points within the HSTF sequence.	31

List of Tables

Table 1. Outputs and quality checks for the six-step HSTF sequence.	21
Table 2. Shared land-use resilience domains and their principal planning roles.	22
Table 3. Planning responses to common governance-readiness gaps.	30
Table 4. Practical checks at the three governance transition points.	33
Table 5. Guidance for applying the HSTF under different data and institutional conditions.	34
Table 6. Ethical and equity screening questions for proposed adaptation measures.	39
Table 7. Minimum HSTF implementation record.	42
Table A8. Hazard-pathway worksheet.	49
Table A9. Six-step HSTF worksheet.	50
Table A10. Governance-readiness worksheet.	52
Table A11. Ethical and equity screening worksheet.	54
Table A12. Implementation worksheet.	56
Table A13. Monitoring-indicator worksheet.	57
Table A14. Final recommendation-readiness checklist.	58

List of Acronyms

Acronym	Definition
BGI	Blue and Green Infrastructure
CINEA	European Climate, Infrastructure and Environment Executive Agency
CoP	Community of Practice
ERDF	European Regional Development Fund
EU	European Union
GIS	Geographic Information System
HSTF	Hazard-Sector Translation Framework
IPCC	Intergovernmental Panel on Climate Change
LIFE	EU Programme for the Environment and Climate Action

Glossary

Term	Definition
Adaptation	Actions taken to prepare for current or expected climate effects, reduce harm, protect people and assets, and, where possible, benefit from new opportunities (IPCC, 2022).
Blue-Green Infrastructure (BGI)	Connected water, vegetation, soil, open-space, and ecosystem features that help manage runoff, heat, water quality, biodiversity, and public-space needs.
Climate hazard	A climate-related event or physical condition that may cause harm, such as extreme heat, drought, wildfire, flooding, or water scarcity.
Climate Resilience	The ability of people, institutions, infrastructure, and ecosystems to prepare for, withstand, respond to, and recover from hazardous events while maintaining essential functions.
Exposure	The presence of people, buildings, infrastructure, ecosystems, services, or economic activities in locations that may be affected by a climate hazard.
Governance readiness	The extent to which responsibility, legal authority, funding, stakeholder support, maintenance, monitoring, and other implementation conditions are in place.
Hazard Pathway	The chain through which a climate-related pressure interacts with local conditions and an exposed territorial system to produce a planning-relevant consequence.
Hazard-Sector Translation Framework (HSTF)	A six-step method connecting a hazard pathway, affected territorial system, land-use domain, recommendation family, planning instrument, and expected resilience function.
Land-Use Domain	A planning area through which climate action can be organised. The HSTF uses Buildings, Agriculture, Blue-Green Infrastructure, Transportation, and Protected-Area Conservation.
Maladaptation	An action intended to reduce climate risk that creates new risks, transfers harm elsewhere, locks in unsustainable practice, or increases inequality (IPCC, 2022).
Planning instrument	A legal, regulatory, administrative, financial, investment, or management mechanism used to put a public decision into practice.

Term	Definition
Recommendation family	A group of related adaptation actions that serve a common planning purpose. For example, the recommendation family “wildfire fuel management” may include clearing undergrowth, maintaining fuel breaks, managing vegetation beside roads, and improving access for firefighting vehicles.
Resilience function	The specific protective result an adaptation action should deliver, such as reducing exposure, lowering vulnerability, or maintaining an essential service.
Risk	The possibility of harmful consequences arising from the interaction of a climate hazard, the people or assets exposed to it, and their vulnerability. In simple terms, a severe hazard does not always produce severe damage: the outcome depends on what lies in its path and how well prepared it is (IPCC, 2022).
Legal authority (formally, statutory competence)	The legal power granted to a public authority to make, approve, or enforce a particular decision. Put simply, it answers the question: “Are we legally allowed to take this action?” For example, a municipality may recognise the need for forest fuel management but lack the legal authority to intervene on nationally managed forest land.
Territorial system	The combination of people, places, infrastructure, ecosystems, and economic activities that interact within a specific area. Examples include an urban neighbourhood, an agricultural plain, a coastal tourism zone, or the mountain villages, forests, roads, and water resources of Troodos.
Vulnerability	The physical, social, economic, environmental, or institutional conditions that make exposed people or systems more likely to experience harm.

About this document

This concise guide forms part of the ClimEmpower Educational Library and contributes to Deliverable D4.2, Educational Materials for Increased Regional Climate Change Resilience v2. It draws on the Hazard–Sector Translation Framework presented by Xekalakis et al. (2026) and relevant ClimEmpower research and regional outputs.

The guide is intended primarily for senior policymakers, mayors, regional directors, lead planners, technical officers, and other public officials who influence land-use, infrastructure, environmental-management, and investment decisions. No advanced knowledge of climate modelling or Geographic Information Systems is required. It addresses the translation gap between climate-risk information and the practical decisions needed to reduce risk. Hazard maps and assessments may identify where a problem could occur, but they do not automatically specify the action, responsible organisation, planning instrument, funding route, maintenance arrangements, or expected resilience result.

The guide will help readers:

- define a decision-relevant hazard pathway;
- identify affected territorial systems and relevant land-use domains;
- connect recommendations to appropriate planning instruments;
- assess governance, evidence, implementation, and ethical requirements; and
- define responsibilities, safeguards, monitoring indicators, and review arrangements.

The guide should be applied to a clearly defined climate-related problem and adapted to the legislation, institutions, evidence, resources, and planning procedures of the region concerned.

Figure 1 summarises the overall process: moving from regional climate information to a locally relevant risk pathway, an appropriate planning action, and a more resilient territory.

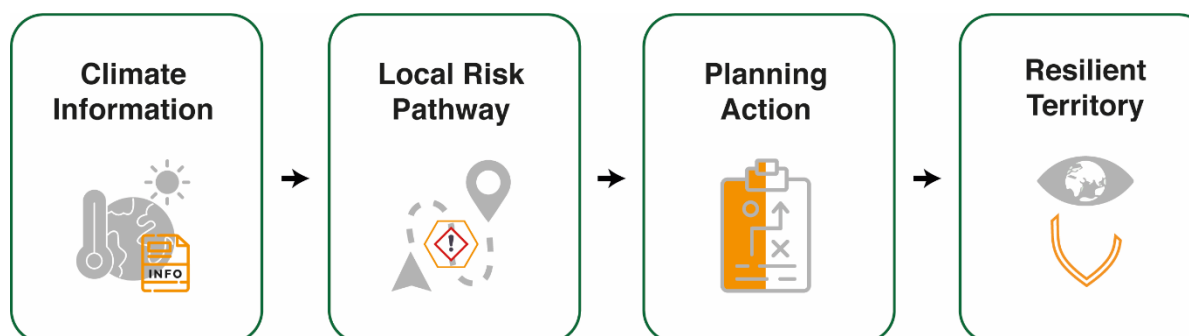


Figure 1: From climate information to local action.

1 Introduction

1.1 Why should I read this manual?

Climate-risk assessments can tell public authorities where heatwaves, floods, droughts, or wildfires are likely to occur. However, they do not automatically explain what a municipality or region should do next.

For a mayor, regional director, or lead planner, the central question is therefore not only:

“What climate hazards affect our territory?”

It is also:

“Which decisions can we take, through which planning tools, to reduce their consequences?”

Public authorities cannot directly control rising temperatures, changing rainfall patterns, or extreme weather events. They can, however, influence how exposed and vulnerable their territories are. Depending on their legal responsibilities, they may:

- establish land-use and development requirements;
- introduce or update building requirements;
- protect natural drainage and water-retention areas;
- manage vegetation near settlements and infrastructure;
- safeguard evacuation and emergency-access routes;
- improve the resilience and redundancy of critical infrastructure;
- direct public investment towards priority locations; and
- coordinate the organisations responsible for implementation, maintenance, and monitoring.

The Hazard–Sector Translation Framework helps connect climate evidence with these existing public-sector responsibilities. It guides decision-makers from a climate-related hazard pathway to the affected territorial system, the relevant land-use domain, an appropriate family of actions, an active planning instrument, and a clearly stated resilience function (Xekalakis et al., 2026).

1.2 The challenge: turning information into action

Many regions already have access to climate projections, hazard maps, vulnerability assessments, historical-event records, and local knowledge. Nevertheless, this information often remains separate from the instruments used in everyday public administration, including development plans, zoning regulations, building

requirements, infrastructure programmes, environmental-management plans, emergency plans, and public budgets.

This separation creates a translation gap between what climate evidence indicates and what public authorities can approve, finance, implement, maintain, and monitor.

What is the "Translation Gap"?

The missing connection between climate-risk information and the specific decisions, responsible organisations, planning instruments, resources, and monitoring arrangements required to convert that information into practical action.

When this connection is missing, climate strategies may produce recommendations such as “increase green space”, “improve water conservation”, or “strengthen infrastructure resilience”. These recommendations may be directionally correct, but they remain difficult to implement unless they also identify:

- the specific hazard pathway being addressed;
- the people, places, infrastructure, ecosystems, services, or activities that may be affected;
- the location and scale at which intervention is required;
- the proposed action and the alternatives considered;
- the organisation responsible for leading implementation;
- the legal, regulatory, administrative, or financial instrument that can put the action into effect;
- the resources required for implementation and long-term maintenance; and
- the measurable resilience function that the action is expected to provide.

A recommendation is traceable when another reader can follow the complete reasoning from the available evidence to the proposed action and understand how implementation and success will be assessed.

The HSTF provides a common structure for organising this reasoning and supporting cooperation between scientific experts, planners, technical departments, finance teams, infrastructure managers, communities, and political decision-makers.

The framework does not replace scientific assessment, technical design, environmental assessment, legal review, financial appraisal, or stakeholder consultation. It helps connect these activities within one coherent and transparent decision-making process.

2 Concepts, methods, and approaches

This chapter introduces the central concepts of the Hazard–Sector Translation Framework. It explains how to move from climate-hazard information to a decision-relevant pathway, apply the six HSTF steps, identify the appropriate land-use domain, and consider multifunctional planning responses.

2.1 From hazard inventories to hazard pathways

2.1.1 Why a list of hazards is not enough

Regional climate assessments commonly begin with a hazard inventory: a list of climate-related pressures such as heatwaves, drought, wildfire, flooding, coastal erosion, extreme rainfall, or water scarcity.

A hazard inventory is a useful starting point because it identifies which pressures require attention. However, it does not explain how each hazard may affect people, infrastructure, ecosystems, services, or economic activities. It also does not identify the public decision needed to reduce the consequences.

For example, identifying flooding as a regional hazard does not by itself explain:

- which neighbourhoods, roads, buildings, services, or ecosystems are exposed;
- which local conditions increase the likelihood or severity of damage;
- how flooding could disrupt the functioning of the territory;
- where preventive measures should be prioritised;
- which organisation has the responsibility and legal authority to intervene; or
- whether the appropriate response involves development control, drainage investment, ecosystem restoration, building measures, emergency planning, or a combination of actions.

A hazard inventory therefore tells decision-makers what may occur, but not yet how harm may occur or where public action can interrupt the process.

Key question for reflection:

Which climate hazard in your region is currently presented mainly as a label, map, or indicator, and what local consequence still needs to be explained before an appropriate action can be selected?

2.1.2 Understanding a hazard pathway

A hazard pathway describes the chain through which a climate-related pressure interacts with local conditions and an exposed territorial system to produce a consequence that public authorities can address through planning, investment, regulation, or management (Xekalakis et al., 2026). A basic pathway identifies four connected elements:

1. **Climate-related pressure or hazard:** What physical climate-related condition or event is occurring or expected?
2. **Local conditions:** Which geographic, environmental, physical, social, or institutional characteristics may intensify or modify its effects?
3. **Exposed and vulnerable territorial system:** Which people, buildings, infrastructure, ecosystems, services, livelihoods, or economic activities may be affected?
4. **Planning-relevant consequence:** What damage, disruption, loss, or reduction in service could result?

The pathway can be expressed in a simplified form:

Climate-related pressure + local conditions → exposed and vulnerable territorial system → planning-relevant consequence.

The purpose is not to describe every possible interaction. It is to identify the dominant relationship relevant to a particular decision.

The same hazard may create different pathways within the same region. Extreme rainfall may threaten buildings in a low-lying neighbourhood, interrupt a transport corridor, or erode agricultural land. Each pathway concerns a different territorial system and may therefore require different authorities, instruments, and measures.

A useful pathway should:

- refer to a clearly defined location or territorial scale;
- distinguish observed evidence from projections, assumptions, and expert judgement;
- explain which local conditions influence the outcome;
- identify the people, assets, ecosystems, or services that may be affected;
- describe the consequence in terms relevant to public responsibilities; and
- avoid a level of precision that is not supported by the available evidence.

The same hazard may require several pathways when it affects different territorial systems. Flooding, for example, may create one pathway for residential buildings,

another for transport infrastructure, and another for agricultural land. Each pathway may lead to different authorities, planning instruments, and possible actions.

Figure 2 illustrates the distinction. A hazard inventory identifies the pressures present in a territory, while a hazard pathway explains how a pressure interacts with local conditions and exposed systems to create a consequence relevant to public action.

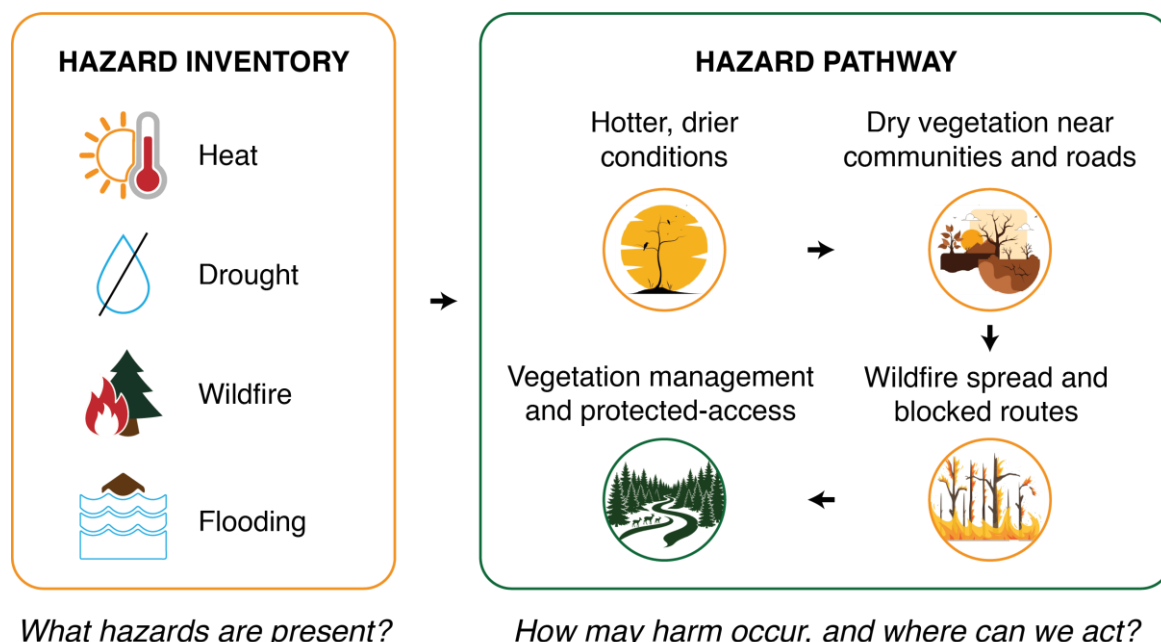


Figure 2: From a hazard inventory to a hazard pathway.

Key question for reflection:

Can you describe one priority risk as a clear chain connecting a climate-related pressure, relevant local conditions, an exposed territorial system, and a consequence that public authorities can influence?

2.2 The Hazard-Sector Translation Framework

A hazard pathway explains how a climate-related pressure may create a planning problem. The Hazard–Sector Translation Framework then organises the reasoning required to move from that problem towards an implementable response. The HSTF consists of six connected steps:

1. Hazard pathway
2. Affected territorial system
3. Land-use domain
4. Recommendation family
5. Active planning instrument
6. Expected resilience function

Each step narrows the problem and makes the final recommendation more specific, traceable, and relevant to implementation. The complete sequence is summarised in Figure 3.

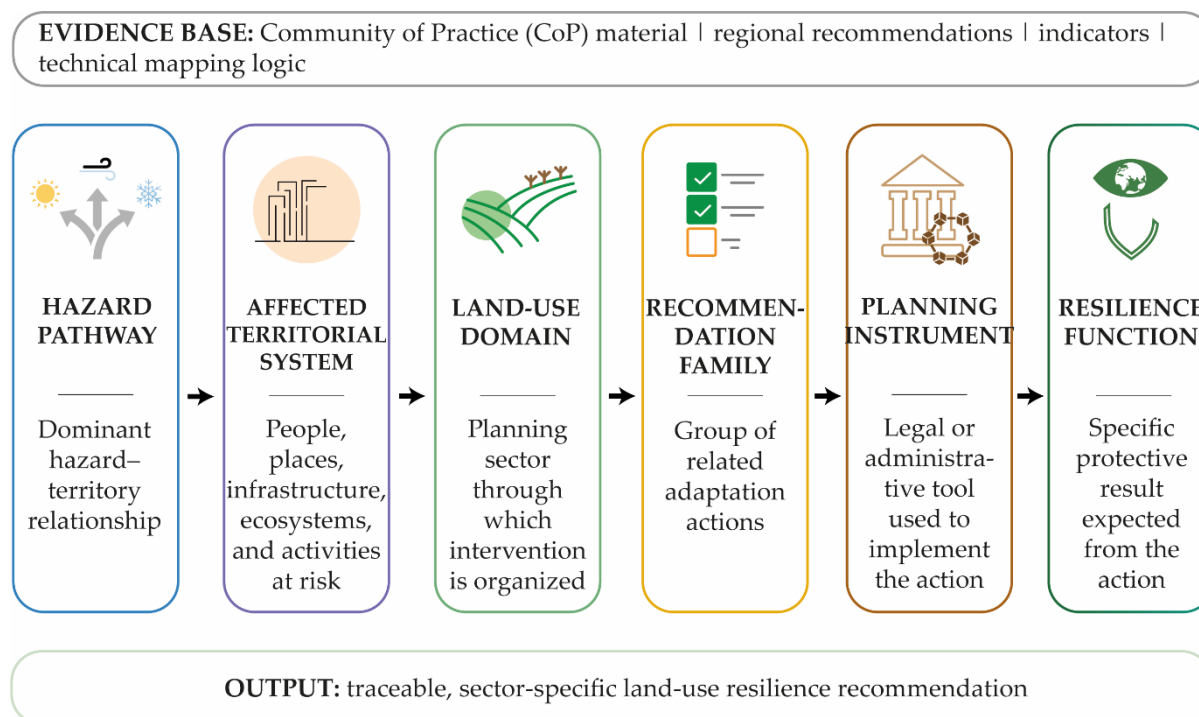


Figure 3: The six-step Hazard-Sector Translation Framework (HSTF).

2.2.1 Step 1 — Identify the hazard pathway

Practical question: What chain of events is creating the problem?

Begin by identifying the dominant relationship between a climate-related pressure, the local conditions that influence its effects, the exposed territorial system, and the resulting consequence.

The purpose is not to describe every possible interaction. It is to define the pathway most relevant to the planning, investment, regulatory, or management decision under consideration.

A useful pathway should explain:

- the climate-related pressure or hazard;
- the location and territorial scale;
- the environmental, physical, social, or institutional conditions that may intensify its effects;
- the people, infrastructure, ecosystems, services, or activities that may be exposed or vulnerable; and
- the damage, disruption, or loss that may result.

Where several consequences are important, decision-makers may need to formulate more than one pathway. Combining too many consequences into a single pathway can make the subsequent recommendation unclear.

Minimum output from Step 1 - A concise statement explaining how a climate-related pressure could produce a planning-relevant consequence in a defined territorial context.

Key question for reflection:

Is the pathway specific enough to guide a public decision, or does it still describe the problem only as a general climate hazard?

2.2.2 Step 2 — Identify the affected territorial system

Practical question: Who or what may be harmed or disrupted?

The next step identifies the elements of the territory that are exposed or vulnerable to the pathway. These may include:

- residents, visitors, and vulnerable population groups;
- settlements, neighbourhoods, and buildings;
- roads, bridges, utilities, and other infrastructure;
- hospitals, schools, emergency facilities, and public services;
- agriculture, tourism, businesses, and local livelihoods;
- forests, rivers, coastal areas, habitats, and protected ecosystems; and
- cultural heritage and other socially important assets.

This step should be as geographically specific as the available evidence allows. Referring to a defined neighbourhood, road corridor, catchment, agricultural zone, coastal area, or group of facilities is usually more useful than referring generally to an entire urban, rural, or regional area.

Decision-makers should consider both exposure and vulnerability. Two assets may be exposed to the same hazard but experience different consequences because of differences in construction, condition, accessibility, emergency capacity, population characteristics, environmental quality, or availability of alternatives.

Available evidence may include hazard and exposure maps, demographic information, infrastructure and building records, environmental datasets, maintenance reports, emergency records, field inspections, community knowledge, and structured expert judgement.

Uncertainty and data limitations should be recorded. A lack of detailed data does not necessarily prevent preliminary action, but it should influence the specificity and confidence of the recommendation.

Minimum output from Step 2 - A geographically defined description of the people, assets, ecosystems, services, or activities that may be affected and the characteristics that make them vulnerable.

Key question for reflection:

Have you identified the specific territorial systems that may be affected, including groups or services that may be overlooked in conventional hazard maps?

2.2.3 Step 3 — Select the relevant land-use domain

Practical question: Which planning area has the principal tools to respond?

The pathway is then connected to one or more of the five shared land-use domains:

- Buildings;
- Agriculture;
- Blue-Green Infrastructure;
- Transportation; and
- Protected-Area Conservation.

The selected domain provides the main planning entry point. It helps identify the departments, professional teams, regulatory processes, investment programmes, and management instruments that may be relevant.

Many pathways cross more than one domain. For example, surface-water flooding may involve Buildings, Transportation, and Blue-Green Infrastructure. The main domain should be the one offering the clearest route to implementation, while supporting domains should also be recorded.

Selecting several domains does not mean that responsibility should remain unclear. One organisation may still need to coordinate the recommendation while other organisations retain responsibility for particular actions, assets, approvals, or monitoring duties.

Minimum output from Step 3 - One principal land-use domain and, where necessary, a clearly identified set of supporting domains.

Key question for reflection:

Which domain offers the strongest implementation route, and which supporting domains could determine whether the action succeeds?

2.2.4 Step 4 — Select a recommendation family

Practical question: What type of action could interrupt or reduce the pathway?

A **recommendation family** is a group of related measures serving a common planning purpose. At this stage, decision-makers identify the appropriate type of intervention before defining its detailed technical design.

Recommendation families may include:

- development controls and zoning requirements;
- building adaptation and retrofit;
- water-retention, drainage, and infiltration measures;
- Blue-Green Infrastructure;
- soil, crop, and agricultural-water management;
- ecosystem conservation and restoration;
- vegetation and wildfire-fuel management;
- infrastructure protection and maintenance;
- transport-network redundancy and emergency access;
- relocation or managed retreat where other options are insufficient;
- awareness, preparedness, and emergency planning; and
- monitoring, inspection, and early-warning measures.

The proposed recommendation should respond directly to the pathway identified in Step 1. If the connection between the cause of the problem and the proposed action cannot be explained clearly, the recommendation should be reconsidered.

Decision-makers should normally compare more than one possible response. Alternatives may differ in effectiveness, cost, legal feasibility, environmental impact, implementation time, maintenance requirements, public acceptance, and distribution of benefits and burdens.

A recommendation family is not a copy-ready regulation or final engineering design. Detailed measures require the appropriate technical, environmental, legal, financial, and stakeholder review.

Minimum output from Step 4 - A preferred recommendation family, the principal action it may contain, and a brief explanation of why it responds to the identified pathway.

Key question for reflection:

Can you explain which part of the hazard pathway the proposed recommendation is intended to change, interrupt, or protect?

2.2.5 Step 5 — Identify the active planning instrument

Practical question: Through which authorised mechanism can the action be delivered?

To move towards implementation, a recommendation must be connected to an appropriate legal, regulatory, administrative, financial, investment, or management instrument.

Relevant instruments may include:

- local or regional development plans;
- zoning and development-control regulations;
- building codes and technical requirements;
- water, agricultural, forest, or ecosystem-management plans;
- transport and mobility plans;
- civil-protection and emergency plans;
- infrastructure investment and maintenance programmes;
- public procurement requirements;
- permits, licences, or environmental conditions;
- funding programmes, grants, or financial incentives; and
- agreements between public authorities, infrastructure operators, or landowners.

An instrument should not be selected only because its title appears relevant. Decision-makers should verify whether it is active, which organisation controls it, what geographic area and activities it covers, whether it can legally support the proposed action, and whether amendment or additional approval is required.

At this stage, confirm:

- which authority owns or manages the affected land, infrastructure, or service;
- which organisation can approve, require, finance, procure, or enforce the measure;
- whether responsibility is divided between different administrative levels;
- whether implementation requires cooperation with private landowners or infrastructure operators;
- whether the instrument includes a realistic funding route; and
- whether its procedures and timetable are compatible with the urgency of the action.

Selecting an instrument does not guarantee implementation. Legal authority, funding, institutional coordination, stakeholder support, maintenance, and monitoring must also be established.

Minimum output from Step 5 - A named planning or implementation instrument, the responsible authority, and the legal or administrative route through which the recommendation may proceed.

Key question for reflection:

Is the selected instrument genuinely capable of authorising, financing, organising, or enforcing the proposed action?

2.2.6 Step 6 — Define the expected resilience function

Practical question: What protective result should the action deliver?

The final step defines the specific resilience function expected from the intervention. This prevents the recommendation from remaining broad or symbolic and provides a basis for selecting monitoring indicators.

Common resilience functions include:

- **reducing exposure:** keeping people, development, infrastructure, or important assets away from hazardous locations;
- **lowering vulnerability:** making people, buildings, infrastructure, ecosystems, or economic activities less likely to experience serious harm;
- **maintaining service continuity:** helping essential services remain operational during and after a hazardous event;
- **supporting recovery:** enabling the timely restoration of services, livelihoods, ecosystems, and community functions;
- **increasing redundancy:** providing alternative routes, facilities, systems, or resources when a primary system fails; and
- **protecting ecosystem functions:** maintaining natural processes that support water management, cooling, biodiversity, slope stability, coastal protection, or other long-term resilience benefits.

The expected function should be stated clearly enough to guide responsibility and monitoring. “Improve resilience” is too broad because it does not explain what should change.

A stronger formulation identifies:

- the system or service to be protected;
- the intended direction of change;

- the location or population concerned;
- the conditions under which the function is expected to operate; and
- the evidence or indicator that could demonstrate progress.

Where an action is expected to provide several benefits, one principal resilience function should be identified. Important secondary functions and co-benefits may then be recorded separately.

Minimum output from Step 6 - A clearly stated protective result that is directly connected to the pathway and can guide the subsequent selection of indicators.

Key question for reflection:

Is the expected resilience function specific enough to determine later whether the intervention has achieved its intended result?

2.2.7 Completing the sequence and checking traceability

The six HSTF steps should form one connected decision chain. Table 1 provides a concise record of the output and quality check required at each step.

Table 1. Outputs and quality checks for the six-step HSTF sequence

HSTF step	HSTF step	HSTF step
1. Hazard pathway	A concise cause-and-consequence pathway for a defined territorial context.	Does it explain how the climate-related pressure may cause a planning-relevant consequence?
2. Affected territorial system	A geographically specific description of exposed and vulnerable people, assets, services, ecosystems, or activities.	Is it clear who or what may be harmed or disrupted?
3. Land-use domain	One principal domain and any necessary supporting domains.	Does the selected domain provide a realistic planning entry point?
4. Recommendation family	A preferred family of actions and an explanation of how it responds to the pathway.	Can the relationship between the problem and proposed response be demonstrated?
5. Active planning instrument	A named instrument, responsible authority, and implementation route.	Can the instrument legally and practically support the action?
6. Expected resilience function	A clearly stated protective or service-related result.	Is the result specific enough to guide monitoring?

Traceability means that another reader can understand:

- why action is needed;
- which evidence supports the identified pathway;
- who or what the action is intended to protect;
- why the selected recommendation responds to the pathway;

- which organisation and planning instrument can support implementation; and
- what practical result is expected.

This makes it easier to justify public expenditure, coordinate departments, explain decisions to stakeholders, and monitor whether the intervention delivers its intended benefits.

The HSTF should be treated as an iterative process. New evidence, stakeholder input, legal review, technical assessment, or monitoring results may require an earlier step to be revised. Returning to a previous step is therefore part of good planning rather than a failure of the method.

Key question for reflection:

Can another reader follow the complete reasoning from the available evidence to the proposed action, implementation instrument, and expected result without having to infer a missing connection?

2.3 Shared land-use resilience domains

Climate risks differ between and within regions, but many planning responses pass through a limited number of familiar public-policy areas. The HSTF organises these areas into five shared land-use resilience domains:

1. Buildings
2. Agriculture
3. Blue-Green Infrastructure
4. Transportation
5. Protected-Area Conservation

The domains provide a common language for scientists, policymakers, planners, engineers, environmental specialists, and other technical departments. They help connect a hazard pathway to the responsibilities, expertise, instruments, and budgets that may be used to address it.

The domains do not reproduce the administrative structure of every region. The names and powers of competent authorities will vary according to national and local legislation. Instead, they act as common planning entry points that can be adapted to different institutional systems..

2.3.1 The five shared domains

The scope and principal planning role of each land-use resilience domain are summarised in Table 2.

Table 2. Shared land-use resilience domains and their principal planning roles

Shared domain	What does it cover?	Main planning role	Examples of relevant hazards
Buildings	Homes, public buildings, commercial buildings, construction sites, and their immediate surroundings.	Reduce the exposure and vulnerability of buildings and their occupants through design, construction, renovation, and site-level requirements.	Extreme heat, surface-water flooding, water scarcity, wildfire, and severe storms.
Agriculture	Crops, livestock, agricultural soils, irrigation systems, rural livelihoods, and food-production areas.	Protect agricultural production, soil health, water efficiency, food security, and the economic continuity of farming communities.	Drought, extreme heat, water scarcity, frost, hail, flooding, and soil erosion.
Blue-Green Infrastructure (BGI)	Natural and semi-natural networks, including rivers, wetlands, drainage corridors, parks, trees, green roofs, rain gardens, and retention areas.	Use natural systems to retain water, reduce heat, filter runoff, support biodiversity, and provide multiple environmental and social benefits.	Surface-water flooding, urban heat, water scarcity, pollution, and ecosystem degradation.
Transportation	Roads, bridges, public transport, pedestrian and cycling routes, ports, evacuation corridors, and emergency-access routes.	Maintain safe movement, access to essential services, emergency response, and transport continuity during hazardous events.	Flooding, wildfire, extreme heat, landslides, erosion, and severe storms.
Protected-Area Conservation	Forests, habitats, protected landscapes, ecological corridors, conservation areas, and climate refuges.	Protect biodiversity, reduce ecosystem vulnerability, maintain ecological connectivity, support recovery after disturbance, and conserve the natural functions that contribute to long-term resilience.	Wildfire, drought, soil erosion, biodiversity loss, heat and changing water availability

A domain identifies the main planning interface; it does not automatically identify the responsible organisation. Decision-makers must still determine which authority has the responsibility, legal power, resources, and instruments required to act.

A single hazard pathway may involve several domains. For example, surface-water flooding may involve Blue-Green Infrastructure where water retention is required, Transportation where roads may be disrupted, and Buildings where development or site-level requirements are needed.

Key question for reflection:

Which of the five domains provide the most relevant planning entry points for the priority climate pathways affecting your territory?

2.3.2 How to select the appropriate domain

The principal domain should be selected according to the territorial system being protected and the type of intervention required—not simply according to the name of the hazard.

The following questions can support domain selection:

- Which people, assets, ecosystems, services, or activities are being protected?
- Which authority normally manages or regulates them?
- Which domain provides the most direct route from the pathway to action?
- Which planning, regulatory, investment, or management instruments are available?
- Are supporting domains required because they control an important asset, approval, or maintenance responsibility?

Where several domains are involved, one should be identified as the principal domain, while the others should be recorded as supporting domains. Selecting several domains does not mean that responsibility should remain unclear. As practical guidance, this guide recommends naming one lead coordinator and documenting:

- the responsibilities of supporting organisations;
- the legal authority held by each organisation;
- dependencies between actions and approvals;
- information-sharing arrangements; and
- implementation, maintenance, and monitoring duties.

The representative responses in Table 2 are not ready-made solutions. They must be adapted to the pathway, local evidence, legislation, institutional capacity, technical feasibility, available finance, maintenance requirements, stakeholder needs, and potential social or environmental effects.

Decision-maker checkpoint

Before moving forward, confirm that the selected domain reflects the system being protected and that all other domains affected by the intervention have been identified.

Key question for reflection:

Which domain has the actual responsibilities and planning tools needed to address the pathway, rather than merely being associated with the name of the hazard?

2.4 Multifunctionality and Blue-Green Infrastructure

Multifunctionality means selecting or designing an intervention so that it addresses more than one risk or provides several public benefits at the same time.

Conventional “grey” infrastructure—such as underground pipes, concrete drainage channels, culverts, retaining structures, and flood barriers—is generally designed to perform a specific engineering function. These systems remain essential in many locations. Where conditions allow, they may be complemented by Blue-Green Infrastructure to provide additional environmental, social, and economic benefits (Xekalakis et al., 2026; Zhu et al., 2025).

Blue-Green Infrastructure includes connected natural and semi-natural features such as wetlands, retention areas, restored waterways, bioswales, rain gardens, urban trees, parks, green corridors, green roofs, permeable surfaces, and vegetated drainage areas.

“Blue” refers mainly to water-related features, while “green” refers to vegetation, soil, and ecosystems. In practice, these elements often work together.

2.4.1 Why multifunctionality matters

A measure designed primarily to manage runoff may also:

- reduce surface-water flooding;
- provide shade and local cooling;
- filter pollutants;
- support infiltration and, where ground conditions allow, groundwater recharge;
- create or connect habitats;
- improve public space and recreation; and
- support walking, cycling, health, and well-being.

Figure 4 illustrates how one Blue-Green Infrastructure intervention may support runoff retention, passive cooling, water storage and infiltration, and habitat connectivity.

Multifunctionality can strengthen the case for investment and create opportunities to combine climate-adaptation, water-management, biodiversity, public-health, regeneration, and mobility objectives.

However, multiple benefits should not be assumed. They should be identified during planning and, where possible, connected to measurable objectives.

Blue-Green Infrastructure should also not be treated as an automatic replacement for conventional infrastructure. Dense development, steep terrain, contaminated soils, limited space, high design flows, safety requirements, or difficult maintenance conditions may still require engineered systems.

The most effective response may be a combined blue-green-grey system, in which natural and engineered measures perform complementary functions.

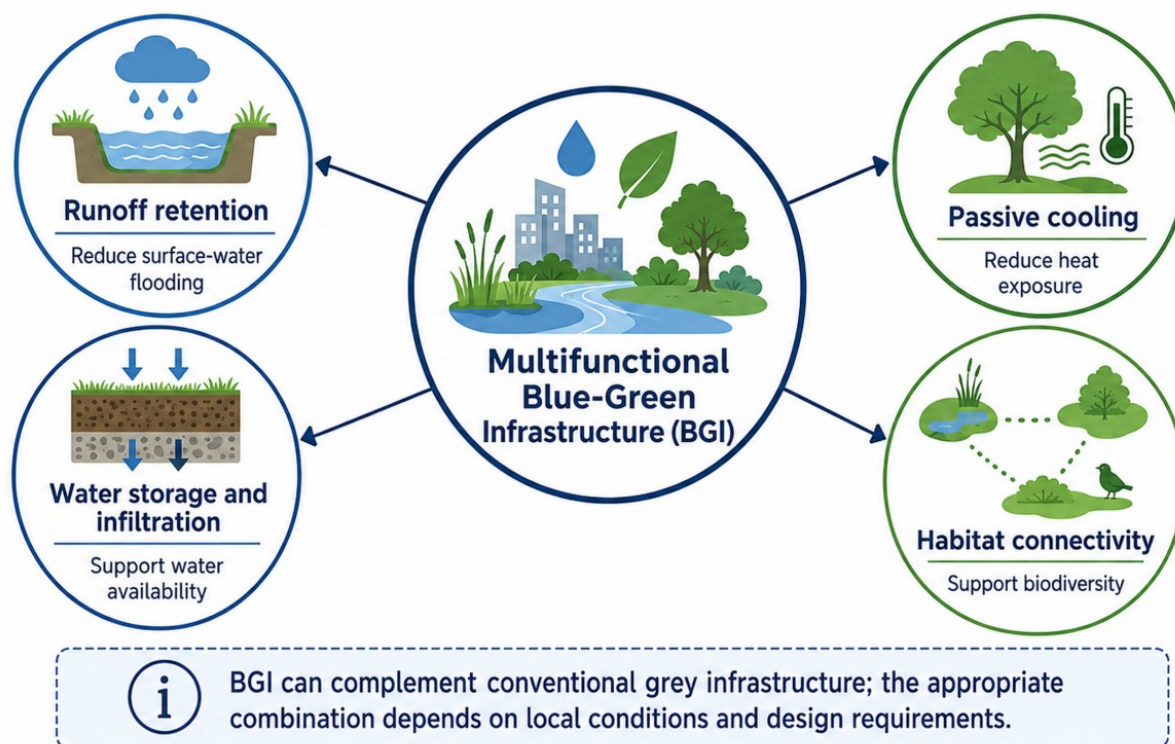


Figure 4: Multiple benefits of Blue-Green Infrastructure.

Key question for reflection:

Could an existing or planned public investment be designed to address more than one hazard pathway or resilience objective without weakening its principal function?

2.4.2 Assessing multifunctional measures

Before approving a multifunctional or Blue-Green Infrastructure intervention, decision-makers should confirm:

- which hazard pathway the intervention primarily addresses;
- what principal resilience function it should provide;
- which additional benefits are expected;
- whether the site and future climate conditions are suitable;
- whether conventional engineered infrastructure is also required;
- whether the intervention could transfer risk or create environmental or social harm;
- which organisations and landowners need to participate;
- who will own, inspect, operate, and maintain the intervention;

- whether long-term maintenance is realistically funded; and
- which indicators will be used to monitor the principal function and important co-benefits.

Site-specific technical and environmental assessment remains necessary. Poorly designed interventions may increase waterlogging, erosion, maintenance burdens, safety risks, ecological disturbance, or unequal access to benefits.

The principal resilience function should be monitored separately from secondary benefits. For example, an intervention intended mainly to manage runoff should have an indicator related to water retention or flood reduction. Additional indicators may assess shade, accessibility, biodiversity, water quality, or public use.

Multifunctionality therefore requires coordination as well as good design. Planning, water, transport, environmental, public-space, health, and civil-protection authorities may influence different aspects of the same intervention.

Decision-maker checkpoint

A multifunctional measure should be selected because it performs its principal protective function effectively and safely—not only because it appears to offer many additional benefits.

Key question for reflection:

Could the proposed intervention create a new risk, maintenance burden, environmental impact, or unequal distribution of benefits, and how could its design be improved?

3 Practical considerations and lessons learnt

A recommendation may be scientifically sound and technically appropriate but still fail during implementation. This may happen when responsibilities are unclear, the responsible authority lacks the legal power to act, funding is unavailable, stakeholders have not been involved, or maintenance and monitoring have not been planned.

For senior decision-makers, the central question is therefore not only:

“Is this a suitable adaptation measure?”

It is also:

“Can our institutions legally, financially, and practically deliver it over the long term?”

This chapter examines the governance, evidence, institutional, and ethical conditions that should be considered before an HSTF recommendation moves towards formal approval, investment, procurement, or implementation.

3.1 From a technically sound recommendation to implementation

Completing the six HSTF steps creates a traceable connection between climate evidence, a proposed action, a planning instrument, and an expected resilience function. However, completing the sequence does not guarantee successful implementation.

Before a recommendation proceeds, decision-makers should also determine:

- which organisation should coordinate the action;
- which organisations have supporting responsibilities;
- whether the responsible bodies have the legal authority to act;
- whether the selected planning instrument can support implementation;
- how capital, operational, and maintenance costs will be financed;
- which landowners, infrastructure operators, and stakeholders must participate; and
- who will maintain, monitor, report, and review the intervention.

If these questions remain unanswered, the recommendation may remain on paper even if its technical logic is strong.

3.1.1 Governance as an implementation condition

In this guide, governance refers to the practical conditions that can enable, delay, modify, or prevent implementation. These conditions include:

- clear institutional responsibility;
- sufficient legal authority;
- an appropriate planning instrument;
- capital and long-term maintenance funding;
- coordination between organisations and administrative levels;
- stakeholder participation and support; and
- monitoring, accountability, and corrective action.

Governance should not be treated as a final administrative check performed after the technical work has been completed. It should be considered from the beginning so that legal, institutional, financial, and social constraints influence the selection and design of the recommendation.

Key question for reflection:

Which unresolved governance condition is most likely to prevent your preferred recommendation from being implemented?

3.1.2 Governance readiness

Governance readiness is the extent to which the conditions required to implement, maintain, and monitor a proposed action are in place.

A recommendation has stronger governance readiness when:

- a lead organisation and supporting organisations have been identified;
- their responsibilities are recognised and accepted;
- the relevant authority has the legal power to act;
- an appropriate planning instrument is available;
- capital, operational, and maintenance funding have plausible sources;
- affected stakeholders have been involved; and
- maintenance and monitoring responsibilities are assigned.

Low governance readiness does not necessarily mean that a recommendation should be abandoned. It means that one or more implementation gaps must be addressed before the action proceeds. Table 3 identifies the immediate response that may be required when a readiness condition is missing.

Table 3. Planning responses to common governance-readiness gaps

Missing condition	Immediate planning response
Lead organisation	Assign coordination responsibility and document supporting roles.
Legal authority	Obtain legal clarification, involve the competent authority, or select another implementation route.
Planning instrument	Identify or amend an appropriate plan, regulation, programme, permit, or agreement.
Capital funding	Connect the action to an appropriate public budget or funding programme.
Maintenance funding	Establish a long-term operational budget and responsible maintenance body.
Stakeholder support	Begin meaningful consultation and revise the measure where justified.
Monitoring arrangements	Define indicators, responsible organisations, reporting frequency, review, and corrective action.

Before advancing a recommendation, decision-makers should be able to complete the following statement:

“The proposed action will be implemented by [lead organisation], using [planning instrument], under [legal authority], financed through [funding source], maintained by [responsible organisation], and monitored using [indicator or review process].”

If an essential part of this statement cannot be completed, the recommendation has an implementation gap requiring further action.

Key question for reflection:

Which governance-readiness condition is currently weakest for your selected recommendation, and what practical action would strengthen it?

3.2 The three governance transition points

The published HSTF contains six steps for translating climate-risk information into planning action. For practical implementation, this guide adds three governance transition points: decision gates that test whether a recommendation can move successfully between key stages.

These checks do not replace or modify the six HSTF steps. They make the implementation conditions more explicit by asking:

1. Who is responsible?
2. Is there sufficient legal authority and funding?
3. Will the action be accepted, maintained, and monitored?

In simple terms, a technically appropriate recommendation must pass these three practical checks before it can deliver its intended resilience function.

As illustrated in Figure 5, the transition points are located between specific steps of the HSTF sequence. They do not replace the six steps; they test whether the proposed action can move successfully from one step to the next.

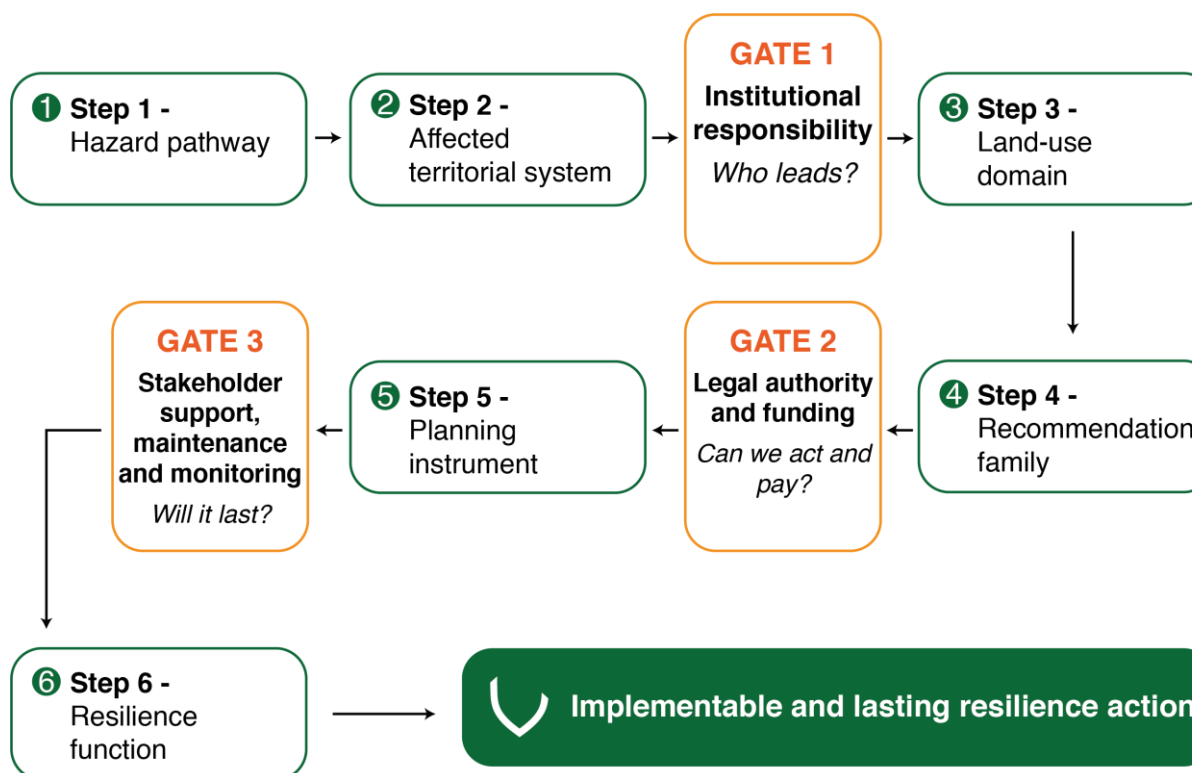


Figure 5: Governance transition points within the HSTF sequence.

3.2.1 Transition Point 1 — Institutional responsibility

Main question: Who should lead, which organisations should provide support?

After identifying the affected territorial system, decision-makers must determine which organisation is responsible for managing it and which other organisations influence the pathway.

Climate risks often cross administrative boundaries. Responsibilities may be divided among planning, infrastructure, water, environmental, emergency, health, or other authorities, as well as private landowners and infrastructure operators.

The first transition point is passed when:

- one lead organisation is identified;
- supporting responsibilities are documented;
- relevant landowners and operators are known; and
- arrangements for coordination and information sharing are established.

Decision rule

If no organisation has been assigned to coordinate the response, the recommendation is not ready to proceed.

Key question for reflection:

Who owns, manages, or regulates the affected system, who should lead the response, and which organisations must provide support?

3.2.2 Transition Point 2 — Legal authority and funding

Main question: Do we have the legal power and funding to act?

Institutional responsibility does not automatically provide legal authority. An organisation may be expected to address a problem but lack the power to regulate private property, intervene on land managed by another authority, change technical requirements, or approve infrastructure outside its jurisdiction.

Decision-makers should confirm:

- which authority has the legal power to approve, require, procure, or enforce the action;
- which instrument provides that authority;
- whether additional permissions or inter-agency agreements are required;
- how initial implementation will be financed; and
- whether funding is realistically available within the required timetable.

Where authority is insufficient, the recommendation may need to involve the competent authority, use another instrument, or be modified to fit existing legal powers.

Decision rule

If the responsible organisation lacks legal authority or an achievable funding route, the recommendation should be revised or transferred to the competent authority before implementation.

Key question for reflection:

Which organisation has the legal power to act, which instrument provides that power, and how will implementation be financed?

3.2.3 Transition Point 3 — Support, maintenance, and monitoring

Main question: Will the action remain effective over time?

Approving a plan, regulation, or investment does not guarantee a lasting resilience benefit. The third transition point examines:

- participation and stakeholder support;
- practical implementation capacity;
- operation and maintenance;

- monitoring and reporting; and
- review and corrective action.

Stakeholders should be involved early enough to influence decisions that can still change. Physical interventions should have a named owner, maintenance schedule, operational budget, and monitoring arrangements.

Indicators should measure the principal resilience function rather than only whether money was spent or an asset was constructed.

Decision rule

If stakeholder participation, maintenance responsibility, or monitoring arrangements are absent, the action is unlikely to provide its intended resilience function over the long term.

Key question for reflection:

Who will maintain and monitor the action, how will affected stakeholders participate, and what will happen if performance is inadequate?

3.2.4 Summary of the transition points

Table 4 summarises the three governance gates. A recommendation should not move directly from technical design to implementation unless decision-makers can explain who is responsible, who has the authority to act, how implementation and maintenance will be financed, who has participated, and how performance will be monitored.

Table 4. Practical checks at the three governance transition points

Governance transition point	Passed when	Response where a gap remains
1. Institutional responsibility	A lead organisation and supporting responsibilities are clearly identified.	Assign coordination, document roles, and establish information-sharing arrangements.
2. Legal authority and funding	The competent authority, enabling instrument, permissions, and funding route are confirmed.	Involve the competent authority, select another instrument, revise the action, or secure funding.
3. Support, maintenance, and monitoring	Stakeholder participation, implementation capacity, maintenance, indicators, reporting, and review are established.	Complete consultation and assign long-term ownership, budgets, monitoring, and corrective action.

Key question for reflection:

Which of the three governance transition points represents the greatest implementation risk for your selected recommendation?

3.3 Applying the HSTF under different planning conditions

Regions do not begin with the same level of climate evidence, technical expertise, institutional coordination, legal authority, or financial capacity. The HSTF can be used under different conditions, but the specificity of the recommendation should reflect what is known and what can realistically be implemented.

Two questions determine how the framework should be applied:

1. How strong is the available evidence?

Are reliable hazard maps, exposure data, vulnerability information, local records, and technical studies available?

2. How strong is the institutional capacity?

The answers create four broad planning conditions, summarised in Table 5. These conditions are not additional HSTF steps. They help decision-makers select an appropriate level of detail, confidence, and institutional support.

Table 5. Guidance for applying the HSTF under different data and institutional conditions

Planning condition	Appropriate use of the HSTF	Required safeguards or adjustments	Main risk if safeguards are absent
Strong evidence and strong institutional capacity	Translate detailed hazard and vulnerability information into geographically specific and traceable policy packages.	Connect HSTF outputs directly to existing GIS systems, statutory plans, departmental responsibilities, and capital budgets.	The framework may duplicate existing procedures if it is not integrated into current planning processes.
Strong evidence but fragmented institutions	Use the HSTF to connect technical evidence with responsible departments, legal instruments, and funding routes.	Add an explicit responsibility-mapping process and resolve overlaps or gaps between authorities.	Technically sound recommendations may remain unimplemented because no organisation clearly owns the problem.
Limited evidence but active institutions	Use the HSTF as a structured qualitative screening method based on available records, expert judgement, and stakeholder knowledge.	Report the confidence of the evidence, use appropriate proxy indicators, and distinguish preliminary recommendations from validated measures.	Recommendations may appear more precise or certain than the supporting evidence allows.
Limited evidence and weak institutional capacity	Begin with hazard pathways and affected systems to identify priorities and urgent information needs.	Keep recommendations preliminary, seek external technical support, establish basic coordination, and collect essential data before adopting detailed requirements.	Generic or unrealistic measures may be proposed without sufficient evidence, legal authority, funding, or implementation capacity.

3.3.1 Matching the application to regional conditions

Where evidence and institutions are strong, the HSTF can support geographically specific requirements, investment priorities, targets, and monitoring indicators.

Where evidence is strong but responsibilities are fragmented, the framework should be used mainly to clarify coordination, legal authority, planning instruments, funding, and monitoring responsibilities.

Where evidence is limited but institutions are active, an initial assessment may use historical-event records, maintenance reports, regional or national maps, open-access data, field inspections, community knowledge, proxy indicators, and structured expert judgement.

Where evidence and institutional capacity are both limited, the initial objective should be modest: identify the most important pathways, locate affected systems, record available knowledge, establish basic coordination, identify data gaps, and select a small number of urgent and low-regret actions.

A detailed HSTF matrix should not be used to create a false impression of precision or implementation readiness.

Key question for reflection:

Which combination of evidence strength and institutional capacity best describes your proposed recommendation, and how should this affect the way the HSTF is applied?

3.3.2 Confidence and low-regret action

Recommendations developed with incomplete evidence should state their level of confidence:

- **High confidence:** supported by several reliable and consistent sources;
- **Moderate confidence:** supported by some relevant evidence but requiring further validation; or
- **Low confidence:** based mainly on incomplete data, proxy information, or expert judgement.

Low confidence does not always require inaction. It requires decision-makers to avoid false precision, collect additional evidence, monitor outcomes closely, and prioritise reversible or low-regret measures.

Low-regret action:

An action expected to provide useful benefits under several plausible future conditions while carrying a relatively low risk of significant social, economic, environmental, or institutional harm.

Key question for reflection:

Could useful progress begin through a low-regret or reversible action while additional evidence is collected?

3.3.3 A proportionate-use rule

The HSTF should be applied in proportion to the importance and consequences of the decision.

A preliminary inspection, awareness activity, or voluntary initiative may reasonably begin with qualitative information. In contrast, a measure that restricts development rights, requires substantial private expenditure, affects property, or directs major public investment requires stronger evidence, technical validation, legal review, and meaningful stakeholder participation.

Practical rule

The greater the legal, financial, environmental, or social consequences of a decision, the stronger its supporting evidence and governance safeguards should be.

This avoids two common mistakes:

- delaying all action until perfect information becomes available; and
- adopting highly specific or restrictive measures unsupported by sufficient evidence.

Key question for reflection:

Does the precision and consequence of the proposed action match the quality of the evidence and the strength of the available governance safeguards?

3.4 Ethical considerations and policy trade-offs

Climate-adaptation measures are intended to protect people, infrastructure, economic activity, and ecosystems. However, even a technically sound measure may distribute its benefits, costs, and restrictions unevenly.

For example, a flood-protection measure may reduce risk in one location while increasing runoff elsewhere. A building requirement may improve safety but impose costs that some households cannot afford. New green space may reduce heat exposure but contribute to rising rents and displacement pressure. Land-use decisions are therefore not socially neutral.

Ethical and equity considerations should be treated as a cross-cutting part of the HSTF rather than as an additional framework step. At every stage, decision-makers should consider:

- who receives protection and other benefits;
- who pays or faces restrictions;
- whether risk is transferred to another place or group;

- whether vulnerable groups can access the benefits;
- who participated in the decision; and
- what safeguards, monitoring, and corrective measures are required.

A simple decision-maker test

Before approving an adaptation measure, ask:

“Who benefits, who pays, who may be negatively affected, and who has had a meaningful opportunity to participate?”

3.4.1 Preventing maladaptation and unfair cost burdens

Maladaptation occurs when an action intended to reduce climate risk creates new risks, transfers risk elsewhere, increases vulnerability, or reinforces existing inequalities (IPCC, 2022).

Examples include:

- a flood barrier that protects one area while redirecting water towards another;
- extensive vegetation clearance that reduces wildfire fuel but increases erosion or damages habitats;
- increased irrigation that protects crops temporarily but intensifies water scarcity;
- air-conditioning that reduces indoor heat exposure but increases energy demand and household expenditure;
- mandatory building retrofits that improve safety but create unaffordable costs for lower-income owners or tenants;
- new Blue-Green Infrastructure that improves environmental quality but contributes to increased rents or the displacement of existing residents; and
- risk maps that support informed planning but affect property values or insurance when their uncertainty and intended use are not clearly explained.

Before selecting a measure, decision-makers should examine both its intended benefits and its possible secondary effects. Particular attention should be given to:

- **distribution:** whether protection and investment are concentrated in some locations or social groups;
- **affordability:** whether households, farmers, small businesses, or landowners can meet the costs imposed on them;
- **risk transfer:** whether the measure increases flooding, heat, erosion, wildfire exposure, environmental damage, or disruption elsewhere;

- **accessibility:** whether people with limited income, mobility, transport, information, or institutional support can benefit;
- **long-term effects:** whether the measure creates dependence on high energy, water, maintenance, or financial inputs; and
- **reversibility:** whether the measure can be adjusted if new evidence reveals unintended consequences.

Where significant burdens are identified, possible safeguards include grants, subsidies, staged compliance periods, technical assistance, compensation, alternative compliance routes, environmental protection measures, and targeted support for vulnerable groups. Monitoring should cover not only the intended reduction in climate risk but also relevant social, economic, and environmental effects.

A measure should not be considered successful merely because it reduces one form of physical risk. It should also avoid creating a new burden of comparable or greater importance.

Key question for reflection:

Could the proposed measure reduce one climate risk while transferring costs, restrictions, or new risks to another place, group, or generation?

3.4.2 Participation, accountability, and ethical screening

A technically appropriate decision may still be considered unfair if the affected people have had no meaningful opportunity to understand or influence it.

Early participation can help public authorities identify local knowledge, understand how different groups use buildings, roads, water, land, and public spaces, and recognise unintended effects before important decisions become difficult to change.

Participation should include groups that may be highly exposed or less able to influence formal planning processes. Depending on the context, these may include:

- lower-income households and tenants;
- older people;
- people with disabilities and their carers;
- residents of isolated communities;
- small farmers and businesses;
- seasonal or migrant workers;
- young people; and
- people without access to private transport or digital information.

Information should be communicated in clear and accessible language. Authorities should explain the evidence supporting the proposal, important uncertainties, which elements can still be changed, and how stakeholder feedback influenced the final decision.

Participation does not require unanimous agreement. It requires a fair opportunity to understand the proposal, contribute relevant knowledge, express concerns, and receive a reasoned explanation of the decision.

Accountability must continue after consultation. Each adopted measure should have a clearly identified responsible authority, an implementation timetable, monitoring indicators, accessible reporting arrangements, and a process for reviewing complaints or unintended outcomes.

Before approving an HSTF recommendation, decision-makers should complete the ethical and equity screening questions in Table 6.

Table 6. Ethical and equity screening questions for proposed adaptation measures

Screening question	What should be examined?	Possible response where a concern is identified
Who is currently most exposed or vulnerable?	Age, income, disability, health, mobility, housing conditions, employment, geographic isolation, and access to services.	Prioritise vulnerable groups and adapt the measure to their specific needs.
Who receives the main benefits?	Geographic distribution of protection, access to services, and short- and long-term benefits.	Adjust the location, design, or eligibility rules to improve access and coverage.
Who pays or faces restrictions?	Public expenditure, private costs, land requirements, development restrictions, maintenance duties, and changes to livelihoods.	Provide subsidies, staged requirements, technical support, compensation, or justified alternative compliance routes.
Could the measure transfer risk?	Increased flooding, erosion, heat, wildfire exposure, environmental damage, or disruption in another location.	Modify the design, add safeguards, or select an alternative measure.
Could the measure increase inequality or displacement?	Rent increases, property-value changes, business displacement, unequal access, and effects on tenants or low-income households.	Combine the measure with housing, affordability, accessibility, or local-business protections.
Was participation meaningful?	Timing, representation, accessibility of information, response to feedback, and involvement of vulnerable groups.	Expand consultation, use accessible formats, and document how feedback influenced the decision.
Is the evidence proportionate to the decision?	Data quality, uncertainty, legal consequences, private costs, and scale of public investment.	Obtain further evidence, legal review, or technical validation before adopting restrictive measures.
Are responsibilities and safeguards monitored?	Named responsible authority, indicators, reporting timetable, complaint process, maintenance, and corrective action.	Assign responsibilities and establish monitoring and review before implementation.

A recommendation should proceed only when decision-makers can explain how it will reduce climate risk, how its benefits and burdens will be distributed, who participated in its development, and how avoidable harm will be prevented or corrected.

Key question for reflection:

Have the people most affected by the proposed action been given a meaningful opportunity to influence it, and is there a clear process for accountability if unintended consequences arise?

4 Key messages and next steps

The HSTF helps public authorities move from climate-risk information to land-use recommendations that can be implemented, funded, maintained, and monitored. It does not replace existing planning procedures, technical assessments, or legal requirements. Instead, it provides a structured way to connect them.

The framework can be applied at different scales. A regional authority may use it to establish strategic investment priorities, while a municipality may use it to address a particular neighbourhood, infrastructure network, development plan, or ecosystem. In either case, the application should be proportionate to the importance of the decision and the quality of the available evidence.

Regions do not need to analyse every climate hazard simultaneously. A focused application to one important hazard pathway can provide a practical starting point, reveal evidence and governance gaps, and demonstrate how the method can support wider planning.

4.1 A focused HSTF application process

A focused application should begin with a clearly defined planning problem. The purpose is not simply to describe climate risk but to identify a decision that a public authority can realistically influence.

The following sequence can be used:

1. Define the planning task.

Identify the territory, population, infrastructure, ecosystem, or economic activity being considered. Clarify the decision that must be prepared or improved.

2. Describe the hazard pathway.

Explain how a climate-related pressure interacts with exposed and vulnerable territorial conditions to produce a relevant consequence.

3. Identify the affected system and land-use domain.

Determine which people, assets, services, or ecosystems are affected and which land-use domain provides the principal planning interface.

4. Develop and compare possible recommendations.

Consider alternative measures, their expected benefits, possible secondary effects, resource requirements, and suitability under future conditions.

5. Connect the preferred recommendation to implementation.

Identify the relevant planning, regulatory, financial, investment, management, or emergency-planning instrument.

6. Define the intended resilience function.

State clearly what the action should protect, maintain, reduce, restore, or improve. The function should be specific enough to guide monitoring.

The three governance transition points described in Section 3.2 should then be applied across the sequence:

- **Who will lead, and which organisations must provide support?**
- **Does the responsible authority have the legal power and financial resources to act?**
- **Have affected stakeholders been involved, and are maintenance and monitoring arrangements realistic?**

The initial output does not need to be a lengthy report. It may consist of a completed HSTF worksheet, a short evidence summary, an agreed recommendation, and an implementation record. Where important information is missing, the output should identify the data or consultation required before the recommendation advances.

A focused application is complete only when the relationship between the climate-risk evidence and the proposed decision can be followed clearly. Another reader should be able to understand why the action was selected, which evidence supports it, who is responsible, and how its performance will be assessed.

Key question for reflection:

Which current planning, investment, or management decision in your region would benefit most from a focused HSTF application?

4.2 Implementation, monitoring, and review

A recommendation should not be considered complete when a suitable measure has been identified. It must also be translated into responsibilities, resources, a timetable, and measurable outcomes.

At minimum, each recommendation should be accompanied by the implementation information presented in Table 7.

Table 7. Minimum HSTF implementation record

Field	Information to record
Recommendation	What action is proposed, and where will it apply?
Supporting evidence	Which evidence supports the action, and how confident are we in it?
Planning instrument	Through which plan, regulation, programme, investment, or management procedure will it be implemented?
Legal authority	Which organisation has the legal power to approve or undertake the action?
Responsibilities	Which organisation will lead, and which organisations will provide support?

Field	Information to record
Resources and timetable	What funding, staff, expertise, and time are required?
Intended resilience function	What should the action protect, maintain, reduce, restore, or improve?
Monitoring indicators	How will progress and performance be measured?
Maintenance	Who will maintain the intervention, and how will recurring costs be covered?
Ethical safeguards	Who may be negatively affected, and what safeguards are required?
Review arrangements	When will the recommendation be reviewed, and what could trigger its revision?

Monitoring should distinguish between three types of information:

- **Implementation indicators** show whether planned activities have been completed, such as the proportion of priority sites inspected.
- **Performance indicators** show whether the measure is providing its intended function, such as whether essential access, drainage capacity, cooling, or ecosystem connectivity has improved.
- **Outcome indicators** show whether vulnerability, disruption, damage, or recovery time has changed over the longer term.

Counting completed activities alone may provide an incomplete picture. For example, the number of trees planted does not show whether they survived, produced usable shade, or reduced heat exposure. Indicators should therefore be connected to the intended resilience function identified in Step 6 of the HSTF.

Monitoring arrangements should use existing administrative and reporting systems wherever possible. This reduces duplication and improves the likelihood that monitoring will continue after initial project funding ends.

A recommendation should be reviewed when:

- improved climate, exposure, or vulnerability data become available;
- a major event reveals unexpected weaknesses;
- monitoring shows that the measure is not performing as intended;
- significant social or environmental effects emerge;
- responsibilities, legislation, land use, or available funding change; or
- the measure reaches an agreed review date.

Review does not necessarily mean abandoning the original recommendation. It may result in adjustments to its location, design, scale, timetable, safeguards, or monitoring arrangements.

Key question for reflection:

Does each priority recommendation in your region have a responsible authority, an implementation instrument, a measurable resilience function, and an agreed review process?

4.3 Key messages and next steps

The central messages of this guide are:

1. Move beyond lists of hazards.

A hazard pathway explains how a climate-related pressure interacts with exposed and vulnerable conditions to produce a consequence that planning can address.

2. Connect risk information to a land-use domain.

The five shared domains help identify the principal administrative and planning interface for action.

3. Consider multifunctional measures.

Where appropriate, interventions should address several connected challenges and combine environmental, infrastructural, and social benefits.

4. Link every recommendation to an implementation instrument.

A recommendation becomes actionable only when it is connected to an appropriate plan, regulation, programme, investment, or management procedure.

5. Treat governance as part of the technical process.

Legal authority, institutional responsibility, funding, participation, maintenance, and monitoring should be considered while the recommendation is being developed.

6. Match precision to the available evidence.

Limited evidence does not prevent all action, but uncertainty should be stated clearly and consequential decisions require stronger validation and safeguards.

7. Examine how benefits and burdens are distributed.

Adaptation should reduce risk without transferring avoidable financial, social, or environmental harm to other places or vulnerable groups.

8. Monitor resilience functions, not only completed activities.

Monitoring should show whether the intervention continues to provide the protection or service for which it was selected.

Decision-makers can begin by selecting one priority hazard pathway and bringing together the organisations that hold the necessary evidence, authority, implementation capacity, and local knowledge. Annex 1 provides an integrated worksheet for documenting this first application.

The completed worksheet can then be used to support technical discussion, stakeholder consultation, funding applications, revisions to existing plans, and the preparation of more detailed assessments. As experience develops, the same structured approach can be extended to additional hazards, sectors, and locations.

The objective is not to produce a perfect matrix. It is to establish a transparent and repeatable connection between climate-risk evidence and decisions that can be implemented, monitored, and improved over time.

Key question for reflection:

What is the first concrete action your organisation can take to begin converting an identified climate risk into an implementable land-use decision?

4.4 Further resources

Table 8 shows the recommended platforms for further reading and access to related project resources. ClimEmpower educational library, among other, includes an extended version of this guideline, as well as related guidelines for risk assessment and risk indicators.

Table 8: Recommended platforms

Source platform	Short definition	Relevant materials
ClimEmpower Project Results — climempower.eu/results/	Official ClimEmpower platform for project results and outputs	Project deliverables; resilience recommendations; risk-map information; project tools and software; scenarios; data and knowledge assessments; stakeholder engagement results
ClimEmpower Educational Library — climempower.eu/knowledge-hubs/	ClimEmpower collection of educational materials and selected knowledge resources	Educational materials; reports and guidance; presentations; learning resources; climate-hazard and sector resources; target-group resources; external knowledge resources
CORDIS — cordis.europa.eu	European Commission platform for EU-funded research and innovation	Project descriptions; public deliverables and reports; publications; project partners; project results and outputs
Climate-ADAPT — climate-adapt.eea.europa.eu	European platform for climate change adaptation knowledge and practice	Adaptation strategies and policies; case studies; climate risks and impacts; adaptation options; tools; indicators; research and innovation projects
ClimEmpower Zenodo Community — zenodo.org/communities/climempower	Open repository for ClimEmpower research outputs and project materials	Datasets; journal publications; conference papers and posters; educational materials; other project outputs

The following resources can support the continued application of this manual.

Climate-Resilient Land-Use Planning Across Heterogeneous Southern European Hazard Regions

This article presents the scientific basis of the Hazard–Sector Translation Framework, its six-step sequence, the five land-use resilience domains, and applications across the ClimEmpower regions.

Web address: <https://www.mdpi.com/2073-445X/15/8/1352>

Climate-ADAPT Regional Adaptation Support Tool

The Regional Adaptation Support Tool provides six-step guidance for regional and local authorities developing, implementing, monitoring, evaluating, and updating climate-adaptation strategies and plans.

Web address: <https://climate-adapt.eea.europa.eu/en/eu-policy/eu-adaptation-policy/eu-mission-on-adaptation/regional-adaptation-support-tool>

MIP4Adapt Regional Adaptation Planning DIY Toolkit

This practical toolkit complements the Regional Adaptation Support Tool and provides templates that regional and local authorities can use across the adaptation-planning cycle.

Web address: https://mission-adaptation-portal.ec.europa.eu/mip4adapt-regional-adaptation-planning-diy-toolkit_en

Copernicus climate data for policymakers

The Copernicus Climate Change Service provides authoritative information, datasets, indicators, and tools concerning past, present, and future climate conditions.

Web address: <https://climate.copernicus.eu/climate-data-policymakers>

European Environment Agency guidance on just resilience

The report *Social Fairness in Preparing for Climate Change* explains how social fairness and the needs of vulnerable groups can be integrated into climate-adaptation planning and implementation.

Web address: <https://www.eea.europa.eu/en/analysis/publications/social-fairness-in-preparing-for-climate-change-how-resilience-can-benefit-communities-across-europe>

EU Mission on Adaptation Funding and Financing Database

The database allows users to explore potential adaptation-funding sources by country, sector, stage of the adaptation cycle, and eligible organisation.

Web address: https://mission-adaptation-portal.ec.europa.eu/funding-financing/funding-and-financing-database_en

5 References

- European Environment Agency. (2022). Who benefits from nature in cities? Social inequalities in access to urban green and blue spaces across Europe (EEA Briefing No. 15/2021). Publications Office of the European Union. <https://doi.org/10.2800/160976>
- European Environment Agency. (2025). Social fairness in preparing for climate change: How just resilience can benefit communities across Europe (EEA Report No. 04/2025). Publications Office of the European Union. <https://doi.org/10.2800/3683343>
- Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, & B. Rama, Eds.). Cambridge University Press. <https://doi.org/10.1017/9781009325844>
- Pavone, V., Vurnek, M., D'Angelo, G., Leone, M., Boccia, R., Perillo, M., Molina, P., & Havlik, D. (2025). Regional CC-resilience recommendations v1 (Deliverable D4.3). Horizon Europe project ClimEmpower, Grant Agreement No. 101112728. [https://climempower.eu/storage/2026/02/D4.3 Resilience-Raccomandations v1 final.pdf](https://climempower.eu/storage/2026/02/D4.3%20Resilience-Raccomandations%20v1%20final.pdf)
- Xekalakis, G., D'Angelo, G., Leone, M. F., Zuccaro, G., Vurnek, M., & Havlik, D. (2026). Climate-resilient land-use planning across heterogeneous Southern European hazard regions. *Land*, 15(8), 1352. <https://doi.org/10.3390/land15081352>
- Zhu, L., Gao, C., Wu, M., & Zhu, R. (2025). Integrating blue–green infrastructure with gray infrastructure for climate-resilient surface water flood management in the plain river networks. *Land*, 14(3), 634. <https://doi.org/10.3390/land14030634>

Annex 1: Integrated HSTF planning exercise

A1.1 Exercise 1 – Define a decision-relevant hazard pathway

Objective

The objective is to move from a broad hazard, such as wildfire, flooding, drought, heat, or coastal erosion, to a specific pathway that connects the climate-related pressure with an exposed territorial system and a consequence relevant to public decision-making.

Instructions

1. Identify the climate-related pressure or hazard.
2. Describe the local environmental, physical, or social conditions that may intensify its effects.
3. Identify the people, infrastructure, buildings, economic activities, ecosystems, or services that may be exposed.
4. Identify the characteristics that make the exposed system vulnerable.
5. Describe the possible consequence.
6. Explain which planning, investment, management, or emergency decision is connected to that consequence.
7. Record the available evidence and remaining uncertainty.

Table A9. Hazard-pathway worksheet

Pathway component	Working response
Geographic scope	
Climate-related pressure or hazard	
Intermediate environmental or physical process	
Exposed territorial system	
Important vulnerability factors	
Possible direct consequence	
Possible indirect or cascading consequence	
Relevant public decision	
Main supporting evidence	
Important assumptions or uncertainties	
Additional information required	

Write the pathway in one sentence

Use the following structure:

In [location], [climate-related pressure] interacts with [local conditions], exposing [territorial system] and potentially resulting in [consequence]. This matters for [relevant planning or management decision].

Quality check

Before continuing, ask:

- Can another person follow the cause-and-effect chain?
- Is the affected territorial system clearly identified?
- Is the consequence sufficiently specific?
- Is the geographic scale appropriate for the intended decision?
- Are evidence and assumptions clearly distinguished?
- Is the pathway connected to a decision that a public authority can influence?

If the answer to several questions is no, revise the pathway before continuing.

A1.2 Exercise 2 – Complete the six-step HSTF sequence

Objective

The objective is to move from a broad hazard, such as wildfire, flooding, drought, heat, or coastal erosion, to a specific pathway that connects the climate-related pressure with an exposed territorial system and a consequence relevant to public decision-making.

Instructions:

Complete each HSTF step in Table A9. The connection between consecutive steps should be explained clearly. Where several options are possible, record the alternatives before selecting the preferred approach.

Table A10. Six-step HSTF worksheet

HSTF step	Guiding question	Working response
1. Hazard pathway	How does the climate-related pressure interact with the territory and produce a consequence?	
2. Affected territorial system	Which people, buildings, infrastructure, activities, ecosystems, or services may be affected?	
3. Land-use resilience domain	Which domain provides the main planning interface? Which supporting domains are also involved?	
4. Recommendation family	What general type of action could interrupt, reduce, or manage the pathway?	
5. Planning instrument	Through which legal, regulatory, administrative, financial, investment, or maintenance instrument could the action be implemented?	
6. Expected resilience function	What practical function should the action protect, restore, or improve?	

Alternatives considered

Record at least one alternative where the consequences, costs, or scale of the decision are substantial.

Alternative	Main advantages	Main limitations	Reason selected or rejected
Preferred option			
Alternative 1			
Alternative 2			

HSTF quality check

Confirm that:

- the recommendation responds directly to the identified pathway;
- the affected territorial system is not described too broadly;
- the main land-use domain has been identified;
- supporting domains and organisations have not been overlooked;
- the planning instrument is within the powers of the relevant authority;
- the expected resilience function is specific enough to monitor; and
- important alternatives and uncertainties have been recorded.

A1.3 Exercise 3 – Test governance readiness and proportionality

Objective

The objective is to determine whether the institutional, legal, financial, and operational conditions required for implementation are sufficiently developed.

Part A – Governance transition points

Table A11. Governance-readiness worksheet

Governance transition point	Questions to answer	Working response and required follow-up
1. Institutional responsibility	Which organisation should coordinate the action? Which organisations have supporting responsibilities? Have these responsibilities been accepted?	
2. Legal authority and funding	Does the responsible authority have the legal power to act? Is land ownership relevant? What financial and staff resources are required? Is funding available?	
3. Stakeholder support, maintenance, and monitoring	Who must be consulted? Who will maintain the intervention? How will its performance be monitored and reported?	

Part B – Select the applicable planning condition

Select the condition that best describes this specific recommendation:

- ☐ Strong evidence and active institutions;
- ☐ Strong evidence but fragmented institutions;
- ☐ Limited evidence but active institutions; or
- ☐ Limited evidence and weak institutional capacity.

Reason for selecting this condition:

.....

.....

Do not assign one permanent condition to the entire region. Different recommendations in the same region may have different evidence and institutional conditions.

Part C – Record confidence

Select the preliminary confidence level:

- ☐ High confidence – supported by several reliable and consistent sources;
- ☐ Moderate confidence – supported by some local evidence but requiring further validation; or
- ☐ Low confidence – based mainly on incomplete data, proxy information, or expert judgement.

Main reason for the confidence rating:

.....

Evidence required to improve confidence:

.....

Part D – Apply the proportionate-use rule

Consider the likely consequences of the decision:

- ☐ Limited consequences – for example, an awareness activity, preliminary inspection, or reversible low-regret measure;
- ☐ Moderate consequences – for example, a targeted maintenance programme or limited public investment; or
- ☐ Substantial consequences – for example, restrictions on development rights, major public investment, compulsory private expenditure, or significant effects on landowners and communities.

The greater the legal, financial, environmental, or social consequences, the stronger the supporting evidence and governance safeguards should be.

Additional validation, consultation, or approval required:

.....

A1.4 Exercise 4 – Apply the ethical and equity screen

Objective

The objective is to identify who benefits, who pays, who may be adversely affected, and what safeguards are needed to prevent maladaptation or unfair outcomes.

Use the detailed screening questions in Table A11 of Section 3.4 and summarise the results below.

Table A12. Ethical and equity screening worksheet

Screening theme	People, places, or effects identified	Safeguard or follow-up action
Groups currently most exposed or vulnerable		
Distribution of the proposed benefits		
Financial costs or restrictions		
Effects on low-income households, tenants, small businesses, or landowners		
Accessibility for older people, people with disabilities, and people without private transport		
Possible transfer of risk to another location or group		
Possible environmental harm or maladaptation		
Possible displacement or gentrification pressure		
Stakeholders who have participated		
Groups not yet adequately represented		
Complaint, correction, or review procedure		

Ethical-screening conclusion

Select one outcome:

- ☐ No significant ethical or equity concern has been identified;
- ☐ The recommendation may proceed with the safeguards recorded above;
- ☐ Further consultation or assessment is required before a decision is made; or
- ☐ The recommendation should be redesigned because its likely adverse effects are unacceptable or insufficiently addressed.

Reason for the selected outcome:

.....

.....

An empty entry should not automatically be interpreted as evidence that no concern exists. Where the effects are unknown, record the issue as an evidence or consultation gap.

A1.5 Exercise 5 – Prepare the implementation and monitoring record

Objective

The objective is to convert the preferred recommendation into a clear implementation and monitoring arrangement.

Part A – Implementation record

Table A13. Implementation worksheet

Implementation field	Working response
Final proposed action	
Geographic coverage	
Financial costs or restrictions	
Planning or implementation instrument	
Lead coordinating organisation	
Supporting organisations	
Legal basis	
Required approvals	
Estimated resources	
Confirmed or potential funding	
Responsible organisation for maintenance	
Stakeholder-engagement requirements	
Environmental and social safeguards	
Indicative implementation timetable	
Expected resilience function	
Main unresolved issue	
Next responsible person or organisation	

Date of next action

Part B – Monitoring record

Complete one copy of Table A13 for each main indicator.

Table A14. Monitoring-indicator worksheet

Monitoring field	Working response
Indicator name	
Connection to the expected resilience function	
Definition and unit of measurement	
Geographic coverage	
Baseline value and date	
Target value and target date	
Data source	
Data-collection method	
Responsible organisation	
Reporting frequency	
Groups or locations for which results should be disaggregated	
Threshold triggering corrective action	
Corrective action that may be considered	
Formal review date	

Indicators should measure a meaningful result rather than only the completion of an administrative activity. Where an outcome cannot yet be measured directly, an output indicator may be used temporarily, provided that its limitation is stated.

A1.6 Final recommendation-readiness checklist

Use Table A14 before submitting the recommendation for approval, funding, integration into a plan, or implementation.

Use the following status categories:

- **Ready:** the requirement has been adequately addressed;
- **Follow-up required:** the issue can be resolved through a recorded action or safeguard; or
- **Not ready:** a significant evidence, legal, institutional, financial, environmental, or ethical issue prevents the recommendation from proceeding in its current form.

Table A15. Final recommendation-readiness checklist

Readiness question	Status and required action
Is the hazard pathway clearly defined and supported by evidence?	
Are important assumptions and uncertainties stated?	
Is the affected territorial system clearly identified?	
Does the proposed action respond directly to the pathway?	
Have reasonable alternatives been considered?	
Are the main and supporting land-use domains identified?	
Is an appropriate planning or implementation instrument available?	
Does the responsible authority have the necessary legal power?	
Is one organisation assigned a clear coordination role?	
Have supporting responsibilities been accepted?	
Are funding, staff, and technical resources identified?	
Are maintenance responsibilities and resources defined?	
Have affected stakeholders participated meaningfully?	
Have vulnerable or under-represented groups been considered?	

Readiness question	Status and required action
Have possible environmental and social harms been assessed?	
Are safeguards included where costs or burdens may be unfair?	
Is the expected resilience function clearly stated?	
Are measurable monitoring indicators defined?	
Is a reporting and review procedure established?	
Is there a procedure for corrective action?	

Final decision

Select the most appropriate outcome:

- ☐ Proceed to formal approval or implementation;
- ☐ Proceed as a pilot or low-regret action with specified safeguards;
- ☐ Proceed only after the recorded follow-up actions have been completed;
- ☐ Collect additional evidence and reassess the recommendation; or
- ☐ Redesign or reject the recommendation.

Decision and justification:

.....

.....

Authority or group making the decision:

.....

Responsible person or organisation for follow-up:

.....

Date for review:

.....

A “follow-up required” response does not always mean that all action should stop. Preliminary inspections, stakeholder engagement, data collection, awareness activities, and other low-regret actions may continue where they are legally authorised and unlikely to cause significant harm.

However, implementation should not proceed where essential legal authority is absent, the evidence is clearly inadequate for the consequences of the decision, or significant environmental or social harm has not been assessed and addressed.