

Converting Climate Risks into Actionable Land-Use Plans



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Author(s):	Havlik, D. (AIT Austrian Institute of Technology GmbH, Austria), Austria Xekalakis, G. (Frederick University), Cyprus

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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 the current or expected effects of climate change. Adaptation aims to reduce harm, protect people and assets, and, where possible, benefit from new opportunities. For example, managing combustible vegetation beside critical roads in Troodos may reduce wildfire exposure and help evacuation and emergency access remain operational (IPCC, 2022; Xekalakis et al., 2026).
Blue-Green Infrastructure (BGI)	A connected network of natural and semi-natural areas that helps manage water, heat, and environmental quality. “Blue” elements include rivers, wetlands, retention ponds, and other water-related features. “Green” elements include parks, trees, forests, green roofs, and planted corridors. Many interventions combine both elements. Together, they can slow and retain rainfall, provide cooling during hot periods, support biodiversity, and improve public space (Xekalakis et al., 2026; Zhu et al., 2025).
Climate hazard	A climate-related event or physical condition that may cause harm. Examples include heatwaves, droughts, wildfires, floods, and prolonged periods of low rainfall. A hazard does not automatically become a disaster: the outcome also depends on who or what is exposed and how vulnerable they are (IPCC, 2022).
Climate impact	The consequence of a climate-related risk for people, ecosystems, infrastructure, public services, livelihoods, or economic and cultural assets. Examples include damage to buildings, crop losses, disruption of transport, health problems during heatwaves, or the isolation of a mountain community during a wildfire (based on IPCC, 2022).

Term	Definition
Climate interaction context (CIC)	A simplified description of how climate hazards interact with the main characteristics of a territory. It helps decision-makers understand why the same hazard may require different actions in an urban, agricultural, coastal, or mountain area.
Climate Resilience	The ability of a community, institution, ecosystem, or infrastructure system to prepare for, withstand, respond to, and recover from a hazardous event while maintaining its essential functions. For example, a resilient mountain transport network should continue to provide safe evacuation and emergency access during a wildfire (IPCC, 2022).
Community of Practice (CoP)	A group of people and organisations that share a common challenge and learn from one another by exchanging knowledge and experience. In ClimEmpower, Communities of Practice bring together public authorities, scientists, businesses, civil-society organisations, and local residents to identify regional climate risks and develop suitable responses.
Exposure	The presence of people, buildings, infrastructure, ecosystems, economic activities, or other assets in places that could be affected by a climate hazard. For example, a village or tourist route located beside a fire-prone forest is exposed to wildfire. Exposure describes what is in harm's way; it does not by itself describe how severely it may be affected (IPCC, 2022).
Governance readiness	A practical term used in this manual to describe the extent to which the institutional, legal, financial, and social conditions required to implement and maintain a proposed action are in place. These conditions include a clearly responsible organisation, sufficient legal authority, an appropriate planning instrument, available funding, stakeholder support, and arrangements for maintenance and monitoring.
Hazard Pathway	The chain of events through which a climate hazard interacts with a particular territory and produces a planning-relevant consequence. It explains not only what hazard may occur, but also how it can affect the local system. In Troodos, prolonged heat and dry conditions can dry forest vegetation, increase wildfire risk, block narrow roads, and isolate mountain communities (Xekalakis et al., 2026).
Hazard-Sector Translation Framework (HSTF)	A six-step method for converting climate-risk information into practical land-use and policy actions. It connects: (1) the hazard pathway, (2) the affected territorial system, (3) the relevant land-use domain, (4) a family of possible recommendations, (5) the planning instrument used to implement them, and (6) the expected resilience function (Xekalakis et al., 2026).
Land-Use Domain	One of the main areas through which spatial-planning authorities can organise climate action. In this manual, five shared domains are used: Buildings, Agriculture, Blue-Green Infrastructure, Transportation, and Protected-Area Conservation (Xekalakis et al., 2026).
Maladaptation	An action intended to reduce climate risk that unintentionally creates new risks, transfers risk to another place or group, or increases inequality. For example, requiring costly building upgrades without financial assistance may protect buildings but place an unfair burden on low-income households (IPCC, 2022).

Term	Definition
Planning instrument	A legal, regulatory, financial, or administrative tool used by a public authority to put a policy decision into practice. Examples include local development plans, zoning regulations, building codes, forest-management plans, civil-protection plans, investment programmes, and public procurement requirements.
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 that an adaptation action is expected to deliver. Typical functions include reducing exposure, lowering vulnerability, maintaining essential services, supporting recovery, or protecting ecosystems. For example, creating alternative evacuation routes serves the resilience function of maintaining transport and emergency-service continuity.
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 conditions that make people, assets, infrastructure, or ecosystems more likely to be harmed by a hazard. Vulnerability may result from physical, social, economic, institutional, or environmental factors. For example, a village with one narrow access road is more vulnerable to wildfire-related isolation than a village with several safe routes (IPCC, 2022).

About this document

This manual 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 and regional land-use planning approach presented by Xekalakis et al. (2026), together with the regional climate-resilience recommendations developed in ClimEmpower Deliverable D4.4 (Pavone et al., 2025).

Who is this manual for?

This manual is designed primarily for senior policymakers, mayors, regional directors, lead planners, and other public officials who influence land-use and investment decisions. It does not assume advanced knowledge of climate modelling, Geographic Information Systems (GIS), or climate-risk assessment.

The manual may also be useful to civil-protection officers, environmental departments, infrastructure managers, technical advisors, and other professionals who need to connect scientific climate information with practical public-sector decisions.

What problem does it address?

Regional authorities now have access to increasing amounts of climate information, including hazard maps, projections, risk indicators, and vulnerability assessments. However, this information does not automatically explain:

- what action should be taken;
- where the action should be applied;
- which public authority is responsible;
- which legal or planning instrument can be used;
- how the action can be funded and maintained; or
- what practical resilience benefit the action is expected to deliver.

This gap between scientific information and practical implementation is referred to in this manual as the translation gap.

The manual introduces the Hazard-Sector Translation Framework (HSTF) as a structured way to bridge this gap. The framework guides the reader through six connected steps, beginning with a climate-related problem and ending with an implementable planning action and a clearly stated resilience objective.

A running example from Troodos

To make the framework easier to understand, the Troodos Mountain Range in Cyprus is used as a running example throughout the manual.

In Troodos, increasing temperatures and prolonged dry periods can dry forest vegetation and increase wildfire risk. A wildfire may then spread towards mountain communities, block narrow roads, interrupt emergency access, and place residents and visitors at risk. The problem is therefore not simply “wildfire.” It is a connected chain involving climate conditions, forest management, settlements, transport routes, emergency services, legal responsibilities, and available funding.

As each step of the HSTF is introduced, this Troodos example will be developed progressively. By the end of the manual, the reader will see how an initial climate-risk observation can be translated into specific actions, such as vegetation management beside critical roads, protection of evacuation corridors, and the creation of alternative emergency routes.

Examples from urban, coastal, and agricultural regions are also included to show how the same framework can be applied in different territorial and institutional settings.

What will you be able to do?

After reading this manual, you should be able to:

- distinguish between a simple list of hazards and a hazard pathway that explains how damage may occur;
- identify which people, places, infrastructure, ecosystems, and economic activities may be affected;
- organise different climate risks under five shared land-use domains: Buildings, Agriculture, Blue-Green Infrastructure, Transportation, and Protected-Area Conservation;
- apply the six steps of the HSTF to connect scientific evidence with a practical planning recommendation;
- identify the legal, regulatory, administrative, or financial instrument needed to implement a recommendation;
- explain the specific resilience function expected from an action, such as reducing exposure or maintaining an essential service; and
- assess whether the responsible authorities have the legal powers, funding, institutional responsibilities, stakeholder support, and long-term maintenance arrangements needed to proceed.

The aim is not to turn public officials into climate scientists. It is to help them ask the right questions, bring the right departments and stakeholders together, and convert available evidence into decisions that can realistically be implemented.

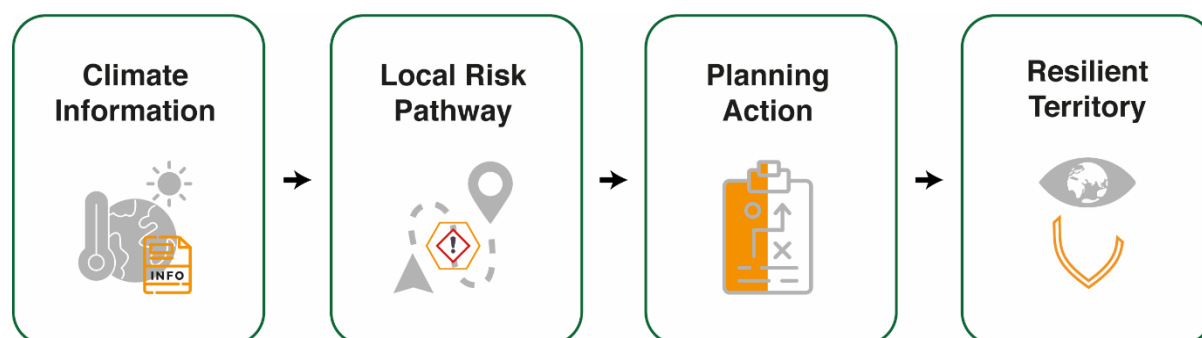


Figure 1: From climate information to local action.

To see how this process works in practice, consider the Troodos Mountain Range in Cyprus. Troodos includes extensive forested areas, mountain communities, agricultural land, tourist destinations, and a road network that also serves as the main route for evacuation and emergency access. Hotter and drier conditions can affect all these elements at the same time. The simplified sequence below shows how climate information can be connected to a local planning problem and then translated into practical action.

Troodos example: *Hotter and drier conditions → Dry forest vegetation and increased wildfire risk → Managed vegetation and protected evacuation routes → Safer evacuation and emergency access.*

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?”

This manual provides a practical introduction to converting regional climate-risk information into clear and implementable land-use recommendations. It focuses on the decisions that public authorities can influence directly, including where development is permitted, which building requirements apply, how land and vegetation are managed, where infrastructure investment is directed, and how critical services are protected.

Public authorities cannot directly regulate rising temperatures or changing rainfall patterns. They can, however:

- establish building and land-use requirements;
- protect natural drainage and water-retention areas;
- manage vegetation near settlements and critical roads;
- safeguard evacuation and emergency-access routes;
- prioritise public infrastructure investments; and
- coordinate the departments and organisations responsible for implementation.

The most important resource available to a public authority is therefore not necessarily an advanced climate model. It is the ability to use scientific evidence through its existing legal, planning, administrative, and financial powers.

This manual uses the Hazard-Sector Translation Framework (HSTF) to structure this task. The HSTF helps decision-makers move from a climate-related hazard pathway to the affected territorial system, the relevant land-use domain, a family of possible actions, an appropriate planning instrument, and a clearly stated resilience function (Xekalakis et al., 2026).

1.2 The challenge: turning information into action

Many European regions already have access to climate projections, hazard maps, vulnerability assessments, and risk indicators. Nevertheless, much of this information remains separate from the planning instruments used in everyday public administration, such as:

- local and regional development plans;
- zoning regulations;
- building codes;
- forest-management plans;
- transport and infrastructure programmes;
- civil-protection and evacuation plans; and
- municipal and regional investment budgets.

This separation creates a translation gap between what scientific evidence shows and what public authorities can implement.

What is the "Translation Gap"?

Consider a weather forecast warning that an intense storm is approaching. The forecast can help emergency services prepare for the immediate event, but it cannot, by itself, improve drainage systems, protect flood-retention areas, or change the building requirements applied in flood-prone neighbourhoods. These changes require planning decisions, responsible authorities, legal instruments, budgets, and long-term maintenance. The missing connection between the scientific warning and these practical decisions is the translation gap.

When this connection is missing, climate strategies often result in broad lists of recommendations, such as “increase green space,” “improve water conservation,” or “strengthen wildfire preparedness.” These recommendations may be scientifically reasonable, but they are difficult to implement unless they also explain:

- the specific local problem they address;
- the people, places, infrastructure, or ecosystems they aim to protect;
- where the intervention should be applied;
- which organisation is responsible;
- which planning instrument can put it into effect;
- how it will be financed and maintained; and
- which measurable resilience benefit it is expected to provide.

The HSTF addresses this problem by organising the reasoning process from climate evidence to practical implementation.

1.3 Following the process through the Troodos example

The Troodos Mountain Range will be used as a running example throughout the manual. This allows each step of the framework to be introduced gradually rather than presenting the complete process only at the end.

In Troodos, hotter conditions and prolonged dry periods can dry forest soils, vegetation, and pine needles. When this climate pressure interacts with dense vegetation near mountain settlements and narrow roads, the likelihood and potential consequences of wildfire increase. A fire may block an evacuation route, delay emergency vehicles, isolate a community, or place residents and visitors at risk.

A general recommendation such as “improve wildfire preparedness” does not provide enough direction for implementation. Decision-makers still need to determine:

- which forests, settlements, and roads are most exposed;
- whether action is required through forest management, transport planning, civil protection, or a combination of these;
- which organisation has the legal power to act;
- whether vegetation management, protected evacuation corridors, alternative routes, or other measures are appropriate; and
- how these measures will be funded, maintained, and monitored.

As the six HSTF steps are introduced, the Troodos example will progressively show how these questions can be answered and assembled into a traceable planning recommendation.

1.4 What will I learn?

After reading this manual, you will be able to:

- distinguish between a static list of hazards and a hazard pathway that explains how a climate pressure can produce a local consequence;
- identify the territorial systems—people, settlements, infrastructure, ecosystems, and economic activities—that may be affected;
- organise different risks under five shared land-use domains: Buildings, Agriculture, Blue-Green Infrastructure, Transportation, and Protected-Area Conservation;

- apply the six steps of the HSTF to connect scientific evidence with practical planning actions;
- select a suitable planning instrument, such as a building code, zoning regulation, forest-management plan, or civil-protection plan;
- define the resilience function expected from an action, such as reducing exposure, lowering vulnerability, or maintaining an essential service; and
- assess whether a proposed action has a responsible authority, sufficient legal power, available funding, stakeholder support, and arrangements for maintenance and monitoring.

The framework is not intended to replace detailed scientific studies, technical design, legal review, or stakeholder consultation. Instead, it provides a common structure through which scientific experts, planners, policymakers, infrastructure managers, and local communities can work together.

2 Concepts, methods, and approaches

This section introduces the main concepts used in the Hazard-Sector Translation Framework. It begins with a basic change in perspective: moving from a list of climate hazards to an explanation of how those hazards can affect a particular territory. It then introduces the six HSTF steps and the land-use domains through which climate risks can be converted into planning actions.

The Troodos Mountain Range is used as the main running example. Short examples from urban and agricultural regions are also provided to demonstrate how the same climate hazard can require different planning responses in different territorial settings.

2.1 From hazard inventories to hazard pathways

2.1.1 Why a list of hazards is not enough

Regional climate assessments often begin with a hazard inventory: a list of the climate-related pressures affecting a territory. A typical inventory may include:

- heatwaves;
- drought;
- wildfire;
- river or surface-water flooding;
- coastal flooding; and
- water scarcity.

Such a list is useful as a starting point. It tells public authorities which hazards require attention. However, it does not explain how each hazard may affect people, infrastructure, ecosystems, or economic activities. It also does not indicate which planning action should be taken.

For example, stating that “wildfire is a major risk in Troodos” is scientifically relevant, but it leaves several practical questions unanswered:

- Which communities, roads, forests, or services are most at risk?
- How could a wildfire disrupt the functioning of the region?
- Where should preventive measures be prioritised?
- Which authority has the power to intervene?
- Which planning or management instrument should be used?

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

A simple comparison:

A list of hazards is similar to a doctor identifying that a patient has a high temperature. This is important information, but it is not enough to select a treatment. The doctor must also understand what is causing the temperature, how it affects the patient, and which intervention is appropriate. Climate planning requires the same movement from identifying a warning sign to understanding the chain of causes and consequences.

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

To make climate information useful for planning, decision-makers must move from hazard inventories to hazard pathways.

A hazard pathway describes the chain through which a climate-related pressure interacts with an exposed territorial system and produces a consequence that public authorities can address through planning or investment (Xekalakis et al., 2026).

In its simplest form, a hazard pathway contains three elements:

- 1. Climate hazard or pressure:** What physical climate-related change is occurring?
- 2. Exposed territorial system:** Which people, places, infrastructure, ecosystems, or economic activities are in its path?
- 3. Planning-relevant consequence:** What damage, disruption, or loss could result?

This can be expressed as:

Climate hazard → Exposed territorial system → Planning-relevant consequence.

The purpose of a hazard pathway is not to describe every possible interaction. It is to identify the **dominant relationship that matters for a particular planning decision.**

Key question for reflection:

Can you describe one priority local risk as a clear chain connecting a climate-related pressure, an exposed territorial system, and a planning-relevant consequence?

2.1.3 Building the Troodos hazard pathway

Consider the wildfire challenge in the Troodos Mountain Range.

The starting point is not simply the word “**wildfire**”. The pathway begins with the climate conditions that contribute to the hazard:

Higher temperatures and prolonged dry periods.

These conditions dry forest soils, undergrowth, and pine needles. The dry vegetation then becomes easier to ignite and can support faster fire spread.

The climate pressure interacts with a particular territorial system:

Forested mountain areas, settlements near vegetation, tourist locations, narrow roads, and emergency-access routes.

The resulting consequences may include:

Rapid wildfire spread, blocked evacuation routes, delayed emergency access, and temporary isolation of mountain communities.

The initial Troodos pathway can therefore be written as:

Higher temperatures and prolonged dry periods → Dry forest vegetation near settlements and critical roads → Increased wildfire spread, blocked evacuation routes, and community isolation.

This formulation is more useful than simply listing “heat,” “drought,” and “wildfire.” It identifies both the local systems that may be affected and the points at which planning action may reduce the risk.

For example, public authorities may not be able to prevent a period of extreme heat, but they may be able to:

- manage undergrowth and other combustible vegetation;
- maintain fuel breaks beside settlements and critical roads;
- protect evacuation corridors from inappropriate development;
- provide alternative routes where possible; and
- maintain access for fire fighting and emergency vehicles.

This is the first important step in translating climate information into action!

Key question for reflection:

Which local characteristics in your region could transform a climate-related pressure into disruption, damage, or community isolation?

2.1.4 The same hazard can create different pathways

A climate hazard does not produce the same consequences everywhere. Its effects depend on the characteristics of the territory with which it interacts.

Extreme heat, for example, can generate different planning problems in urban, agricultural, and mountain systems.

Urban and coastal system: Sicily

In a densely built urban area, extreme heat may interact with sealed surfaces, limited vegetation, poorly insulated buildings, and vulnerable residents. The resulting pathway may lead to urban overheating, unsafe indoor temperatures, and increased demand for electricity and cooling.

Extreme heat → Sealed urban surfaces and poorly insulated buildings → Indoor thermal stress and increased energy demand.

Possible planning responses include urban trees, shaded public spaces, green roofs, reflective building materials, and improved thermal-performance requirements.

Agricultural system: Osijek-Baranja

In an agricultural area, extreme heat and prolonged dry periods may interact with shallow soils, water-demanding crops, and limited irrigation infrastructure. The resulting pathway may lead to soil-moisture loss, reduced crop yields, and declining farm income (Bügelmayer-Blaschek et al., 2025; Xekalakis et al., 2026).

Extreme heat and dry periods → Exposed crops and insufficient irrigation → Crop losses and reduced rural income.

Possible responses include crop diversification, drought-tolerant varieties, soil-moisture conservation, and efficient irrigation.

Mountain system: Troodos

In a forested mountain area, heat and prolonged dry conditions may interact with combustible vegetation, isolated settlements, tourist activity, and a road network with limited alternative routes.

Heat and prolonged dry periods → Dry forest vegetation near settlements and roads → Wildfire spread, evacuation difficulties, and community isolation.

Possible responses include vegetation management, fuel breaks, forest-road maintenance, protected evacuation corridors, and alternative emergency routes.

Key question for reflection:

How could the same climate hazard produce different consequences in two parts of your region, and why might each area require a different planning response?

2.1.5 Why this distinction matters

Public authorities cannot plan effectively for “heat,” “drought,” or “wildfire” in the abstract. They must understand how each hazard interacts with the territory under their responsibility. The hazard-pathway approach helps decision-makers:

- identify which local systems are most at risk;
- understand how disruption or damage may occur;
- locate points where planning action can interrupt the pathway;
- involve the departments and stakeholders responsible for those points; and
- justify why a particular intervention is needed.

The practical question therefore changes from:

“Which hazards affect our region?”

to:

“How can these hazards affect our territory, and where can our decisions reduce the consequences?”

This change in perspective provides the foundation for the six-step HSTF sequence introduced in the next section. The difference between a static hazard inventory and an actionable hazard pathway is illustrated in Figure 2. While the inventory identifies the hazards present in a territory, the pathway connects a climate pressure to the exposed local system, its consequences, and the points where planning action can reduce risk.

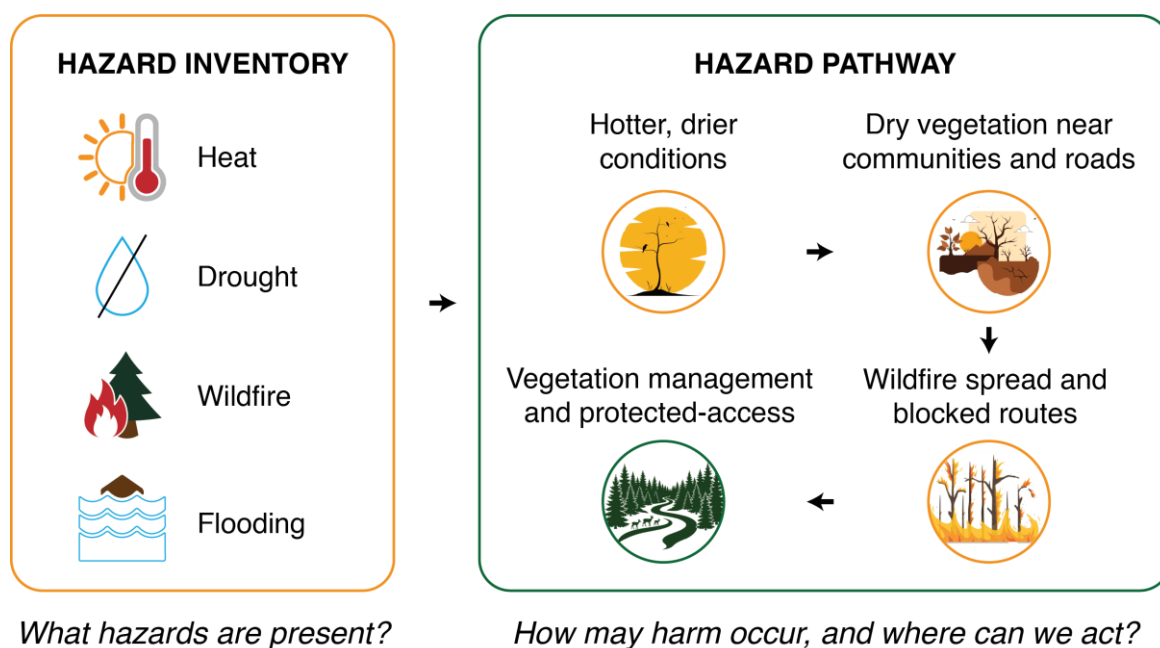


Figure 2: From a hazard inventory to a hazard pathway.

A hazard inventory identifies the climate pressures present in a region, while a hazard pathway describes the chain through which a climate-related pressure interacts with an exposed territorial system and produces a consequence that public authorities can address through planning, investment, or management.

Key question for reflection:

What planning or investment decision becomes easier once a hazard is described as a pathway rather than simply included in a hazard list?

2.2 The Hazard-Sector Translation Framework sequence

Identifying a hazard pathway explains how a climate pressure may create a local problem. However, decision-makers must still determine what should be done, who should act, which planning instrument should be used, and what result the intervention is expected to achieve.

The Hazard-Sector Translation Framework (HSTF) organises this reasoning into six connected steps. It begins with scientific and territorial evidence and ends with an action that can be linked to an existing planning instrument and a clearly defined resilience objective (Xekalakis et al., 2026).

The six steps are:

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

Each step answers a practical question. To make the sequence easier to follow, the Troodos wildfire example is developed progressively below.

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 the climate pressure and its local consequences. The purpose is not to describe every possible interaction, but to define the pathway that is most relevant to the decision under consideration.

A useful pathway should explain:

- the climate-related pressure;

- the local conditions with which it interacts; and
- the resulting damage or disruption.

Troodos example — Step 1

In a forested mountain area, heat and prolonged dry conditions may interact with combustible vegetation, isolated settlements, tourist activity, and a road network with limited alternative routes.

Heat and prolonged dry periods → Dry forest vegetation near settlements and roads → Wildfire spread, evacuation difficulties, and community isolation.

HSTF entry:

Hazard pathway: Hotter and drier conditions → Dry forest vegetation → Increased likelihood of wildfire ignition and rapid spread.

2.2.2 Step 2 — Identify the affected territorial system

Practical question: Who or what is in harm's way?

The next step is to identify the people, places, infrastructure, ecosystems, services, and economic activities that may be affected.

This step should be as geographically specific as the available evidence allows. It is more useful to identify “mountain communities served by a single access road” than to refer generally to “rural areas.” Decision-makers should consider:

- residents and visitors;
- settlements and buildings;
- roads and other infrastructure;
- emergency and public services;
- agricultural activities;
- forests and protected ecosystems; and
- local businesses and livelihoods.

Troodos example — Step 2

Several mountain communities are surrounded by or located close to forested areas. Narrow roads provide everyday access but also serve as evacuation routes and entry points for firefighting and emergency vehicles. Tourists may be particularly vulnerable because they are less familiar with the local road network.

HSTF entry:

Affected territorial system: Forested mountain settlements, residents and visitors, protected forests, narrow access roads, evacuation routes, and emergency services.

2.2.3 Step 3 — Select the relevant land-use domain

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

The problem 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 helps identify the departments, professional teams, and planning processes that should be involved. Some problems will require more than one domain.

Troodos example — Step 3

The wildfire pathway crosses two main land-use domains. Protected-Area Conservation is relevant because forest vegetation and fuel loads must be managed. Transportation is also relevant because roads must remain available for evacuation and emergency access.

HSTF entry:

Land-use domains: Protected-Area Conservation and Transportation.

Selecting more than one domain does not mean that responsibility should remain unclear. It means that the relevant authorities must coordinate their actions while maintaining clearly defined roles.

2.2.4 Step 4 — Select a recommendation family

Practical question: What type of action could reduce the risk?

A **recommendation family** is a group of related measures that serve a common planning purpose. At this stage, decision-makers identify the most appropriate type of intervention before selecting its detailed design. For example, a wildfire-related recommendation family may include:

- vegetation and fuel-load management;
- maintenance of fuel breaks;
- forest-road maintenance;
- protection of evacuation corridors;
- emergency-route redundancy; and
- improved access for fire fighting vehicles.

Troodos example — Step 4

Two linked recommendation families are selected. The first concerns vegetation and fuel-load management near communities and critical roads. The second concerns the protection of evacuation routes and the provision of alternative emergency access where feasible.

HSTF entry:

Recommendation families:

1. Vegetation and wildfire fuel-load management near settlements and critical roads.
2. Evacuation-route protection and emergency road redundancy.

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

2.2.5 Step 5 — Identify the active planning instrument

Practical question: Which existing tool can put the action into effect?

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

Depending on the regional and national context, relevant instruments may include:

- local or regional development plans;
- zoning regulations;
- building codes;
- forest-management plans;
- transport and mobility plans;
- civil-protection and evacuation plans;
- infrastructure investment programmes;
- public procurement requirements; and
- agricultural advisory or support programmes.

The appropriate instrument depends on the legal powers and institutional structure of the region. The HSTF does not assume that every municipality has authority over every planning issue.

Troodos example — Step 5

Vegetation and fuel-load management may be introduced through forest-management plans and agreements with the authorities responsible for state or protected forest land. Evacuation routes and emergency-access requirements may be incorporated into local or regional civil-protection plans, transport plans, and infrastructure-maintenance programmes.

HSTF entry:

Active planning instruments: Forest-management plans, civil-protection and evacuation plans, transport plans, and road-maintenance programmes.

At this stage, decision-makers should confirm:

- which authority owns or manages the affected land or infrastructure;
- which organisation can approve or enforce the measure;
- whether coordination between different levels of government is required; and
- whether the instrument has an available funding and implementation route.

2.2.6 Step 6 — Define the expected resilience function

Practical question: What protective result should the action deliver?

The final step states the specific resilience function expected from the intervention. This prevents recommendations from remaining broad or symbolic.

Common resilience functions include:

- **reducing exposure:** keeping people or critical assets away from hazardous locations;
- **lowering vulnerability:** making people, infrastructure, or ecosystems less likely to suffer damage;
- **maintaining service continuity:** ensuring that essential services continue during and after an event;
- **supporting recovery:** enabling faster restoration of services and livelihoods; and
- **protecting ecosystem functions:** maintaining the natural processes that support long-term resilience.

Troodos example — Step 6

Managing vegetation beside settlements and critical roads is expected to reduce exposure to rapid wildfire spread. Protecting evacuation corridors and providing alternative routes are expected to maintain transport, evacuation, firefighting, and emergency-service continuity.

HSTF entry:

Expected resilience functions: Reduce wildfire exposure and maintain safe evacuation and emergency access.

The expected function should be stated clearly enough to guide future monitoring. For example, “improve resilience” is too broad. A more useful objective would be: “Keep designated evacuation and emergency-access routes inspected, maintained, and operational during periods of high wildfire danger.” This provides a clearer basis for assigning responsibilities and evaluating performance.

2.2.7 The completed Troodos sequence

After completing the six steps, the initial observation—“Troodos faces increasing wildfire risk”—has been converted into a structured planning logic summarised in Table 1.

Table 1. Application of the six-step HSTF sequence to the Troodos wildfire pathway

HSTF step	Troodos wildfire application
1. Hazard pathway	Hotter and drier conditions dry forest vegetation, increasing the likelihood of wildfire ignition and rapid spread.
2. Affected territorial system	Mountain settlements, residents, visitors, protected forests, narrow roads, evacuation routes, and emergency services.
3. Land-use domain	Protected-Area Conservation and Transportation.
4. Recommendation family	Vegetation and fuel-load management; evacuation-route protection and emergency road redundancy.
5. Active planning instrument	Forest-management plans, civil-protection and evacuation plans, transport plans, and road-maintenance programmes.
6. Expected resilience function	Reduce wildfire exposure and maintain safe evacuation and emergency access.

The complete HSTF sequence is presented in Figure 3. The framework begins with the available evidence and progressively connects the hazard pathway to the affected territorial system, the relevant land-use domain, a recommendation family, an active planning instrument, and an expected resilience function.

EVIDENCE BASE: Community of Practice (CoP) material | regional recommendations | indicators | technical mapping logic

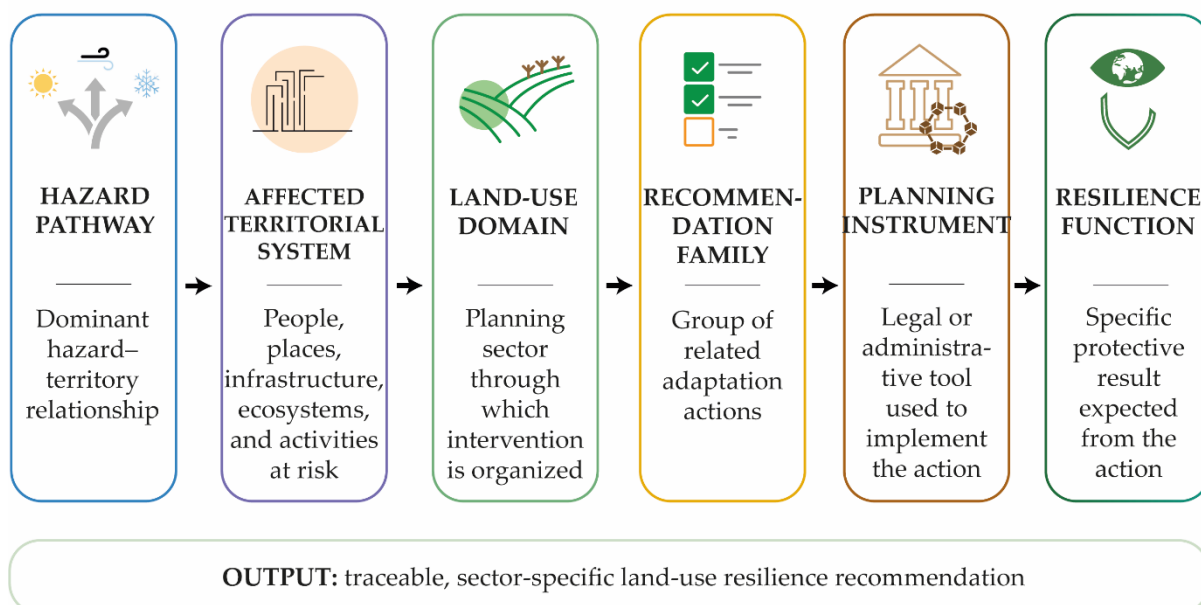


Figure 3: The six-step Hazard-Sector Translation Framework (HSTF).

This sequence creates traceability. In simple terms, traceability means that public authorities can explain:

- why an action is needed;
- which evidence supports it;
- which people or assets it protects;
- who is expected to implement it;
- which planning instrument will be used; and
- what practical result is expected.

This makes it easier to justify public expenditure, coordinate departments, communicate decisions to communities, and monitor whether the intervention is delivering its intended benefit.

2.3 Shared land-use resilience domains

Climate risks differ considerably between regions. A coastal city may be concerned with sea-level rise and extreme heat, an agricultural region with drought and crop losses, and a mountain region with wildfire, erosion, and isolated communities.

Despite these differences, the available planning responses usually 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

These domains provide a common language between scientists, policymakers, planners, and technical departments. They help translate a climate-related problem into a planning area where responsibilities, instruments, budgets, and professional expertise can be identified.

In practical terms:

Think of the five domains as the main administrative doors through which climate action can enter. A problem affecting buildings may be addressed through building or development requirements; a problem affecting roads through transport and maintenance programmes; and a problem affecting forests through conservation or forest-management instruments. When one hazard pathway crosses several domains, the relevant authorities must work together.

A single hazard pathway may involve more than one domain. For example, the Troodos wildfire pathway involves Protected-Area Conservation, because forest vegetation must be managed, and Transportation, because roads must remain available for evacuation and emergency access.

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,	Use natural systems to retain water, reduce heat, filter runoff, support biodiversity, and provide	Surface-water flooding, urban heat, water scarcity, pollution, and

	parks, trees, green roofs, rain gardens, and retention areas.	multiple environmental and social benefits.	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

Troodos example:

Forest vegetation beside a critical road belongs primarily to the **Protected-Area Conservation** domain, while the road's function as an evacuation and emergency-access route belongs to the Transportation domain. Coordinating the two domains helps prevent a situation in which vegetation is managed without considering evacuation needs, or roads are maintained without considering wildfire exposure.

Key question for reflection:

Which of the five shared land-use domains are most relevant to the main climate risks facing your region?

2.3.2 How to select the appropriate domain

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

For example, wildfire may require action in several domains:

- Buildings: requirements for fire-resistant materials and defensible space around properties;
- Agriculture: management of abandoned fields and dry agricultural vegetation;
- Transportation: protection of evacuation routes and emergency access;
- Protected-Area Conservation: forest fuel management and maintenance of fuel breaks; and
- Blue-Green Infrastructure: restoration of burned landscapes and measures to reduce post-fire runoff and erosion.

The following questions can help decision-makers select the relevant domain:

- Which people, assets, ecosystems, or economic activities are being protected?
- Which department normally manages them?
- Which planning or regulatory tools are available?
- Is action required in more than one domain?
- If several domains are involved, which authority should coordinate them?

The HSTF allows more than one domain to be selected when the pathway crosses administrative or sectoral boundaries. However, each participating authority should still have a clearly defined role.

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?

2.3.3 Recommendation families

Once the relevant domain has been identified, possible actions can be organised into **recommendation families**. A recommendation family is a group of related measures that serve a common planning purpose.

This helps decision-makers move from a broad objective—such as “reduce heat risk” or “improve wildfire preparedness”—towards a manageable group of interventions.

Examples of recommendation families associated with each domain are presented in Table 3.

Table 3. Examples of recommendation families and their main planning purposes

Land-use domain	Examples of recommendation families	Main planning purpose
Buildings	Passive cooling, shading, reflective materials, green roofs, site-level water retention, flood-resistant design, and water-efficiency measures.	Protect occupants and improve building and neighbourhood resilience to heat, flooding, wildfire, and water stress.
Agriculture	Crop diversification, drought-tolerant varieties, efficient irrigation, soil-moisture conservation, erosion control, and adjusted planting calendars.	Maintain agricultural production, protect soils and water resources, and support the economic continuity of farming communities.
Blue-Green Infrastructure (BGI)	Urban trees, wetlands, bioswales, rain gardens, retention areas, green corridors, restored riverbanks, and permeable public spaces.	Manage runoff, reduce temperatures, improve water quality, support biodiversity, and provide accessible public space.

Transportation	Alternative routes, improved road drainage, heat-resistant materials, emergency-access mapping, protected evacuation corridors, and infrastructure-maintenance programmes.	Maintain mobility, evacuation capacity, emergency response, and access to essential services during hazardous events.
Protected-Area Conservation	Habitat restoration, ecological connectivity, climate refuges, vegetation management, fuel breaks, forest-road maintenance, and post-fire erosion control.	Protect biodiversity, limit wildfire spread, support ecosystem recovery, and maintain long-term ecological functions.

Recommendation families are not ready-made solutions that can be copied into every region. They provide a structured starting point. The final measure must be adapted to:

- local hazard conditions;
- the characteristics of the affected territory;
- available scientific evidence;
- institutional responsibilities;
- legal powers;
- financial capacity; and
- community needs and priorities.

Key question for reflection:

Which recommendation family provides the most suitable starting point for your selected pathway, and how would its measures need to be adapted to local conditions?

2.3.4 From domain to coordinated action

The five domains should not be treated as separate administrative silos. Many adaptation measures are most effective when departments work together.

In the Troodos example:

- forest authorities may manage vegetation and fuel loads;
- transport authorities may maintain critical roads;
- civil-protection services may define evacuation requirements;
- local authorities may communicate with residents and visitors; and
- funding authorities may support implementation and long-term maintenance.

The domain identifies the main planning interface, but successful implementation depends on coordination across all organisations that influence the pathway. As

practical guidance, this manual recommends naming one lead coordinator while documenting the supporting responsibilities of the other organisations.

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 organisation should coordinate the response, and what supporting responsibilities should be assigned to the other participating organisations?

2.4 Multifunctionality and Blue-Green Infrastructure

One of the most useful principles for public investment is multifunctionality: selecting an intervention that addresses more than one problem or provides several public benefits at the same time.

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

BGI includes natural and semi-natural features such as:

- wetlands and retention ponds;
- restored rivers and streams;
- bioswales and rain gardens;
- urban trees and forests;
- parks and green corridors;
- green roofs and walls;
- permeable public spaces; and
- vegetated areas designed to manage runoff.

“Blue” refers primarily to water-related features, while “green” refers to vegetation, soil, and ecosystems. In practice, the two often work together.

A simple way to understand BGI:

During heavy rainfall, soil, vegetation, wetlands, and retention areas can work like a sponge, slowing down and storing water. During hot periods, trees and vegetation

can work like a natural shade and cooling system. The same area may also provide habitat, recreation, and improved public space.

2.4.1 Why multifunctionality matters

A conventional drainage project may be designed mainly to move stormwater away from a developed area. A well-designed BGI intervention may also:

- temporarily store rainfall and reduce surface-water flooding;
- provide shade and reduce local temperatures;
- support infiltration and, where ground conditions allow, groundwater recharge;
- filter pollutants from runoff;
- create or connect habitats;
- improve public space and recreation;
- support walking and cycling; and
- increase the environmental quality of neighbourhoods.

This does not mean that BGI should replace all conventional infrastructure. Dense urban areas, steep terrain, limited space, contaminated soils, or high design flows may still require engineered drainage and protection systems.

The most effective solution is often a combined blue-green-grey system, in which natural and engineered measures work together.

For final design, the suitability of each BGI measure should be confirmed through the relevant site-specific technical and environmental assessments, together with a realistic long-term maintenance plan.

Decision-maker example:

A municipality planning to upgrade an overloaded stormwater pipe could examine whether part of the runoff can first be captured by rain gardens, permeable surfaces, or a retention area. The pipe may still be necessary, but the BGI elements can reduce the amount and speed of water reaching it while providing shade, greenery, and public-space benefits.

2.4.2 Connecting one investment to several risks

The value of multifunctionality becomes clearer when a single intervention is linked to several hazard pathways and resilience functions. As illustrated in Figure 4, Blue-Green Infrastructure can simultaneously support runoff retention, passive cooling, water storage and infiltration, and habitat connectivity.

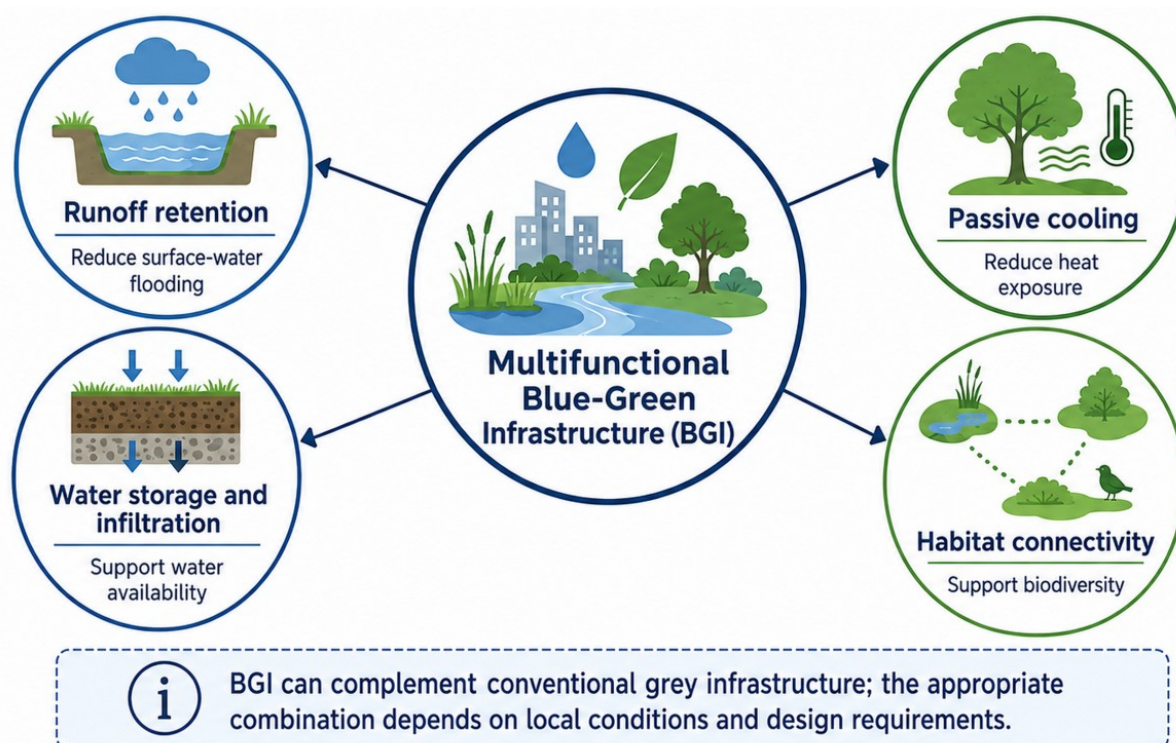


Figure 4: Multiple benefits of Blue-Green Infrastructure.

For example, an urban wetland or retention park may contribute to:

- surface-water flood management by storing runoff;
- heat reduction through vegetation and evaporation;
- water management by supporting infiltration or controlled storage;
- biodiversity protection by creating habitat; and
- public health and well-being by providing accessible green space.

This means that a single intervention may support several land-use domains and resilience functions. It may also attract support from different funding programmes, including those related to climate adaptation, water management, biodiversity, public health, urban regeneration, and sustainable mobility (D'Angelo et al., 2026).

However, multiple benefits should not simply be assumed. They should be identified during planning and, where possible, supported by measurable objectives.

Examples of questions that can be used to assess the expected benefits of a BGI intervention are provided in Table 4.

Table 4. Example monitoring questions for multifunctional BGI benefits

Expected benefit	Possible monitoring question
Reduced surface-water flooding	How much rainfall can the intervention temporarily store?
Reduced heat exposure	How much shaded area will be created, and which populations will benefit?
Improved water management	How much runoff will be retained, filtered, or infiltrated?
Increased biodiversity	Will the intervention create or connect suitable habitats?
Improved public space	Is the area safe, accessible, and useful to local communities?

Key question for reflection:

How could an existing or planned public investment be redesigned to address several hazard pathways or resilience objectives simultaneously?

2.4.3 Multifunctionality in the Troodos context

Although BGI is often discussed in relation to cities, the same principle applies in mountain and rural regions.

In Troodos, vegetation management beside settlements and roads should not be understood only as the removal of combustible material. If poorly planned, extensive vegetation clearance may increase soil erosion, damage habitats, and accelerate runoff after heavy rainfall. A multifunctional approach could combine:

- selective management of wildfire fuel near settlements and critical roads;
- retention of vegetation where it stabilises slopes;
- restoration of fire-affected soils;
- small check dams or natural barriers that slow runoff;
- protection of streams and riparian vegetation; and
- maintenance of habitat connections where these do not conflict with safety requirements.

The objective is to reduce wildfire risk without creating new erosion, flooding, or ecological problems.

Troodos example:

A managed strip beside an evacuation road could reduce combustible vegetation, maintain visibility and emergency access, include erosion-resistant planting, and direct runoff towards protected drainage points. One intervention could therefore support wildfire safety, slope stability, road protection, and ecosystem recovery.

This illustrates an important planning principle: an adaptation measure should be assessed not only for the risk it reduces, but also for the additional benefits—or unintended problems—it may create.

Key question for reflection:

Could an intervention intended to reduce one risk in your region create erosion, flooding, ecological damage, or another unintended effect, and how could its design be improved?

2.4.4 Questions for decision-makers

Before approving a BGI or multifunctional adaptation project, ask:

- Which hazard pathway is the intervention intended to address?
- What is its primary protective function?
- Which additional benefits could it provide?
- Are any of these benefits supported by measurable objectives?
- Could the intervention transfer risk to another place or group?
- Is conventional engineered infrastructure also required?
- Which departments need to be involved?
- Who will maintain the intervention over its full service life?
- Is long-term monitoring included in the budget?

Multifunctionality strengthens the case for investment, but it also requires coordination. A park department, water authority, transport department, planning office, and civil-protection service may all influence the same intervention.

3 Practical considerations and lessons learnt

A recommendation may be scientifically sound and technically appropriate but still fail during implementation. This can happen when responsibilities are unclear, the responsible authority lacks the legal power to act, funding is unavailable, or the proposed measure does not have sufficient public support.

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 introduces the governance and implementation conditions that should be examined before an HSTF recommendation moves towards formal approval, procurement, or construction. It also considers how the framework can be used in regions with different levels of data and institutional capacity and discusses the social and ethical consequences that may arise from land-use decisions.

The Troodos wildfire example continues throughout the chapter to demonstrate how a technically appropriate recommendation—such as managing vegetation beside evacuation roads—must pass through several practical checks before it can be implemented.

3.1 From a technically sound recommendation to implementation

The six-step HSTF sequence establishes a traceable connection between climate evidence and an expected resilience result. However, completing the sequence does not guarantee that the proposed action will be implemented successfully.

In Section 2.2, the Troodos example identified two linked recommendation families: vegetation and wildfire fuel-load management near settlements and critical roads, and evacuation-route protection and emergency road redundancy. Together, these form the following working recommendation:

“Manage vegetation and wildfire fuel beside critical roads, protect evacuation corridors, and provide alternative emergency-access routes where feasible.”

The recommendation responds to an identified hazard pathway and has a clear resilience purpose. Nevertheless, implementation requires answers to several additional questions:

- Who owns or manages the affected land and roads?

- Which organisation is responsible for the intervention?
- Does that organisation have the legal power to act?
- Is coordination with national authorities required?
- Which planning instrument can introduce or enforce the measure?
- Is funding available for construction and long-term maintenance?
- Do local communities, landowners, and businesses support the proposal?
- Who will monitor whether the intervention remains effective?

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

Governance determines whether a proposed measure can move from planning to action. In this manual, governance refers to the practical conditions that can enable, delay, change, or prevent implementation.

These conditions include:

- clear institutional responsibility;
- sufficient legal authority;
- an appropriate planning instrument;
- available capital funding;
- a budget for operation and maintenance;
- coordination between departments and levels of government;
- stakeholder and community support; and
- long-term monitoring and accountability.

A simple comparison:

A technically correct building design cannot be constructed without land ownership, planning permission, finance, a contractor, and arrangements for maintenance. In the same way, a technically sound climate-adaptation recommendation cannot be implemented without responsible institutions, legal authority, funding, and long-term support.

Governance should therefore not be treated as a final administrative check performed after the technical work is complete. It should be considered from the beginning of the planning process.

3.1.2 Governance readiness

In this manual, governance readiness means the extent to which the institutional, legal, financial, and social conditions needed to implement and maintain a proposed action are in place.

A recommendation has a high level of governance readiness when:

- a responsible authority has been identified;
- its responsibilities are formally recognised;
- it has the legal power to approve or enforce the action;
- a suitable planning instrument is available;
- capital and maintenance funding have been identified;
- relevant departments and authorities are coordinated;
- affected communities and stakeholders have been consulted; and
- monitoring responsibilities have been assigned.

A recommendation has low governance readiness when one or more of these conditions are missing or unclear. This does not necessarily mean that the recommendation should be abandoned. Instead, it means that the missing condition must be addressed before implementation proceeds.

Table 5 presents the immediate planning response that may be required when an important governance-readiness condition is missing.

Table 5. Planning responses to common governance-readiness gaps

If this condition is missing...	The immediate planning response should be...
Responsible authority	Assign formal ownership and clarify departmental roles.
Legal power	Seek legal review, use a different instrument, or coordinate with the competent authority.
Implementation instrument	Identify or amend an appropriate plan, regulation, programme, or agreement.
Capital funding	Connect the proposal to a municipal, regional, national, or European funding programme.
Maintenance funding	Establish a long-term operational budget and responsible maintenance body.
Stakeholder support	Begin consultation, explain the risk and expected benefits, and revise the measure where justified.
Monitoring arrangement	Define indicators, responsibilities, reporting frequency, and review procedures.

Key question for reflection: Which governance-readiness condition is currently weakest for your selected recommendation, and what practical action could strengthen it?

3.1.3 Applying the readiness check to Troodos

The Troodos recommendation can be used to demonstrate why governance readiness matters.

Technical recommendation:

Manage combustible vegetation beside critical roads and protect evacuation and emergency-access routes.

Governance questions

Institutional responsibility: Is vegetation management the responsibility of the municipality, the Forestry Department, the road authority, a protected-area manager, or a private landowner?

Legal authority: Can the municipality require vegetation clearance on land it does not own, or must the competent national authority approve and implement the work?

Planning instrument: Should the measure be included in a forest-management plan, civil-protection plan, road-maintenance programme, local development plan, or a formal agreement between authorities?

Funding: Is funding available only for initial clearance, or does it also cover repeated vegetation management, inspections, and road maintenance?

Stakeholder support: Have residents, environmental organisations, tourism operators, and affected landowners been consulted?

Monitoring: Who will confirm that vegetation remains within the required safety conditions and that evacuation routes remain accessible?

The example shows that a recommendation may involve several organisations and planning instruments. As a practical rule, this manual recommends assigning one authority a clear coordination role, even when responsibility for individual actions remains distributed among several organisations.

Key question for reflection:

If the Troodos readiness questions were applied to a priority recommendation in your region, which questions would remain unanswered?

3.1.4 A practical readiness test

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

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

If any part of this statement cannot be completed, the proposal has an implementation gap that should be resolved.

The next section introduces three governance transition points that help decision-makers locate these gaps within the HSTF sequence.

3.2 The three governance transition points

The published HSTF sets out six steps for translating climate-risk information into planning action. For practical implementation, this manual adds three governance transition points: decision gates that help public authorities test whether a recommendation can move successfully from one stage to the next.

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

1. Institutional responsibility: Who should lead, and which organisations should support the action?
2. Legal authority and funding: Does the responsible authority have the power and resources to act?
3. Stakeholder support, maintenance, and monitoring: Will the action be accepted and remain effective over time?

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.

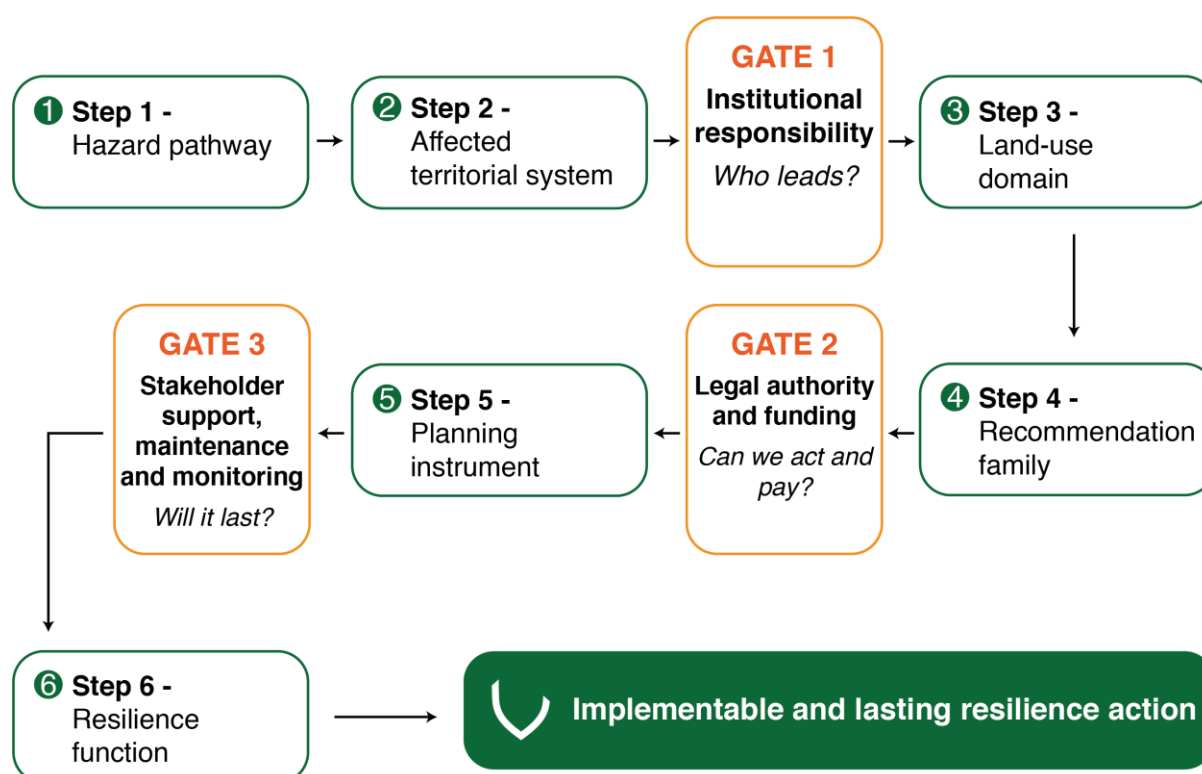


Figure 5: Governance transition points within the HSTF sequence.

The three transition points test whether a recommendation has: (1) a clearly responsible institution, (2) sufficient legal authority and funding, and (3) stakeholder support together with arrangements for maintenance and monitoring.

3.2.1 Transition Point 1 — From the affected system to the land-use domain

Main question: Who is responsible for the problem?

The first transition point concerns institutional responsibility, also referred to formally as the institutional mandate.

Once the affected territorial system has been identified, decision-makers must determine which department or organisation has responsibility for managing it. This may appear straightforward, but climate risks often cross traditional administrative boundaries.

For example, when intense rainfall floods an urban street, responsibility may involve:

- the public-works department, because the road is affected;
- the water authority, because the drainage system is overloaded;
- the planning department, because extensive soil sealing contributes to runoff; and
- the parks or environmental department, because green areas could help retain rainfall.

If roles are unclear, departments may assume that another organisation will act. Activities may also be duplicated, delayed, or implemented without sufficient coordination.

Plain-language test:

Within our administration, who is expected to take the lead, and which other organisations must support them?

Troodos application

In Troodos, wildfire risk beside an evacuation road may involve:

- the Forestry Department, which manages forest vegetation;
- the road authority, which maintains the road;
- local authorities, which represent affected communities;
- civil-protection services, which plan evacuation and emergency response; and
- private landowners where vegetation is located outside publicly managed land.

The first transition point is passed only when a lead organisation is identified and the supporting responsibilities of the other organisations are clearly assigned.

Decision rule:

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

Key question for reflection:

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

3.2.2 Transition Point 2 — From the recommendation family to the planning instrument

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

The second transition point concerns two closely connected conditions:

- legal authority, formally referred to as statutory competence; and
- financial viability, including a realistic source of capital funding.

Identifying the responsible department does not automatically mean that it has the legal power to implement or enforce the recommendation.

For example, a municipality may maintain local roads but may not have the legal authority to:

- clear vegetation on nationally managed forest land;
- require action on private property;
- change national building requirements;
- impose restrictions within a protected area; or
- approve major infrastructure outside its administrative boundary.

The appropriate authority must therefore confirm that the proposed action can be introduced through the selected planning instrument.

Plain-language test:

Are we legally allowed to take this action, which instrument gives us that power, and how will the initial implementation be paid for?

If the local or regional authority lacks the necessary legal power, possible responses include:

- cooperating with the competent national authority;
- using a formal inter-agency agreement;
- selecting a different planning instrument;
- requesting an amendment to existing legislation or regulations; or
- modifying the recommendation so that it falls within the authority's existing powers.

Funding must be examined at the same stage. A recommendation should be connected to a realistic financial route, such as:

- a municipal or regional capital budget;
- a national investment programme;
- European funding, including ERDF or LIFE;
- a sector-specific forestry, water, agricultural, or transport programme; or
- an appropriate public–private arrangement.

Troodos application

A municipality may recognise that vegetation beside a critical road must be managed. However, the land may belong to the state, a protected-area authority, or private landowners.

The relevant questions are therefore:

- Who has the legal authority to approve vegetation management?

- Which forest-management or civil-protection instrument permits the work?
- Are environmental approvals required?
- Who will finance the initial intervention?
- Does the funding cover all affected sections of the evacuation route?

Decision rule:

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

3.2.3 Distinguishing responsibility from legal authority

Institutional responsibility and legal authority are closely related, but they are not the same.

The distinction is summarised in Table 6.

Table 6. Difference between institutional responsibility and legal authority

Governance question	Transition Point 1: Institutional responsibility	Transition Point 2: Legal authority and funding
What does it ask?	Who should lead and coordinate the response?	Who is legally permitted to approve or enforce it, and how will it be financed?
Where is the issue usually found?	Within or between departments and organisations.	Between different levels of government, legislation, planning instruments, and funding systems.
Simple question	“Who owns this problem?”	“Who has the legal power to act, and who will pay?”
Troodos example	Which organisation leads the protection of a critical evacuation road?	Which authority may legally clear vegetation on the affected land, and which budget will fund the work?
Response if unclear	Assign a lead organisation and document supporting roles.	Obtain legal clarification, involve the competent authority, select another instrument, or secure an appropriate funding route.

A useful rule:

Transition Point 1 concerns **administrative ownership**. Transition Point 2 concerns **legal power** and **initial funding**.

3.2.4 Transition Point 3 — From the planning instrument to the resilience function

Main question: Will the action be accepted, maintained, and monitored?

Passing a regulation, approving a plan, or constructing an asset does not guarantee that the intended resilience function will continue over time.

The third transition point examines:

- stakeholder and community support;
- practical implementation;
- long-term operation and maintenance;
- monitoring and reporting; and
- adjustment when conditions or performance change.

A measure may face resistance if affected residents, landowners, businesses, or community groups do not understand its purpose or believe that its costs and restrictions are unfairly distributed.

Physical interventions can also lose effectiveness without maintenance. Examples include:

- a bioswale that becomes blocked;
- a rain garden that is not replanted;
- a drainage channel filled with sediment;
- an evacuation road obstructed by vegetation; or
- a wildfire fuel break that is not maintained regularly.

Plain-language test:

Do affected people understand and support the action, and who will maintain and check it over the coming years?

Troodos application

Vegetation may be cleared beside a critical road once, but wildfire fuel will gradually return. The measure therefore requires:

- an agreed inspection schedule;
- clear responsibility for repeated vegetation management;
- a long-term maintenance budget;
- coordination with environmental and forest-management requirements;
- communication with affected communities and landowners; and
- monitoring of whether the road remains accessible during periods of high wildfire danger.

A useful monitoring indicator could be:

“Percentage of priority evacuation-route length inspected and maintained before the annual wildfire season“.

Another could be:

“ Number of mountain communities for which at least one designated evacuation and emergency-response route has been inspected and confirmed accessible before the annual wildfire season“.

These are examples for planning purposes. Final indicators should be agreed with the responsible authorities and adapted to the available data, inspection procedures, and local emergency plans.

Decision rule:

If stakeholder support, maintenance responsibilities, or monitoring arrangements are absent, the intervention is unlikely to provide its intended resilience function over the long term.

3.2.5 Summary of the three transition points

The three transition points and the action required at each one are summarised in Table 7.

Table 7. Practical checks at the three governance transition points

Transition point	Main question	Evidence needed before proceeding	Response if the condition is missing
1. Institutional responsibility	Who leads and who supports?	Named lead organisation, documented responsibilities, and coordination arrangements.	Assign ownership and clarify the roles of participating organisations.
2. Legal authority and funding	Are we legally permitted and financially able to act?	Legal basis, appropriate planning instrument, competent authority, and identified capital funding.	Obtain legal review, involve the competent authority, revise the instrument, or secure funding.
3. Support, maintenance, and monitoring	Will the action be accepted and remain effective?	Stakeholder-engagement record, maintenance responsibility and budget, indicators, and review schedule.	Consult affected groups, adjust the measure where justified, and establish long-term maintenance and monitoring.

Together, these transition points provide a practical governance test. A recommendation should not move directly from technical design to implementation unless public authorities can explain:

- who is responsible;
- who has the legal power to act;
- how implementation and maintenance will be financed;

- who is affected and has been consulted; and
- how long-term performance will be monitored.

The next section explains how the HSTF can be adapted to regions with different levels of scientific data and institutional capacity.

3.3 Applying the HSTF under different planning conditions

Not every region begins with the same level of climate data, technical expertise, legal authority, or institutional capacity. A large metropolitan authority may have detailed hazard maps, specialist GIS teams, and established investment programmes. A small rural municipality may rely on regional data, staff experience, and consultation with local communities.

The HSTF can be used in both settings, but the level of detail and certainty should match the evidence and implementation capacity available.

A key principle:

Limited data does not prevent a region from beginning climate-resilience planning. However, uncertainty must be stated clearly, and the level of detail in a recommendation should be proportionate to the quality of the available evidence. Measures that restrict development rights, require substantial private expenditure, or direct major public investment should not be adopted without appropriate technical validation, legal review, and stakeholder consultation.

Two questions help determine how the framework should be applied:

1. How strong is the available evidence?

Are there reliable hazard maps, exposure data, vulnerability indicators, local records, and technical studies?

2. How strong is the institutional capacity?

Are responsibilities clear, legal powers understood, departments coordinated, and funding routes available?

For practical use in this manual, the answers to these questions are organised into four broad planning conditions. These conditions are not additional HSTF steps; they help decision-makers select an appropriate level of detail, confidence, and institutional support when applying the framework. Their implications are summarised in Table 8.

Table 8. 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 Strong evidence and strong institutional capacity

Regions in this condition can apply the full HSTF sequence at a detailed spatial level.

For example, a municipality may already have:

- high-resolution heat or flood maps;
- a detailed building and infrastructure database;
- established planning and GIS departments;
- clearly defined legal powers;
- an approved climate-adaptation strategy; and
- active capital-investment programmes.

In this case, the HSTF should not create a separate parallel process. It should connect existing evidence and institutional procedures more clearly.

The main question is:

How can the framework improve traceability between the evidence already available and the decisions already being prepared?

Suitable outputs may include:

- geographically specific zoning requirements;
- prioritised infrastructure-investment programmes;
- updated building or site-development requirements;
- measurable resilience targets; and
- monitoring indicators linked to existing reporting systems.

3.3.2 Strong evidence but fragmented institutions

Some regions have detailed scientific studies but struggle to convert them into action because responsibilities are divided among several organisations.

For example, a flood-risk map may identify a priority area, but implementation may involve:

- the municipality;
- the regional planning authority;
- the water or drainage authority;
- the road authority;
- private landowners; and
- a national environmental agency.

In this condition, the HSTF should be used primarily as a **coordination tool**.

Decision-makers should:

- identify one lead organisation for each recommendation;
- document the responsibilities of supporting organisations;
- determine which authority has the legal power to act;
- connect each action to an existing planning instrument;
- establish procedures for sharing data; and
- agree on funding and monitoring responsibilities.

A technically detailed recommendation should not proceed until these institutional relationships are clarified.

3.3.3 Limited evidence but active institutions

A region may have committed public authorities and effective local partnerships but lack detailed climate or exposure data.

In this situation, the HSTF can support an initial qualitative assessment using:

- historical disaster and emergency records;
- municipal maintenance reports;
- observations from technical staff;
- regional or national hazard maps;
- satellite and open-access datasets;
- proxy indicators;
- information from local communities; and
- structured expert judgement.

What is a proxy indicator?

A proxy is an indirect measure used when the preferred information is unavailable. For example, where no detailed heat-exposure survey exists, the age of buildings, roof materials, population age, and availability of public shade may provide an initial indication of neighbourhood vulnerability.

Recommendations produced under limited evidence should be labelled according to their level of confidence.

For practical use in this manual, preliminary recommendations may be classified according to the confidence of their supporting evidence:

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

Low confidence does not necessarily mean that no action should be taken. It means that decision-makers should:

- avoid presenting the recommendation as highly precise;
- prioritise low-regret or reversible measures;
- collect additional evidence;
- monitor results closely; and
- review the recommendation when better information becomes available.

3.3.4 Limited evidence and weak institutional capacity

Where both evidence and institutional capacity are limited, attempting to prepare a complete and detailed HSTF matrix may create a false impression of readiness.

The initial focus should instead be on:

- identifying the most important hazard pathways;
- locating communities, infrastructure, and ecosystems that may be affected;
- recording existing knowledge and recent events;
- identifying the main data gaps;
- establishing basic coordination between organisations;
- seeking regional, national, or external technical support; and
- selecting a small number of urgent and low-regret actions.

Low-regret action:

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

Examples may include:

- protecting existing drainage routes from obstruction;
- inspecting critical evacuation roads;
- updating emergency contact information;
- identifying vulnerable facilities;
- avoiding new development in locations already known to experience repeated flooding; and
- beginning community awareness and preparedness activities.

Detailed regulatory measures should be postponed when their evidence base, legal basis, or practical feasibility has not been established.

3.3.5 Applying the matrix to the Troodos example

The appropriate planning condition should be assessed for each specific recommendation rather than assigning one permanent category to the entire Troodos region.

For the protection of wildfire evacuation routes, available hazard information may be relatively strong, while institutional responsibility may remain distributed among forestry, transport, civil-protection, local-government, and land-management authorities.

In such a case, the relevant condition may be:

“Strong or developing evidence, but fragmented institutional responsibility.”

The HSTF should then be used to:

- identify the roads and communities requiring priority attention;
- assign a lead authority;
- clarify the supporting roles of forestry, transport, and civil protection;
- confirm the legal basis for vegetation management;
- connect the action to forest, transport, and evacuation plans;
- establish a shared maintenance programme; and
- agree on common monitoring indicators.

If detailed information is unavailable for a particular road or settlement, the recommendation should be marked as preliminary and followed by a targeted inspection or data-collection action.

3.3.6 A proportionate-use rule

The HSTF should be applied in proportion to the importance of the decision and the quality of the available evidence.

A preliminary awareness action may be based on qualitative information. In contrast, a decision that restricts development rights, requires substantial private expenditure, or directs major public investment requires stronger evidence, formal legal review, and stakeholder consultation. A practical rule for this manual is:

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

This rule helps prevent two common mistakes:

- delaying all action until perfect information becomes available; and
- adopting highly specific or restrictive measures that are not supported by sufficient evidence.

3.4 Ethical considerations and policy trade-offs

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

A new flood-retention area may protect one neighbourhood but require land from another. A building requirement may reduce heat risk but impose costs that lower-income households cannot afford. A new urban park may improve cooling and public space but contribute to rising rents. Vegetation clearance may reduce wildfire risk but damage habitats or increase erosion if it is poorly designed.

Land-use decisions are therefore not socially neutral. They influence:

- who receives protection;
- who pays for the intervention;
- whose land or activities are restricted;
- whether risk is transferred to another place or group;
- who participates in the decision; and
- who remains responsible if the measure does not perform as expected.

An ethical approach to adaptation does not mean avoiding difficult decisions. It means identifying these effects openly, comparing alternatives, involving affected groups, and introducing safeguards where the burdens are unfair or avoidable. This principle is closely connected to the idea of just resilience: reducing climate risk while ensuring that vulnerable groups are not excluded from the benefits of adaptation or burdened disproportionately by its costs (IPCC, 2022; European Environment Agency, 2025).

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 a new problem, transfers risk elsewhere, or increases existing inequalities (IPCC, 2022).

For example:

- a flood barrier may protect one area while directing water towards another;
- extensive vegetation clearance may reduce wildfire fuel but increase erosion and habitat loss;
- increased irrigation may protect crops in the short term but intensify water scarcity;
- air-conditioning may reduce indoor heat exposure but increase energy costs and electricity demand;
- a mandatory building retrofit may improve safety but place an unaffordable cost on low-income owners or tenants; and
- closing a high-risk road may improve immediate safety but isolate residents who have no practical alternative route.

The ethical question is not only whether a measure reduces a particular risk. It is also whether it creates another risk, and who bears that new risk.

Where an adaptation requirement creates substantial private costs, public authorities should consider supporting measures such as:

- grants or subsidies for low-income households;
- favourable loans or staged compliance periods;
- technical assistance for small businesses, farmers, or property owners;
- exemptions or alternative compliance routes where these are legally and technically justified;
- public investment in shared protective infrastructure; and
- targeted support for tenants, older people, people with disabilities, and other groups with limited capacity to adapt.

These safeguards do not remove the need for protective action. They help ensure that the action does not penalise the people who are least able to absorb its costs.

Decision-maker checkpoint:

A measure should not be considered successful if it reduces physical risk while creating an avoidable social, economic, or environmental burden of comparable importance.

Key question for reflection:

Could the proposed measure create a new risk or an unfair financial, social, or environmental burden, and who would be most affected?

3.4.2 Risk maps, property values, and insurance

Risk maps are important tools for showing where hazards, exposed assets, and vulnerable populations are located. They support land-use decisions, emergency planning, infrastructure investment, and public awareness.

However, publishing or formally adopting a risk map may also raise concerns about:

- property values;
- development rights;
- access to mortgages or insurance;
- the cost or availability of insurance;
- the reputation of a neighbourhood or tourism destination; and
- whether the information is sufficiently detailed and up to date.

These concerns are not a reason to hide risk information. People have a legitimate interest in understanding the hazards that may affect them. However, maps should be communicated responsibly.

Public authorities should:

- explain what the map shows and what it does not show;
- state the date, spatial resolution, evidence base, and level of uncertainty;
- avoid describing an area as simply “safe” or “unsafe” when the evidence does not support such a clear distinction;
- distinguish between preliminary screening maps and maps approved for regulatory use;
- provide a process for correcting inaccurate information;
- update the map when improved evidence becomes available;
- explain how the information will be used in planning and investment decisions; and
- accompany risk disclosure with information about planned protective measures, financial support, and available advice.

A simple comparison:

A risk map is similar to a medical test. It can reveal an important warning, but its meaning depends on the quality of the test, the circumstances of the individual case, and the actions taken afterwards. Publishing the result without explanation or follow-up may create fear without improving safety.

Where a map may affect development rights, property values, insurance, or substantial private investment, its technical evidence and legal basis should receive appropriate review before formal adoption.

3.4.3 Environmental gentrification and unequal access to benefits

Blue-Green Infrastructure can provide cooling, runoff management, cleaner air, recreation, biodiversity, and improved public space. However, these benefits may not always be distributed fairly.

Investment in a new park, waterfront, green corridor, or climate-resilient neighbourhood may increase the attractiveness and value of the surrounding area. In some locations, this may contribute to higher rents or redevelopment pressure, making it more difficult for existing lower-income residents or small businesses to remain. This process is often referred to as environmental or green gentrification.

At the same time, disadvantaged neighbourhoods frequently have less access to high-quality green and blue space, even though their residents may benefit considerably from cooling, shade, recreation, and improved environmental quality (European Environment Agency, 2021; European Environment Agency, 2025).

Public authorities should therefore examine:

- which neighbourhoods currently have the least protection and environmental investment;
- who will have practical access to the new facility;
- whether the intervention may increase housing or commercial displacement pressure;
- whether tenants as well as property owners will benefit;
- whether the design meets the needs of children, older people, people with disabilities, and other vulnerable users;
- whether affordable housing or local-business protections are needed; and
- whether changes in rents, property values, accessibility, and population composition should be monitored.

The appropriate response is not to avoid environmental improvement in lower-income areas. It is to combine environmental investment with social and housing safeguards so that existing communities can remain and benefit from the improvement.

3.4.4 Participation and procedural fairness

A decision may provide an appropriate technical outcome but still be considered unfair if affected people were excluded from the process.

Meaningful participation helps public authorities:

- identify local knowledge that may not appear in technical datasets;
- understand how different groups use buildings, roads, water, forests, and public spaces;
- identify unintended effects at an early stage;
- explain the evidence and limitations behind a proposal;
- compare alternative measures;
- understand which costs or restrictions are likely to create opposition; and
- build long-term support for implementation and maintenance.

Participation should begin early enough to influence the decision. Informing residents after the main design and funding decisions have already been made is communication, but it is not co-creation.

The process should also include people who may not normally attend public meetings, including:

- older residents;

- people with disabilities and their carers;
- low-income households;
- tenants;
- small farmers and businesses;
- seasonal workers;
- young people;
- residents of remote communities; and
- visitors or tourism operators where emergency planning affects them.

Information should be provided in clear language and, where necessary, in accessible formats or more than one language. Public authorities should explain which elements of the proposal can still change, which are legally or technically fixed, and how stakeholder feedback influenced the final decision.

Participation does not mean that every stakeholder must agree with every decision. It means that affected groups have a genuine opportunity to understand the proposal, express their concerns, offer local knowledge, and receive a reasoned explanation of the final decision.

3.4.5 Applying the ethical screen to the Troodos recommendation

Consider the working Troodos recommendation developed in Section 2.2:

“Manage vegetation and wildfire fuel beside critical roads, protect evacuation corridors, and provide alternative emergency-access routes where feasible.”

The recommendation has a clear safety objective, but several ethical and environmental questions must still be considered.

Who benefits?

Residents, visitors, emergency services, tourism businesses, and communities served by roads with limited alternatives may all benefit from safer evacuation and emergency access.

Who may bear the costs?

Costs may fall on public authorities, private landowners, local businesses, or residents required to manage vegetation on their property. Small landowners or older residents may lack the financial or physical capacity to carry out repeated vegetation management.

Could the measure create another environmental problem?

Extensive or poorly targeted clearance could damage habitats, destabilise slopes, increase erosion, or accelerate runoff after heavy rainfall. Vegetation management

should therefore be selective, risk-based, and coordinated with environmental and forest-management requirements.

Could access become less fair?

An evacuation plan designed mainly around private vehicles may not meet the needs of residents without cars, people with reduced mobility, visitors unfamiliar with the area, or people requiring assistance. The plan should explain how these groups will receive warnings, transport, and practical support.

Who should participate?

Relevant participants may include local communities, the Forestry Department, road and transport authorities, civil-protection services, emergency responders, environmental organisations, private landowners, tourism operators, and organisations representing vulnerable residents.

What safeguards are appropriate?

Possible safeguards include:

- targeted financial or practical assistance for vegetation management on vulnerable households' property;
- environmental review of clearance widths and methods;
- erosion-control and habitat-restoration measures;
- accessible evacuation arrangements for people without private transport;
- clear compensation or land-access procedures where private property is affected;
- transparent criteria for prioritising roads and communities; and
- monitoring of both wildfire-safety and environmental outcomes.

The ethical review does not weaken the original recommendation. It improves it by making the action safer, fairer, and more likely to receive long-term community support.

3.4.6 A practical ethical and equity screening check

Before approving an HSTF recommendation, decision-makers should complete the screening questions in Table 9.

Table 9. 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 arrangements before implementation.

A recommendation should proceed only when decision-makers can explain not only how it reduces climate risk, but also how its benefits and burdens will be distributed, which groups have participated, and what safeguards will prevent avoidable harm.

Final decision-maker checkpoint:

A good adaptation measure should reduce risk without transferring an unfair share of its financial, social, or environmental costs to those who are least able to bear them.

4 Key messages and next steps

The Hazard–Sector Translation Framework helps public authorities move from climate-risk information to land-use recommendations that can be explained, implemented, and monitored. Its main value lies in making the reasoning behind a recommendation traceable.

The framework does not replace detailed hazard modelling, engineering design, environmental assessment, legal review, or stakeholder consultation. Instead, it connects these activities by clarifying:

- how a climate-related pressure may produce consequences within a territory;
- which territorial systems and land-use domains are affected;
- what type of action may reduce the risk;
- which planning instrument could put the action into practice;
- what resilience function the action is expected to provide; and
- what governance and ethical safeguards are needed for implementation.

The framework should be used as an iterative process. New evidence, implementation experience, stakeholder feedback, and monitoring results may require an earlier decision to be reviewed or revised.

4.1 Key messages

The following messages summarise the main lessons of this manual.

1. Begin with a hazard pathway, not only a list of hazards.

Knowing that a region faces wildfire, flooding, drought, heat, or coastal erosion is not sufficient for planning. Decision-makers need to understand how the climate-related pressure interacts with people, buildings, infrastructure, economic activities, and ecosystems to produce a consequence that can be addressed.

2. Maintain a clear translation chain.

Each recommendation should be traceable through the six HSTF steps:

- I. Hazard pathway;
- II. Affected territorial system;
- III. Land-use resilience domain;
- IV. Recommendation family;
- V. Planning instrument; and
- VI. Expected resilience function.

If one of these connections cannot be explained, the recommendation may require further evidence or clarification.

3. Use land-use domains as planning entry points, not as administrative silos.

The five domains help identify the main planning interface through which an action may be implemented. However, a single hazard pathway may affect several domains and involve several organisations. Cross-sectoral coordination is therefore essential.

4. Connect every recommendation to implementation conditions.

A technically appropriate recommendation will not produce results unless decision-makers identify:

- a responsible coordinating organisation;
- the supporting organisations;
- the necessary legal authority;
- an appropriate planning instrument;
- possible funding sources;
- maintenance responsibilities;
- monitoring indicators; and
- a procedure for reviewing progress.

5. Match the level of detail to the strength of the evidence.

Limited information does not prevent a region from beginning adaptation planning. It does require uncertainty to be stated clearly.

Preliminary or low-confidence recommendations should favour low-regret, reversible, or exploratory actions. Measures that restrict development rights, impose substantial private costs, or direct major public investment require stronger evidence, technical validation, legal review, and stakeholder consultation.

6. Seek multifunctional benefits, but confirm local suitability.

A well-designed intervention may reduce several risks and provide environmental or social co-benefits. Blue-Green Infrastructure, for example, may support cooling, runoff management, biodiversity, and public-space improvement.

Multifunctionality should not be assumed automatically. The suitability, environmental consequences, maintenance needs, and performance of each measure must be assessed in relation to local conditions.

7. Examine who benefits and who bears the costs.

Adaptation decisions are not socially neutral. Decision-makers should identify:

- which people and places receive protection;
- who pays or faces new restrictions;
- whether risk is transferred elsewhere;
- whether vulnerable groups can access the benefits;
- whether the action may contribute to displacement or inequality; and
- whether affected groups had a meaningful opportunity to participate.

A measure should not be considered successful if it reduces one physical risk while creating an avoidable social, economic, or environmental burden of comparable importance.

8. Treat monitoring as part of the decision, not as a later addition.

Monitoring should be planned when the recommendation is developed. Each action should have a clearly stated expected function, one or more measurable indicators, a responsible organisation, a reporting timetable, and a process for corrective action.

Monitoring results should be used to revise the recommendation when conditions, evidence, or performance change.

The central message of this manual is:

A climate-resilience recommendation becomes actionable when the pathway, proposed action, planning instrument, responsible organisations, safeguards, and intended result can all be explained as one connected decision.

4.2 What can decision-makers do next?

A region does not need to complete an assessment of every climate hazard before beginning to use the HSTF. A practical starting point is to select one important hazard pathway and take it through the complete process.

4.2.1 Step 1: Establish a small coordinating team

Bring together the organisations that hold relevant evidence, legal responsibilities, operational knowledge, or implementation capacity.

The initial team may include representatives from:

- spatial or land-use planning;
- civil protection and emergency management;
- infrastructure and transport;
- environmental or forest management;
- water management;

- public health;
- social services;
- finance and public investment;
- local government; and
- relevant research or technical organisations.

At this stage, the purpose is not to create a new permanent institution. It is to establish a clear working arrangement for preparing and reviewing the first application.

4.2.2 Step 2: Select a priority hazard pathway

Select a pathway that is sufficiently important, understandable, and connected to an existing public decision.

Priority may be given to pathways involving:

- possible loss of life or serious health consequences;
- critical infrastructure or essential services;
- vulnerable or geographically isolated communities;
- repeated or recently observed impacts;
- irreversible environmental or cultural losses;
- existing investment or planning decisions;
- known institutional responsibilities; or
- opportunities for early, low-regret action.

The selected pathway should be described in one clear sentence showing the climate-related pressure, the exposed territorial system, and the possible consequence.

4.2.3 Step 3: Assemble the minimum evidence base

Collect the information required to understand the pathway and support an initial recommendation. This may include:

- regional or national hazard maps;
- climate observations and projections;
- records of previous events;
- infrastructure and land-use data;
- environmental information;

- municipal maintenance records;
- emergency-service experience;
- demographic and social-vulnerability information;
- stakeholder and community knowledge; and
- relevant legislation, plans, and investment programmes.

Record the source, date, geographic scale, limitations, and level of confidence of the evidence. Important information gaps should be documented rather than hidden.

4.2.4 Step 4: Complete the six-step HSTF sequence

Translate the pathway into:

1. the affected territorial system;
2. the main and supporting land-use domains;
3. a suitable recommendation family;
4. a specific planning or management action;
5. the instrument through which it may be implemented; and
6. the expected resilience function.

More than one alternative may be considered before selecting the preferred recommendation.

4.2.5 Step 5: Apply the governance and ethical checks

Test the recommendation against the three governance transition points introduced in Section 3.2:

- institutional responsibility;
- legal authority and funding; and
- stakeholder support, maintenance, and monitoring.

Then determine which planning condition from Section 3.3 best describes the recommendation and apply the ethical and equity screen from Section 3.4.

Where a concern is identified, the recommendation should be revised, supported by additional evidence, or accompanied by appropriate safeguards.

4.2.6 Step 6: Consult affected stakeholders and technical specialists

Consultation should occur while alternatives can still be changed. Decision-makers should present:

- the identified pathway;
- the supporting evidence and uncertainties;
- the proposed action and alternatives;

- the expected benefits;
- possible costs and restrictions;
- potential environmental and social effects; and
- the proposed implementation and monitoring arrangements.

Specialist review may also be required for engineering, environmental, legal, financial, public-health, or social aspects of the recommendation.

4.2.7 Step 7: Integrate, fund, implement, and monitor the action

The final recommendation should be incorporated into an appropriate planning, regulatory, administrative, investment, or maintenance instrument.

Before implementation begins, decision-makers should confirm:

- who has approved the action;
- who will coordinate implementation;
- which organisations will perform individual tasks;
- what funding is available;
- how affected stakeholders will be informed or supported;
- what safeguards must be applied;
- how performance will be monitored; and
- when the action will be reviewed.

Table 10 provides a minimum record for documenting this process.

Table 10. Minimum HSTF implementation record

Field	Information to record
Priority hazard pathway	The climate-related pressure, exposed system, and potential consequence.
Evidence and confidence	Main data sources, dates, geographic scale, limitations, and confidence level.
Affected territorial system	People, infrastructure, buildings, activities, ecosystems, or services at risk.
Main land-use domain	The primary planning interface through which the pathway can be addressed.
Supporting domains	Other domains that influence the pathway or proposed response.
Proposed action	The specific measure or coordinated package of measures.
Alternatives considered	Other options examined and the reason for selecting the preferred action.
Planning instrument	The legal, regulatory, administrative, financial, investment, or maintenance mechanism through which the action will be implemented.
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Expected resilience function	The practical result the action is intended to provide.
Lead coordinating organisation	The organisation responsible for coordinating progress and reporting.
Supporting organisations	The organisations responsible for individual tasks or specialist support.
Legal authority	The legal basis for adopting, implementing, or enforcing the action.
Funding and resources	Confirmed or potential funding, staff, technical support, and equipment.
Stakeholders	Groups affected by the action or required for its implementation.
Ethical and environmental safeguards	Measures to prevent unfair burdens, risk transfer, environmental harm, or exclusion.
Monitoring indicators	Measurable indicators connected to the expected resilience function.
Review arrangements	Reporting timetable, review date, responsible body, and procedure for corrective action.

Applying the next steps in Troodos

For the running Troodos example, an initial application could focus on the pathway through which hotter and drier conditions increase wildfire danger, while dense vegetation near mountain settlements and narrow roads may contribute to the obstruction of evacuation and emergency-access routes.

The first practical output would not need to be a complete regional wildfire plan. It could be a jointly agreed priority list of communities and road sections requiring further inspection and coordinated action.

The implementation record would identify:

- the available wildfire, vegetation, road-access, and community-vulnerability evidence;
- the roads and settlements requiring priority assessment;
- the main and supporting land-use domains;
- the responsible authorities and landowners;
- the legal basis for vegetation and road management;
- the relevant forest-management, transport, maintenance, and emergency-planning instruments;
- the required environmental and social safeguards;
- potential funding and maintenance arrangements; and
- illustrative indicators for route inspection, maintenance, and accessibility.

Where evidence is insufficient for a particular road or settlement, a targeted inspection or data-collection activity should be recorded as the next action.

This focused application could then be reviewed, improved, and extended to other communities or hazard pathways.

4.3 Further resources

Error! Reference source not found. shows the recommended platforms for further reading and access to related project resources.

Table 11: 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

IPCC Sixth Assessment Report: Impacts, Adaptation and Vulnerability

The Working Group II contribution to the Sixth Assessment Report provides the wider scientific basis for understanding climate impacts, adaptation, vulnerability, maladaptation, equity, and climate-resilient development.

Web address: <https://www.ipcc.ch/report/ar6/wg2/>

These resources should be used together with the applicable national and local legislation, spatial plans, sectoral strategies, technical standards, emergency plans, environmental requirements, and official regional datasets.

5 References

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- 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: Practical planning exercises and checklists

This annex provides practical worksheets for applying the Hazard–Sector Translation Framework to a real regional or local planning problem.

The exercises may be used:

- during a facilitated workshop;
- by a small interdepartmental working group;
- when preparing or reviewing a climate-adaptation recommendation;
- as part of training for public authorities; or
- as a record supporting a planning, funding, or investment decision.

The exercises should normally be completed in sequence. However, regions that have already developed part of a recommendation may begin with the exercise most relevant to their current needs.

The completed worksheets do not replace the technical studies, legal procedures, environmental assessments, or formal approvals required for implementation. Their purpose is to make the evidence, reasoning, responsibilities, uncertainties, and safeguards behind a recommendation visible and traceable.

Preparing the exercise

Before beginning, identify:

- the geographic area under consideration;
- the public decision or problem to be addressed;
- the organisation requesting the assessment;
- a facilitator or coordinating officer;
- the organisations that should participate;
- the evidence already available; and
- the intended use of the results.

Participants may include representatives from spatial planning, civil protection, infrastructure, environmental management, public health, social services, finance, local government, research organisations, and affected communities.

The exercises can be completed during one extended workshop or divided across several shorter sessions. Additional technical or stakeholder consultation may be required between exercises.

Table A12. Workshop and assessment record

Field	Information
Assessment title	
Geographic area	
Decision or planning process being supported	
Date and location	
Coordinating organisation	
Facilitator	
Participating organisations	
Stakeholder groups represented	
Evidence reviewed before the exercise	
Important evidence not yet available	
Intended use of the results	
Version and review date	

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 A13. 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 A13. The connection between consecutive steps should be explained clearly. Where several options are possible, record the alternatives before selecting the preferred approach.

Table A14. 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 A15. 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 9 of Section 3.4 and summarise the results below.

Table A16. 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 A17. 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 A17 for each main indicator.

Table A18. 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 A8 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 A19. 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	
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resources defined?

Have affected stakeholders participated meaningfully?

Have vulnerable or under-represented groups been considered?

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.

A1.7 Optional training application

For a training workshop, participants may apply the worksheets to the following pathway:

In your mountain region, hotter conditions and prolonged dry periods may increase the dryness of forest soils and vegetation. Where combustible vegetation is located close to mountain settlements and narrow roads, wildfire may obstruct evacuation routes, delay emergency access, and isolate communities.

Participants should select one settlement or road corridor rather than assessing the entire region at once.

The exercise should identify:

- the evidence available for the selected location;
- the affected communities and services;
- the main and supporting land-use domains;
- possible vegetation-management, road-maintenance, emergency-access, and evacuation measures;
- the authorities and landowners involved;
- the relevant legal and planning instruments;
- environmental and social safeguards;
- arrangements for residents without private transport or requiring assistance; and
- indicators for route inspection, maintenance, accessibility, and environmental effects.

The purpose of the exercise is not to assume that the illustrative recommendation is automatically suitable for every community. It is to test how the HSTF can support a transparent, location-specific, and proportionate planning process.