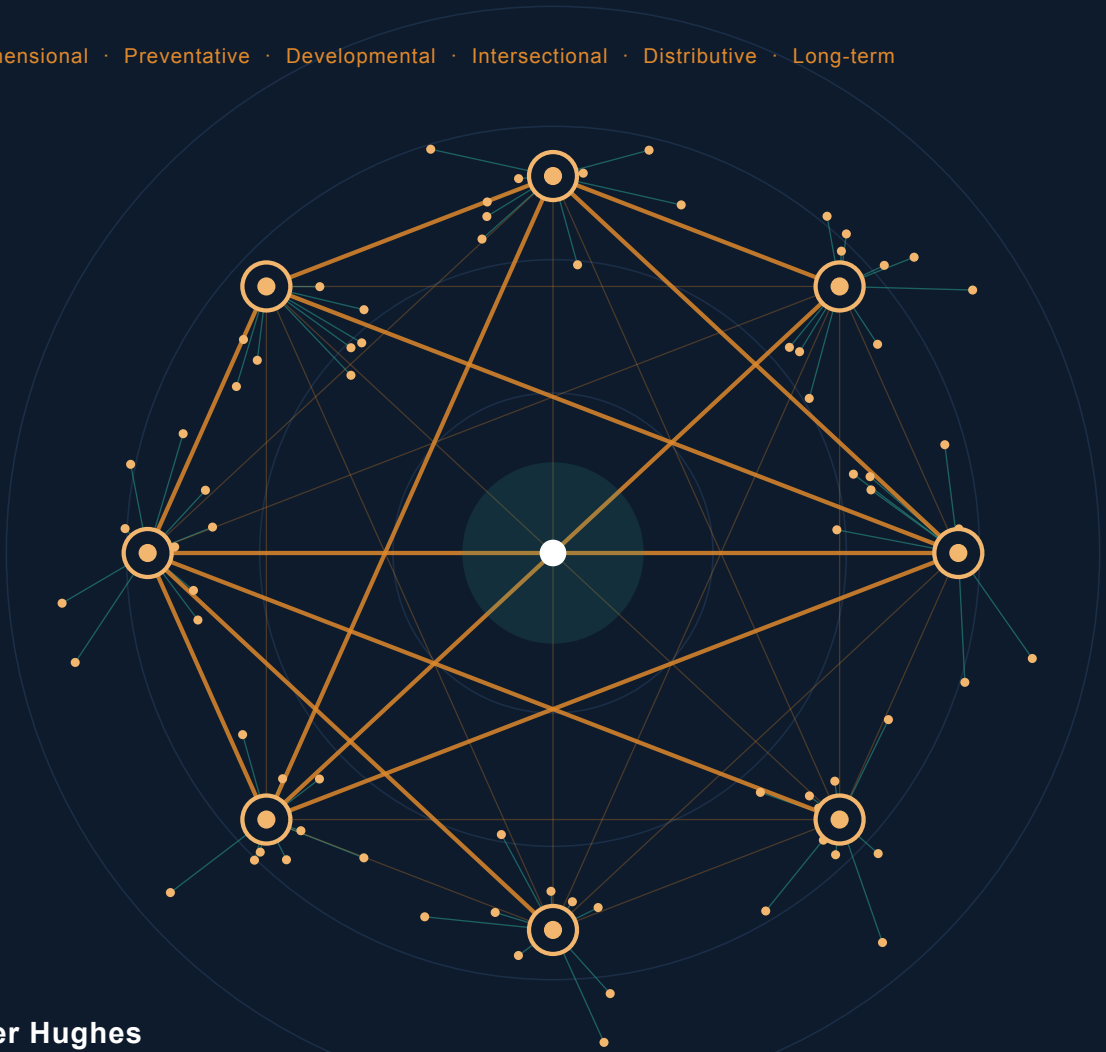
H HEURISTICS

RESEARCH REPORT · NOVEMBER 2026

Polycrisis Resilience

Defining the capacity to withstand, adapt to, and reduce the interconnected risks of the 21st century

Multidimensional · Preventative · Developmental · Intersectional · Distributive · Long-term



Hunter Hughes

H Heuristics · Research Report on the foundations of a new concept

Contents

About This Report . . . 3
Executive Summary . . . 4
1. The Overarching Effort . . . 6
2. Defining Polycrisis Resilience . . . 8
3. Intellectual Lineage . . . 11
4. The Anatomy of the Polycrisis . . . 13
5. Why Isolated Resilience Falls Short . . . 17
6. The Polycrisis Resilience Framework . . . 19
7. Intersectional Opportunities . . . 22
8. The Economics of Polycrisis Resilience . . . 24
9. Resilience for Whom? The Distributive Imperative . . . 26
10. The Long-Term Horizon . . . 28
11. Measuring Polycrisis Resilience . . . 29
12. Strategic Pathways: What To Do . . . 31
13. Critiques, Limits and the Research Agenda . . . 33
14. The H Heuristics Program and Conclusion . . . 35
Glossary . . . 37
References . . . 38

About This Report

This report is the founding statement of **Polycrisis Resilience**, a term and a framework developed by H Heuristics. Its purpose is to establish the concept: to define it precisely, to show where it comes from and what it adds, to set out a structure that others can test and apply, and to specify the research and public-education work needed to turn it from an idea into a field.

The report is conceptual and synthetic. It draws on published evidence from climate science, disaster-risk research, development economics, complex-systems theory and the polycrisis literature, and it contributes four things of its own: a definition with six defining properties; a framework of capacities, capability classes and scales; a set of screening and measurement tools; and a research agenda. Its own analysis is labeled as illustrative and graded as such.

How to read this report

Each chapter opens with a short summary box. **Part I** (Chapters 1 to 3) establishes the problem, the definition and the intellectual lineage. **Part II** (Chapters 4 and 5) analyzes the structure of interacting crises and why isolated responses fall short. **Part III** (Chapters 6 to 10) builds the framework, applies it to concrete capabilities, and examines its economic, distributional and long-term dimensions. **Part IV** (Chapters 11 to 14) turns to measurement, action, criticism and the work program. Readers short of time can read the Executive Summary and Chapter 2.

Evidence grades

Claims are graded on the four-level scale used across H Heuristics research. The grade describes the state of knowledge, not the importance of the claim. Illustrative analyses by H Heuristics are always grade C or D.

Table 1. Evidence grades used in this report

Grade	Meaning	Example from this report
A: Established	Confirmed by multiple independent lines of evidence and assessed as such by leading scientific or statistical bodies.	Seven of nine planetary boundaries are assessed as transgressed.
B: Well supported	Strong evidence from several lines of work, with some unresolved detail or range.	Adaptation and resilient infrastructure investments generally return more than they cost.
C: Plausible or contested	A credible argument with partial evidence; specialists disagree on size or mechanism.	Coupling between crisis domains makes joint stress more likely than independence implies.
D: Speculative	A scenario or hypothesis offered for evaluation, labeled as such.	That a composite resilience index can rank countries usefully.

Source: H Heuristics.

Illustrative analyses. Four exhibits are H Heuristics constructions rather than reported data, and each is labeled where it appears. **Figure 2** and **Figure 6** rest on qualitative scores assigned by the author from the literature (grade C). **Figure 4** is a stylized simulation that shows a mechanism, not a forecast (grade C). **Figure 10** uses hypothetical profiles to illustrate an aggregation choice (grade D). Every other figure reports data from the cited source.

How to cite. Hughes, H. (2026). *Polycrisis Resilience: Defining the Capacity to Withstand, Adapt to and Reduce the Interconnected Risks of the 21st Century.* H Heuristics Research Report, November 2026.

Executive Summary

The central thesis

Humanity's major challenges do not operate independently. Climate change, pollution, economic instability, technological disruption, demographic transitions, resource constraints, conflict and unequal development increasingly interact, and the interactions, not the individual challenges, now drive much of the risk. A response organized domain by domain therefore misses the thing that makes the situation dangerous. **Polycrisis Resilience** is H Heuristics' proposed framework for responding to the interactions themselves.

Polycrisis Resilience

H Heuristics proposed definition

Polycrisis Resilience is the capacity of individuals, communities, economies, institutions, and interconnected systems to anticipate, withstand, adapt to, recover from, and reduce the cascading and compounding effects of multiple interconnected crises.

It encompasses the development and diffusion of technologies, infrastructure, knowledge, institutions, and socioeconomic capabilities that reduce systemic vulnerabilities, strengthen adaptive capacity, and improve human survivability across interacting environmental, economic, technological, and societal challenges.

What the concept adds

Existing bodies of work each capture part of the problem. The polycrisis literature explains how crises become entangled but says less about what to build. Resilience research says what makes systems adaptive but is usually applied to one hazard or one system. Disaster-risk reduction and climate adaptation supply tools but are organized by hazard. Sustainable development supplies goals but treats risk as secondary. Polycrisis Resilience joins these: it takes the entanglement of crises as the object to be addressed and development, technology and institutions as the means of addressing it. Its six defining properties (multidimensional, preventative, developmental, intersectional, distributive and long-term) are what separate it from adjacent concepts.

Principal findings

- **The risks are interacting, and the evidence base is strong.** Seven of nine planetary boundaries are now assessed as transgressed; air pollution is linked to about 7.9 million deaths a year; and 3.4 billion people live in countries that spend more on interest than on health or education. These are not separate problems with separate solutions (Chapter 1).
- **Coupling changes the shape of risk, not just its size.** In a stylized simulation, raising the correlation between eight stress domains from zero to 0.5 leaves the chance of at least one domain in acute stress lower (37% against 57%) but raises the chance of three or more from 3.8% to 11.1%, and of five or more from 0.04% to 3.6%, a roughly 80-fold increase. Quiet years become more common and the worst years much worse (Chapter 5, grade C).
- **Intersectional capabilities are the most valuable.** In a qualitative screen of twelve capabilities against eight stress domains, girls' education, distributed clean energy, resilient infrastructure and diversified food systems

score highest because they reduce vulnerability in most or all domains at once (Chapter 7, grade C).

- **The economics favor prevention but the finance does not follow.** Estimated adaptation needs in developing countries are $310 to $365 billion a year by 2035 against international public flows of $26 billion in 2023; disaster costs including cascading effects exceed $2.3 trillion a year, while only about 2% of development aid goes to disaster-risk reduction (Chapters 8 and 9, grade B).
- **Resilience that stops at the border fails.** Weak points propagate through trade, migration, disease, finance and conflict, so distribution is a condition of effectiveness as well as a matter of fairness (Chapter 9).
- **Measurement is feasible but must be built carefully.** A weakest-link aggregation rule is essential: in the worked illustration two profiles with identical arithmetic averages (60) separate to 60 and 43 under a geometric mean (Chapter 11, grade D).

What this report proposes

- A shared **definition** and vocabulary, centered on five capacities, five classes of capability and five scales of action.
- A six-question **Polycrisis Resilience Test** that any policy, investment or technology can be screened against.
- An indicator architecture for a future **Polycrisis Resilience Profile** of countries and regions, designed to expose the weakest link instead of averaging it away.
- A **research agenda** of ten questions and a three-pillar H Heuristics program: framework, research and public education.

What remains unsettled

The concept is new and its boundaries will be contested. Critics will ask whether it is too elastic to be useful, whether it shifts responsibility from institutions to individuals, whether it favors technical fixes over political change, and whether it can be measured without false precision. Chapter 13 sets out these objections and the responses, and says what evidence would lead H Heuristics to revise or abandon parts of the framework.

PART I · FOUNDATIONS

1. The Overarching Effort

IN BRIEF

- H Heuristics is developing Polycrisis Resilience as a framework for understanding, strengthening and expanding humanity's capacity to withstand, adapt to and reduce interconnected risks.
- The starting observation is that major challenges interact; resilience therefore cannot be built through isolated interventions.
- The ambition is not only to describe the polycrisis but to develop a framework for responding to it.

1.1 The central observation

H Heuristics is developing **Polycrisis Resilience** as a conceptual framework for understanding, strengthening and expanding humanity's capacity to withstand, adapt to and reduce the interconnected risks of the 21st century.

The initiative builds on a central observation: humanity's major challenges do not operate independently. Climate change, pollution, economic instability, technological disruption, demographic transitions, resource constraints, conflict and unequal development increasingly interact.

Consequently, resilience cannot be approached exclusively through isolated interventions. Climate adaptation, economic development, clean technology, healthcare, education, infrastructure and institutional capacity must increasingly be understood in relation to one another.

H Heuristics seeks to establish Polycrisis Resilience as a framework that connects these disciplines and translates their intersections into practical opportunities to reduce human suffering, improve survivability and strengthen long-term development.

The ambition is not simply to describe the polycrisis. It is to develop a framework for responding to it.

1.2 Why the observation matters now

The observation is not speculative. The evidence that crises are accumulating and interacting has strengthened each year, and the language of leading risk assessments has moved with it. The World Economic Forum's Global Risks Report took up the term polycrisis in 2023; its 2026 edition ranks geoeconomic confrontation as the leading near-term risk, followed by interstate conflict and extreme weather, and counts environmental threats as five of the top ten long-term risks (World Economic Forum, 2026). **Table 2** collects eight indicators that show the pattern across the domains this report covers.

Table 2. Eight indicators of an interacting set of crises

Domain	Indicator	Source	Grade
Climate	2025 was about 1.43 °C above the 1850–1900 baseline; 2015–2025 was the warmest eleven-year period on record.	WMO, 2026	A
Ecosystems	Seven of nine planetary boundaries are transgressed; ocean acidification was added in 2025.	Steinert et al., 2025	A
Pollution and health	Air pollution was linked to about 7.9 million deaths in 2023, of which 2.8 million came from household air pollution.	Health Effects Institute, 2025	A/B
Economy and finance	Global public debt reached about $102 trillion in 2024; 3.4 billion people live in countries spending more on interest than on health or education.	UNCTAD, 2025	B
Energy and technology	Clean-energy investment of about $2.2 trillion in 2025 is roughly double fossil-fuel investment; solar electricity costs have fallen about 90% since 2010.	IEA, 2025; IRENA, 2025	B
Disasters	Disaster costs exceed $2.3 trillion a year once cascading and ecosystem effects are counted, against about $202 billion in direct losses.	UNDRR, 2025	B
Adaptation	Developing countries need an estimated $310–365 billion a year for adaptation by 2035; international public flows were $26 billion in 2023.	UNEP, 2025	B
Poverty	About 808 million people are estimated to live below the $3.00-a-day international poverty line in 2025.	World Bank, 2025	B

Sources as shown. The 2025 poverty headcount is a nowcast and varies by source.

Three features of the table matter for what follows. First, the indicators span physical, biological, economic and social systems, and none of them can be moved far in isolation. Second, several of the most severe numbers sit in the same places: many of the countries with the highest debt burdens also have high climate exposure and the lowest adaptation finance. Third, some indicators point in a hopeful direction. Falling clean-technology costs and rising clean-energy investment mean that the means of reducing several risks at once are cheaper than at any time in history. The problem is as much one of connecting what exists as of inventing what does not.

1.3 From description to response

A large literature now describes the polycrisis. Far less has been written on what a society, an economy or a development agency should do differently if it takes the polycrisis seriously. Most responses remain organized by sector or hazard: a climate ministry, a health ministry, a debt office, a disaster agency, each with its own metrics and budgets. Each does valuable work. But risk arrives through the connections between them, and the connections belong to nobody.

Polycrisis Resilience is H Heuristics' attempt to supply the missing response layer. It asks a different question of any proposed action: not only whether it works in its own domain, but what it does to the vulnerability of the other systems it touches, for whom, and over what time horizon.

1.4 Three uses of the concept

H Heuristics is developing Polycrisis Resilience in three connected forms, and the structure of this report follows them.

- **A conceptual framework.** A definition, a vocabulary and a set of principles that let practitioners in different fields describe their work in common terms (Chapters 2 and 6).

- **A research agenda.** A set of open questions about coupling, measurement, economics and governance that need empirical work (Chapters 8, 11 and 13).
- **A public-education initiative.** Plain-language materials that explain interacting risks and what reduces them, aimed at policymakers, students, journalists and the general public (Chapter 14).

PART I · FOUNDATIONS

2. Defining Polycrisis Resilience

IN BRIEF

- Polycrisis Resilience is the capacity of individuals, communities, economies, institutions and interconnected systems to anticipate, withstand, adapt to, recover from and reduce the cascading and compounding effects of multiple interconnected crises.
- Six properties distinguish it from adjacent concepts: it is multidimensional, preventative, developmental, intersectional, distributive and long-term.
- A useful concept must mark a boundary, be operational and be honest about its values. Section 2.5 tests the definition against these standards.

2.1 The definition

Polycrisis Resilience

H Heuristics proposed definition

Polycrisis Resilience is the capacity of individuals, communities, economies, institutions, and interconnected systems to anticipate, withstand, adapt to, recover from, and reduce the cascading and compounding effects of multiple interconnected crises.

It encompasses the development and diffusion of technologies, infrastructure, knowledge, institutions, and socioeconomic capabilities that reduce systemic vulnerabilities, strengthen adaptive capacity, and improve human survivability across interacting environmental, economic, technological, and societal challenges.

2.2 Reading the definition closely

Each phrase of the definition does work. Reading it clause by clause shows the structure on which the framework in Chapter 6 is built.

Who has the capacity: five scales

The definition names **individuals, communities, economies, institutions and interconnected systems**. The list is deliberate. Household resilience that depends on a fragile local economy is brittle; an economy that is resilient on paper but rests on institutions with no capacity to act is brittle too. Polycrisis Resilience is a property that must hold across scales and, above all, between them. The final term, *interconnected systems*, signals that supply chains, power grids, financial networks and information systems are themselves bearers of resilience or fragility, and that no single actor owns them.

What the capacity consists of: five verbs

The definition lists five capacities: to **anticipate**, **withstand**, **adapt to**, **recover from** and **reduce** the effects of crises. Conventional resilience emphasizes the middle three. Anticipation and reduction are what make the concept preventative rather than only reactive. The fifth verb is the most distinctive: it commits the framework to lowering the sources and magnitude of risk, not only to coping with it.

What builds it: five classes of capability

The second paragraph of the definition names the means: **technologies, infrastructure, knowledge, institutions and socioeconomic capabilities**. These are the assets that can be developed and spread. Placing technology and economic advancement on the list is a choice. It reflects the view that wealthier, better-equipped and better-informed societies have more options in a crisis, and that the central task is to make those options available widely.

Against what: cascading and compounding effects

The object of resilience is not any single hazard but **the cascading and compounding effects of multiple interconnected crises**. *Cascading* effects propagate from one system to another; *compounding* effects arise when several stresses hit the same people or systems at once. The two together mark the territory that single-hazard frameworks leave uncovered.

2.3 The six defining properties

The definition establishes six distinctions. Together they separate Polycrisis Resilience from the concepts it builds on. **Table 3** states each as a property, a test question and the failure it guards against; the paragraphs below explain the reasoning.

Table 3. The six defining properties of Polycrisis Resilience

Property	Meaning	Test question	Failure it guards against
Multidimensional	Resilience must account for multiple interacting crisis domains.	Does the action consider at least the climate, economic, technological and social systems it touches?	Siloed optimization that shifts risk elsewhere
Preventative	Reducing the probability and severity of future harm is as important as responding to existing crises.	Does it lower the likelihood or size of future crises, not only the cost of the next one?	A permanent cycle of response and repair
Developmental	Economic and technological advancement can increase the resources available to manage systemic risks.	Does it build lasting economic, technological or human capacity?	Resilience framed as austerity or retreat
Intersectional	Solutions become particularly valuable when they address several vulnerabilities simultaneously.	How many distinct vulnerabilities does it reduce, and does it create new ones?	Single-purpose investments with unpriced side effects
Distributive	Resilience must extend to vulnerable populations and emerging economies, not simply wealthy countries.	Who gains protection, and who is left exposed or pays?	Islands of security in a fragile system
Long-term	Resilience must account for cumulative risks, intergenerational consequences and potentially irreversible damage.	Does it preserve options and avoid lock-in or irreversible harm?	Short-term fixes that store up larger problems

Source: H Heuristics proposed definition; test questions developed for this report.

Multidimensional. A resilient power grid, a solvent state and a stable climate are not three separate achievements. Each depends on the others, and a measure that strengthens one while quietly weakening another may leave total risk higher. Multidimensionality is the property that forces the analysis to look across domains.

Preventative. Most resilience spending in practice follows a disaster. The framework insists that reducing the probability and severity of harm is of equal standing with response. In a world of cascading risk this has special force: preventing the first failure often prevents the second and third.

Developmental. Some conceptions of resilience emphasize endurance and frugality. Polycrisis Resilience takes the opposite view of resources: economic and technological progress expands the means available for managing systemic risk, from cheaper clean energy to better forecasting to larger fiscal buffers. The caveat, developed in Chapter 13, is that development must be of a kind that does not itself create new vulnerabilities.

Intersectional. This is the framework's organizing idea for action. Because crises interact, interventions that reduce several vulnerabilities at once are worth more than the sum of their single-purpose effects. Chapter 7 develops the idea and offers a screening method.

Distributive. A wealthy country cannot be resilient to a global polycrisis if the systems it depends on are fragile elsewhere. The distributive property has an ethical basis, the obligation to reduce suffering where it is greatest, and a structural one, that the weakest link determines the behavior of the network.

Long-term. Cumulative pollutants, ecosystem loss, debt and institutional decay are slow variables whose effects arrive late and may not reverse. The long-term property directs attention to intergenerational consequences and irreversibility, and to keeping options open.

2.4 What Polycrisis Resilience is not

- **Not a synonym for polycrisis.** The polycrisis is the condition; Polycrisis Resilience is the capacity to respond to it.
- **Not only adaptation.** Adapting to impacts is one of five capacities. Reduction and anticipation are equally central.
- **Not a return to the previous state.** In a changing climate and economy there may be no stable baseline to return to. Recovery that preserves vulnerability is not resilience.
- **Not isolation or self-sufficiency.** Cutting links can reduce exposure to cascades but also removes the shared buffers, trade and knowledge flows that make recovery possible. The aim is to manage coupling, not to abolish it.
- **Not a prediction of collapse.** The framework is built for uncertainty, not forecasting. It assumes only that interacting risks are large enough to warrant specific preparation.
- **Not purely technocratic.** Choices about who is protected first and who bears costs are political. The distributive property makes that explicit.

2.5 Is it a good concept?

Concepts of this kind often fail by becoming either too narrow to matter or too broad to use. Five tests help judge whether the definition avoids both.

Table 4. Five tests of a useful concept

Test	Question	How Polycrisis Resilience responds
Demarcation	Does it separate things that should be separated?	It excludes single-hazard, single-system and short-term resilience from its core claim, while treating them as components.
Operability	Can it be turned into tools and measures?	The six test questions (Chapter 6) and indicator architecture (Chapter 11) are designed for this.
Added value	Does it explain or enable something existing concepts do not?	The intersectional and distributive properties generate a distinct prioritization of actions (Chapter 7).
Transparency	Are its values and assumptions stated?	The definition states development, equity and long-term welfare as aims, and Chapter 13 sets out the objections.
Revisability	Could evidence show it to be wrong or unhelpful?	Section 13.3 lists the findings that would lead to revision.

Source: H Heuristics.

PART I · FOUNDATIONS

3. Intellectual Lineage

IN BRIEF

- Polycrisis Resilience stands on four bodies of work: the polycrisis literature, resilience science, planetary-boundary and tipping-point research, and systemic-risk theory.
- Each supplies part of the structure. None, taken alone, supplies a response framework for interacting crises that is developmental, distributive and long-term.
- Naming the debts clearly is part of establishing the concept responsibly.

3.1 The polycrisis concept

The word *polycrisis* is generally traced to Edgar Morin and Anne-Brigitte Kern, who used it in *Terre-Patrie* (1993; English edition *Homeland Earth*, 1999) to describe interwoven and overlapping crises of planetary scale. It was reportedly used in European policy discourse in the 2010s, and it entered wide use after the historian Adam Tooze applied it to the shocks of the early 2020s in the *Financial Times* in October 2022 (Tooze, 2022). The World Economic Forum's Global Risks Report adopted it in 2023.

The most developed analytical treatment comes from the Cascade Institute. Homer-Dixon and colleagues described the emerging causal architecture of synchronous failure in 2015, and Janzwood and Homer-Dixon (2022) proposed that a global polycrisis exists when crises in multiple global systems become causally entangled in ways that significantly degrade humanity's prospects. Lawrence and colleagues (2024) identified three causal pathways: **common drivers**, **domino effects** and **inter-systemic feedbacks**. Chapter 4 uses this typology. A 2025 review by Mark and colleagues surveyed the definitions in use, noted that the term is applied in several different ways, and set out responses for managing it.

That last point marks the gap. The polycrisis literature is strong on diagnosis and thinner on prescription, and critics have observed that the term can describe more than it can help decide. Polycrisis Resilience is H Heuristics' contribution to the second half of the problem.

3.2 Resilience science

Resilience entered ecology through Holling (1973), who distinguished a system's stability from its capacity to absorb disturbance and persist. Walker and colleagues (2004) added *adaptability* and *transformability*, and Folke (2006) extended the perspective to coupled social-ecological systems. The disaster-risk field developed its own tradition, codified in the Sendai Framework (UNDRR, 2015) and tracked by the Global Assessment Reports, which increasingly emphasize systemic risk (UNDRR, 2022). Development economists measured what resilience means for the poor: Hallegatte and colleagues (2017) estimated that natural disasters push about 26 million people into poverty each year and cost about $520 billion in consumption losses. Rodin (2014) and Tanner and colleagues (2015) framed resilience as yielding a *dividend*, a return in good times as well as bad. Aldrich (2012) showed how social capital shapes recovery.

Resilience has also drawn serious criticism. Béné and colleagues (2012) argued that the concept can become a utopian label that shifts responsibility to the vulnerable, and Kates and colleagues (2012) and Pelling (2011) argued that incremental adaptation is sometimes not enough and transformation is required. Polycrisis Resilience accepts both critiques: the distributive property answers the first, and the inclusion of *reduce* among the five capacities answers the second.

3.3 Planetary boundaries and tipping points

Rockström and colleagues (2009) proposed a set of Earth-system boundaries within which humanity can operate safely; Steffen and colleagues (2015) updated the framework, and Richardson and colleagues (2023) concluded that six of nine boundaries had been crossed. The 2025 Planetary Health Check found seven (Steinert et al., 2025). The Earth Commission added a justice dimension with its safe and just boundaries (Rockström et al., 2023). A parallel literature on climate tipping points (Lenton et al., 2019; Armstrong McKay et al., 2022) concluded that several tipping elements could be triggered at warming within the range the world is now approaching, and Kemp and colleagues (2022) argued that low-probability, high-severity climate outcomes deserve more systematic assessment. Ord (2020) placed such risks within a wider analysis of catastrophic threats.

This work supplies the long-term property of the framework: the recognition that some damage is cumulative and irreversible, and that the margin for error in the Earth system is narrowing.

3.4 Systemic risk and complex systems

Perrow (1984) showed that tightly coupled, complex technological systems produce *normal accidents*. Buldyrev and colleagues (2010) showed in *Nature* that interdependent networks can fail catastrophically in ways that isolated networks do not. Helbing (2013) and Centeno and colleagues (2015) applied network thinking to global systemic risk. Scheffer and colleagues (2009) described early-warning signals for critical transitions, and Taleb (2012) introduced the idea of antifragility, systems that gain from disorder. Ostrom (2010) argued that polycentric governance can cope with problems that no single authority can. These ideas give the framework its mechanisms: coupling, buffers, early warning, redundancy and polycentric action.

3.5 What is new

Table 5 compares the principal neighboring concepts. The contribution of Polycrisis Resilience is not any single element, all of which have antecedents, but the combination of an interaction-first view of risk with a response framework that is developmental, distributive and long-term.

Table 5. Polycrisis Resilience compared with neighboring concepts

Concept	Core focus	Strength	Gap that Polycrisis Resilience addresses
Polycrisis (Cascade Institute and others)	How crises become causally entangled	Rigorous diagnosis of mechanisms	Limited prescription; no development or distribution logic
Resilience (social-ecological)	Capacity to absorb disturbance, adapt, transform	Deep theoretical base	Usually applied to one system or hazard
Disaster-risk reduction	Reducing hazard exposure and loss	Operational tools, global framework	Organized by hazard; limited cross-domain view
Climate adaptation	Adjusting to climate impacts	Large policy and finance architecture	One driver among several; adaptation-only emphasis
Sustainable development	Human wellbeing within ecological limits	Agreed goals and indicators	Treats risk and interaction as secondary
Planetary boundaries	Earth-system limits	Clear biophysical thresholds	Not a response framework; limited social dimension
Systemic-risk governance	Managing risks that cross systems	Network and cascade analysis	Focus on financial and technical systems
Polycrisis Resilience	**Capacity to withstand, adapt to and reduce interacting crises**	**Combines interaction-first diagnosis with a developmental, distributive, long-term response**	**Newly proposed; requires empirical testing (grade D for measurement claims)**

Source: H Heuristics synthesis of the works cited in this chapter.

PART II · THE PROBLEM

4. The Anatomy of the Polycrisis

IN BRIEF

- Eight stress domains interact through three mechanisms: common drivers, domino cascades and feedback loops.
- In a qualitative mapping, unequal development, climate change and conflict are the most strongly coupled domains (grade C).
- The 2020–2024 sequence from pandemic to supply-chain disruption to price shocks to debt distress shows the mechanisms operating in the real world.

4.1 Eight stress domains

The framework starts from the eight domains named in H Heuristics' overview: climate change, pollution, economic instability, technological disruption, demographic transitions, resource constraints, conflict and unequal development. The list is a working boundary, not a claim that no other crisis matters; pandemics, for instance, appear in the framework as events that act through several domains at once. **Table 6** summarizes the state of each domain and its principal links.

Table 6. The eight stress domains and their principal couplings

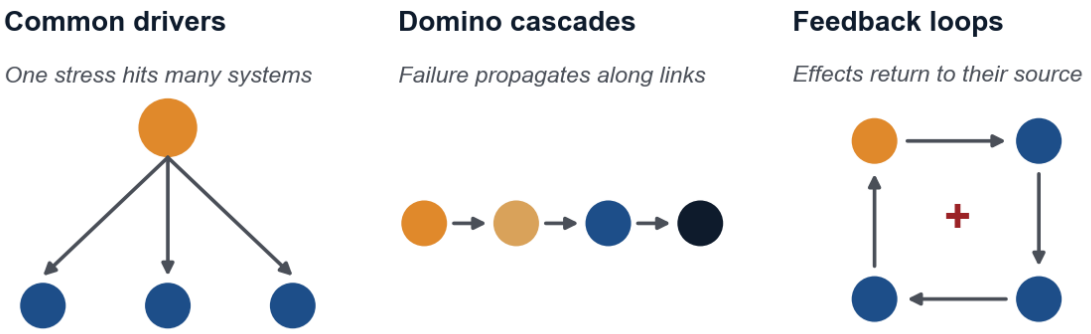
Domain	State of the evidence	Principal couplings
Climate change	Warming of about 1.43 °C above preindustrial in 2025; 2015–2025 the warmest eleven years on record (WMO, 2026).	Resources (water, food, energy demand); economy (damages, insurance); conflict and displacement; inequality
Pollution and ecosystem loss	About 7.9 million deaths linked to air pollution in 2023 (HEI, 2025); biosphere integrity, land and freshwater boundaries transgressed.	Health and productivity; climate (shared sources); resources (water, soils)
Economic and financial instability	Public debt about $102 trillion; interest costs exceed health or education spending for 3.4 billion people (UNCTAD, 2025).	Fiscal space for every other domain; conflict; inequality; technology investment
Technological disruption	Rapid change in automation, artificial intelligence, digital infrastructure and cyber exposure; clean technologies falling in cost.	Economy (labor, productivity); conflict (cyber, information); inequality (access)
Demographic transitions	Population ageing in many countries and young, growing populations in others; UN projections place the global peak near the mid-2080s.	Economy (labor, fiscal); migration and conflict; climate exposure
Resource constraints	Water, soils, critical minerals and energy supply, with several boundaries already transgressed.	Conflict; economy (prices); climate and pollution (extraction, use)
Conflict and fragmentation	Geoeconomic confrontation ranked the leading near-term global risk for 2026 (WEF, 2026).	Economy (trade, sanctions); resources; displacement; inequality
Unequal development	About 808 million people below $3.00 a day; adaptation finance flows far below needs (World Bank, 2025; UNEP, 2025).	Exposure to every other domain; weakest-link effects on global systems

Sources as shown. Couplings are H Heuristics' summary of the literature (grade C). UN population projection from World Population Prospects 2024.

4.2 Three coupling mechanisms

Lawrence and colleagues (2024) identify three ways in which crises become entangled, and **Figure 1** sketches them. They are not mutually exclusive, and a real episode usually involves all three.

Figure 1. The three coupling mechanisms



Source: after Lawrence et al. (2024); schematic by H Heuristics.

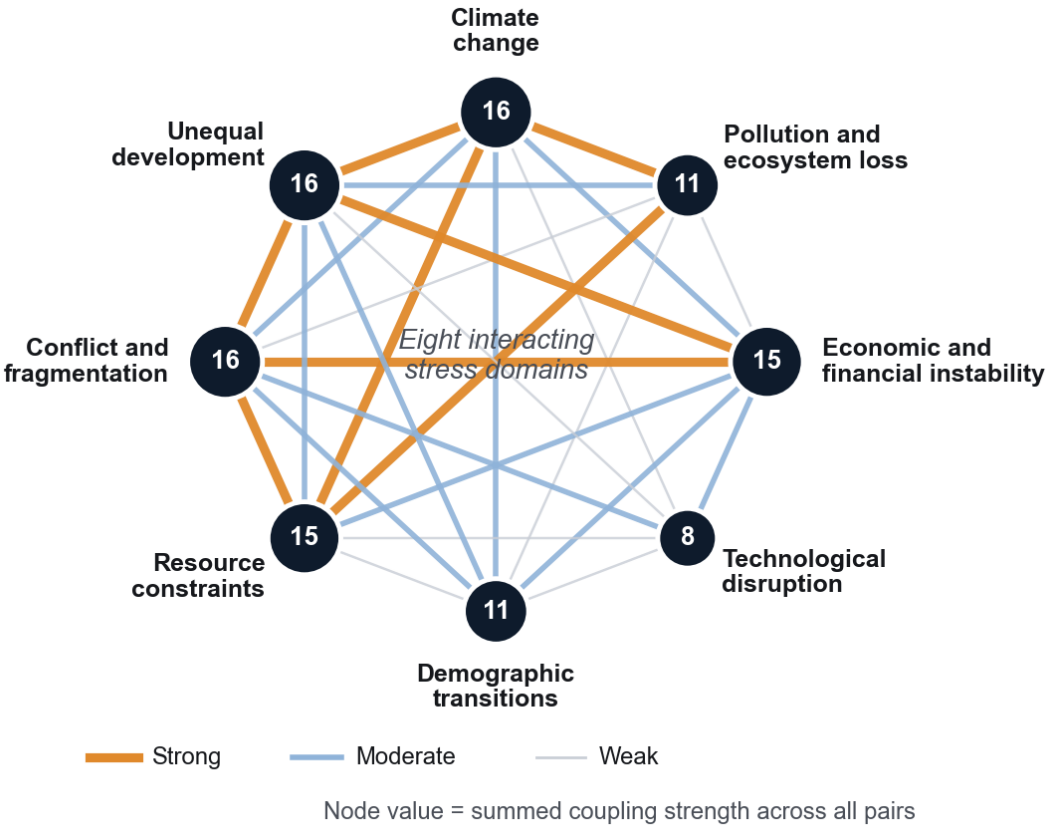
- **Common drivers.** A single stress affects several systems simultaneously. A heatwave strains power grids, reduces crop yields, raises mortality and cuts labor productivity in the same week. The systems need not be linked to each other for their failures to coincide.

- **Domino cascades.** Failure in one system propagates along a chain of dependencies. A port closure disrupts supply chains, which raises prices, which squeezes household budgets, which raises political instability.
- **Feedback loops.** The effect returns to the system that caused it. Fiscal stress reduces investment in adaptation, which increases disaster losses, which increases fiscal stress. Reinforcing loops are what turn shocks into spirals.

4.3 Mapping the couplings

To make the interaction structure visible, H Heuristics assigned qualitative coupling strengths (0 to 3) to each of the 28 pairs of domains, drawing on the literature summarized in **Table 6**. The result is the network in **Figure 2**. Of the 28 pairs, 8 are rated as strongly coupled. The domains with the highest summed coupling are climate change, conflict and unequal development (16 each), followed by economic instability and resource constraints (15 each). Technological disruption is the least coupled in this scoring (8), though its couplings are growing.

Figure 2. A qualitative coupling map of the eight stress domains



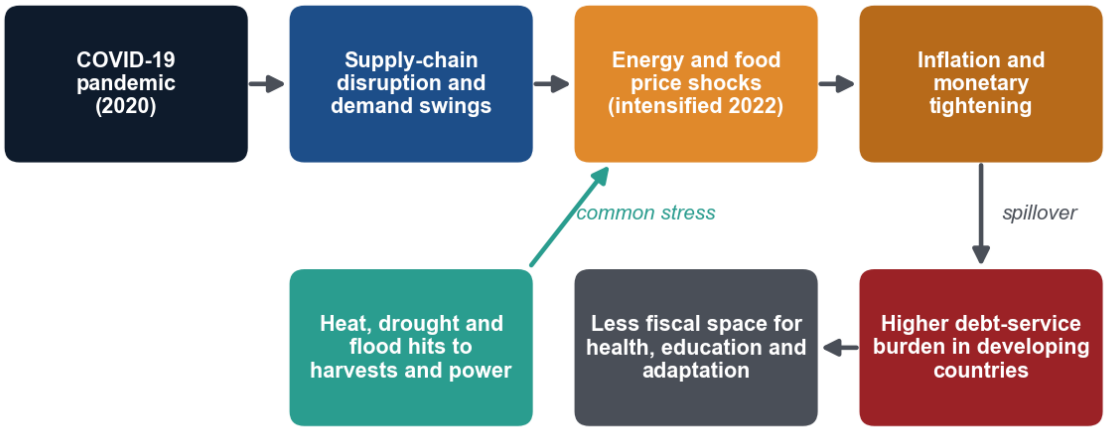
Source: H Heuristics qualitative judgment from the literature (evidence grade C). Coupling strengths are scored 0–3 per pair; they are not measured quantities.

Three cautions apply. The scores are judgments, and other analysts would score differently. Coupling strength varies by place and time. And a high score does not mean a domain is more important in isolation; it means a change there is more likely to propagate. The map is a prompt for discussion and a starting point for measurement, not a finding.

4.4 A worked case: 2020–2024

The sequence that began with COVID-19 illustrates all three mechanisms. The pandemic disrupted production and shipping and unbalanced demand (a common driver of supply-chain failure). Those disruptions, followed by the 2022 war in Ukraine, produced energy and food price shocks (a domino). Inflation led central banks to raise interest rates, which raised debt-service costs across the world, with the heaviest burden on developing countries (a further domino). In many of those countries, higher debt service reduced the fiscal space available for health, education and adaptation just as extreme weather was damaging harvests and power systems (a feedback loop). By 2024, net interest payments by developing countries had reached $921 billion, up 10% in a year (UNCTAD, 2025). **Figure 3** sets out the sequence.

Figure 3. The 2020–2024 cascade from pandemic to reduced fiscal space



Source: H Heuristics schematic based on public accounts of the period; debt figures from UNCTAD (2025).

4.5 What makes a polycrisis different

Four properties distinguish interacting crises from a set of unrelated problems. First, **synchronization**: stresses arrive together, so buffers that would cope with one are exhausted by several. Second, **fat tails**: because the same drivers act on many systems, extreme joint outcomes are far more likely than independence implies (Chapter 5). Third, **time compression**: the interval between shocks shortens, leaving less time to recover. Fourth, **erosion of buffers**: each crisis consumes the fiscal, ecological and social slack on which the next response depends. These four properties are why a response must work at the level of the interactions.

PART II · THE PROBLEM

5. Why Isolated Resilience Falls Short

IN BRIEF

- Siloed responses fail in four ways: they displace risk, understate joint tail risk, fragment finance and institutions, and miss co-benefits.
- A stylized simulation shows that coupling between domains raises the probability of three or more simultaneous stresses from 3.8% to 11.1% and of five or more from 0.04% to 3.6%.
- The implication is that resilience must reduce coupling and build shared buffers, which is what the intersectional property demands.

5.1 Four failure modes of isolated responses

Displacement. An intervention that lowers risk in its own domain can raise it in another. Air conditioning that runs on fossil electricity eases heat exposure while adding to the emissions that cause it. Irrigation that protects a harvest can draw down aquifers on which the next harvest depends. Seawalls can protect one coast and harm another. The literature on *maladaptation* documents such cases. Without a cross-domain view, displacement goes undetected.

Understated joint risk. Risk assessments carried out by domain treat each hazard separately and then combine them as if independent. When drivers are shared, that method understates the probability of several things going wrong in the same year. The next section quantifies the effect.

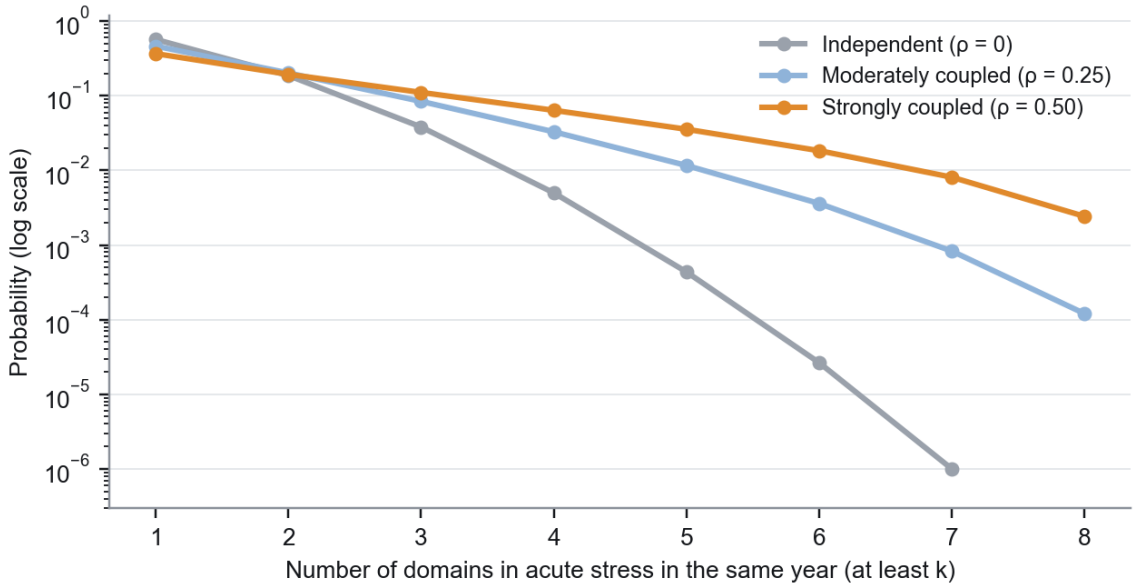
Fragmented finance and institutions. Budgets and mandates follow sectors, so the benefits that fall between sectors are nobody's to claim. The pattern shows in the numbers: only about 2% of development aid goes to disaster-risk reduction (UNDRR, 2025), and international public adaptation finance was $26 billion in 2023 against estimated needs of $310 to $365 billion a year by 2035 (UNEP, 2025).

Missed co-benefits. The corollary of displacement is lost opportunity. A clinic with reliable solar power and cold storage is simultaneously a health, energy, climate and development investment, but it is typically funded, evaluated and scored as only one of them. The programs that serve several domains at once are often the hardest to fund.

5.2 A simulation of joint stress

To show why coupling matters for the whole distribution of outcomes, H Heuristics ran a deliberately simple simulation. Eight domains each have a 10% chance in any year of being in acute stress. The domains are linked through a single shared factor, using a Gaussian copula, with the common correlation (ρ) set at 0, 0.25 and 0.5. Two million simulated years were drawn for each setting. The model is a stylization: it contains no dynamics, no domain-specific parameters and no calibration to history. It shows a mechanism, not a forecast (grade C). **Figure 4** plots the probability that at least *k* domains are in stress at once.

Figure 4. Coupling fattens the tail of joint stress (stylized simulation)



Source: H Heuristics simulation; eight domains, 10% annual stress probability each, Gaussian copula with equal correlation, 2 million trials per setting (evidence grade C). Illustrative only.

Table 7. Selected results of the simulation

Outcome (in the same year)	Independent (ρ = 0)	Coupled (ρ = 0.25)	Strongly coupled (ρ = 0.50)
At least 1 domain in stress	57.0%	46.3%	36.7%
At least 3 domains	3.8%	8.4%	11.1%
At least 5 domains	0.04%	1.16%	3.56%
At least 7 domains	0.0001%	0.08%	0.81%

Source: H Heuristics simulation (grade C). Illustrative only.

Two results stand out. First, the probability of *any* stress falls as coupling rises (from 57% to 37%), because stresses cluster into the same years. Quiet years become more common. Second, the probability of severe years rises steeply: three or more simultaneous stresses become about three times as likely, and five or more about 80 times as likely. An observer who watches the average year may conclude that things are stable while the exposure to the worst years has grown. This is the statistical signature of a polycrisis: an average that looks tolerable and a tail that does not.

5.3 Implications

The simulation suggests two kinds of response. The first is to **reduce coupling**: weaken the shared drivers and the links through which stress travels, by cutting emissions and pollution, diversifying supply, improving the quality of governance and reducing debt vulnerability. The second is to **build shared buffers**: fiscal reserves, diversified energy and food systems, social protection, reliable infrastructure and healthy, educated populations. These are buffers that work for many kinds of shock at once. Both are inherently cross-domain, which is the reason for the intersectional property. Both are also developmental, because the means come from economic and technological progress.

PART III · THE FRAMEWORK

6. The Polycrisis Resilience Framework

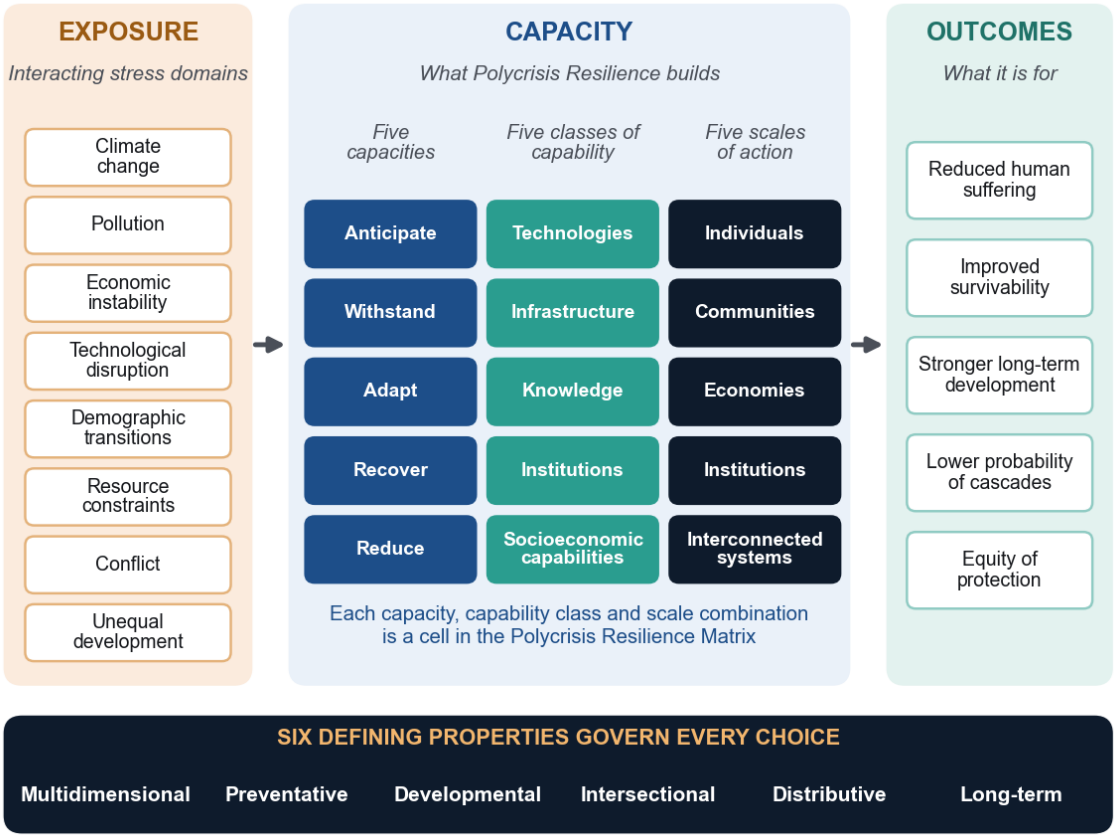
IN BRIEF

- The framework connects exposure to eight interacting stress domains with capacity built from five capacities, five classes of capability and five scales of action.
- Together these define a 5 × 5 × 5 matrix in which any resilience action can be located.
- Six test questions, drawn from the defining properties, allow any policy, investment or technology to be screened.

6.1 Architecture

Figure 5 shows the overall structure. On the left is **exposure**: the eight interacting stress domains. In the middle is **capacity**: the things Polycrisis Resilience builds. On the right are the **outcomes** that justify the effort. Beneath all three run the six defining properties, which act as constraints on every choice.

Figure 5. The Polycrisis Resilience Framework



Source: H Heuristics.

6.2 Five capacities

Table 8. The five capacities

Capacity	Meaning	Illustrative actions
Anticipate	Detect, understand and prepare for interacting risks before they strike.	Early warning and climate services; cross-domain risk assessment; stress-testing of systems; scenario planning
Withstand	Absorb shocks without catastrophic loss of function or life.	Resilient infrastructure; redundancy and diversification; social protection; fiscal and food reserves
Adapt	Change practices, livelihoods and systems to fit new conditions.	Climate-adapted agriculture and cities; skills and education; flexible institutions; technology diffusion
Recover	Restore function and wellbeing quickly, and build back so vulnerability is lower.	Contingent finance and insurance; reconstruction standards; health system surge capacity; community networks
Reduce	Lower the sources, probability and magnitude of crises.	Emissions and pollution reduction; ecosystem protection; debt sustainability; conflict prevention; safe technology governance

Source: H Heuristics, derived from the proposed definition.

6.3 Five classes of capability

The definition names the assets that build capacity. Each class has a distinct role.

- **Technologies** reduce the cost or raise the performance of protection: solar generation and storage, efficient cooling, drought-tolerant crops, satellite monitoring, diagnostics.
- **Infrastructure** is the physical backbone of function: power, water, transport, communications, health facilities, flood defenses, and the networks that connect them.
- **Knowledge** includes science, data, local and indigenous understanding, and the human skills to use them, from forecasting to foundational literacy.
- **Institutions** are the rules, organizations and norms that coordinate action: effective states, regulators, markets, courts, and cooperation across borders.
- **Socioeconomic capabilities** are the incomes, savings, health, education, insurance and social networks that let people and firms cope and recover.

6.4 Five scales of action

Action takes place at five scales, from **individuals** to **interconnected systems**. The scales are nested and interdependent: households rely on communities, which rely on local economies and institutions, which rely on larger networks of trade, energy and information. Ostrom's (2010) argument for polycentric governance applies directly. No single authority holds all the levers, so the framework assumes many centers of decision-making that need to coordinate. A diagnostic question for any proposal is which scales it strengthens and which it assumes are already strong.

6.5 The Polycrisis Resilience Matrix

Crossing capacities with capability classes yields a 5 × 5 matrix, and adding scales yields 125 cells. **Table 9** shows the first two dimensions with an example action in each cell. The matrix is a planning tool: gaps show where a country or program has invested in some capacities but not others, a common pattern being strength in response and weakness in anticipation and reduction.

Table 9. The Polycrisis Resilience Matrix: capacities by capability classes (examples)

	Technologies	Infrastructure	Knowledge	Institutions	Socioeconomic
Anticipate	Satellite and sensor networks	Weather radar and gauges	Cross-domain risk models	Risk-informed planning rules	Community alert networks
Withstand	Storage; cooling	Hardened power and water	Hazard-resistant building skills	Backup supply agreements	Savings; social protection
Adapt	Drought-tolerant varieties	Flexible transport and grids	Extension and training	Adaptive regulation	Skills and mobility
Recover	Rapid damage mapping	Modular repair capacity	Lessons-learned systems	Contingent finance	Insurance; credit access
Reduce	Clean energy; clean cooking	Efficient grids and buildings	Emissions and pollution data	Carbon and debt frameworks	Livelihoods beyond high-risk activity

Source: H Heuristics. Cells give one example each; each can be expanded by scale (individual to system).

6.6 The Polycrisis Resilience Test

The six defining properties convert directly into six screening questions. The test is meant for use in policy design, investment appraisal and technology assessment. It is deliberately simple; a rigorous application would attach evidence and numbers to each answer.

The Polycrisis Resilience Test

1. Multidimensional. Which stress domains does this action touch, and does it raise or lower vulnerability in each?

2. Preventative. Does it reduce the probability or severity of future crises, or only the cost of the next response?

3. Developmental. Does it leave behind lasting economic, technological, institutional or human capacity?

4. Intersectional. Does it reduce several vulnerabilities at once, and are there cheaper ways to achieve the same combination?

5. Distributive. Who gains protection, who remains exposed, and who bears the cost?

6. Long-term. Does it keep options open and avoid lock-in, irreversibility and costs passed to future generations?

An action does not need to score well on all six to be worthwhile. A flood defense might be strong on withstanding and weak on intersectionality. The test makes the trade-offs visible so they can be chosen rather than stumbled into.

PART III · THE FRAMEWORK

7. Intersectional Opportunities

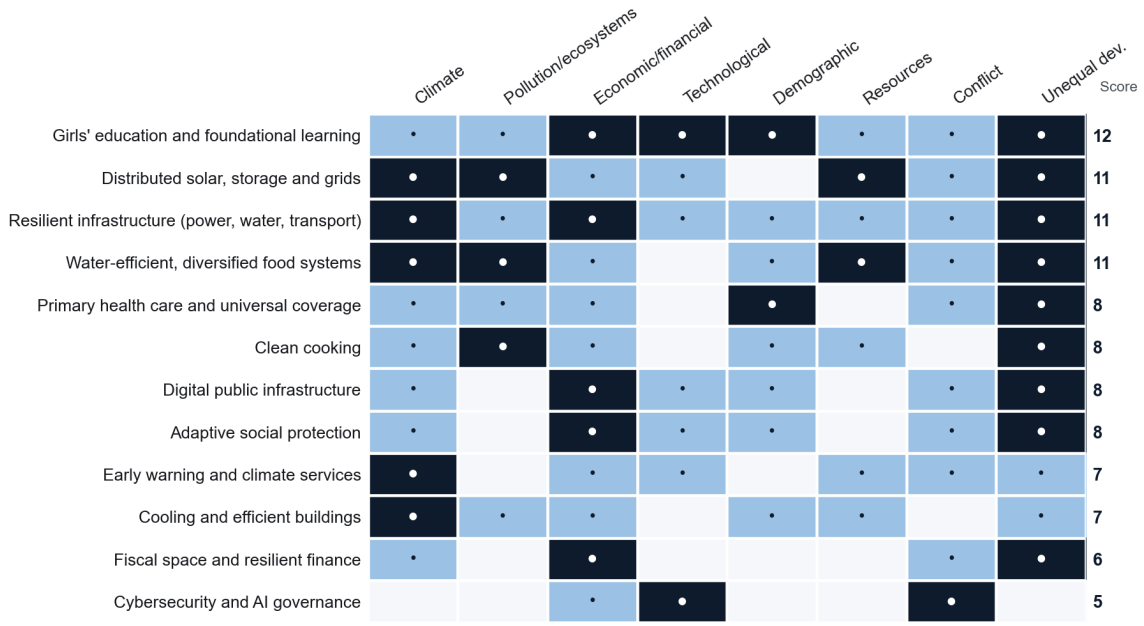
IN BRIEF

- The practical payoff of the framework is identifying interventions that reduce vulnerability across many domains at once.
- A qualitative screen of twelve capabilities finds girls' education, distributed clean energy, resilient infrastructure and diversified food systems at the top (grade C).
- Intersectional solutions also carry cross-dependencies and new risks, which must be managed rather than ignored.

7.1 A screening method

If crises interact, the value of an action depends on how many vulnerabilities it reduces. H Heuristics built a simple screen. Twelve capabilities, chosen to span the five capability classes, were scored against the eight stress domains on a three-point scale: 0 (no meaningful effect), 1 (a meaningful indirect or partial effect) and 2 (a direct and substantial effect). The totals, shown in **Figure 6**, range from 0 to 16.

Figure 6. Intersectional value of twelve capabilities across eight stress domains



Source: H Heuristics qualitative scoring from the literature (evidence grade C). Dot = partial or indirect effect (1); large dot = direct and substantial effect (2). Scores are judgments, not measurements; the ranking is a hypothesis for testing.

7.2 Reading the screen

Four capabilities lead: **girls' education and foundational learning** (12), **distributed solar, storage and grids** (11), **resilient infrastructure** (11) and **water-efficient, diversified food systems** (11). The ranking reflects breadth, not importance in any single domain. Education scores well everywhere because knowledge and skills raise the capacity to adapt, to use technology, to earn through shocks and to participate in institutions, while educated populations also tend to have smaller and healthier families, which links to demographic transition. Distributed solar and storage reduce emissions and air pollution, relieve fuel-import and fiscal pressure, and provide power during grid failures and disasters. At the lower end, **cybersecurity and AI governance** (5) and **fiscal space** (6) score as narrower in breadth, though strongly in their own domains (technology risk and finance). Narrow does not mean unimportant: these are enabling conditions. Fiscal space determines whether the other investments can be financed at all, and cybersecurity determines whether digital and energy systems stay reliable. The screen helps to sequence such actions rather than to rank them for funding.

7.3 Evidence from the main capability families

Energy. The cost of solar electricity has fallen about 90% since 2010 (IRENA, 2025), and clean-energy investment of roughly $2.2 trillion in 2025 is about double that in fossil fuels (IEA, 2025). Cheap distributed power is the clearest example of a developmental intersectional opportunity: it cuts emissions and air pollution, reduces import dependence, and powers clinics, pumps, cooling and digital services. The gap is distributional. Africa has about 20% of the world's population but about 2% of clean-energy investment (IEA, 2025).

Infrastructure. The World Bank's *Lifelines* analysis found that making infrastructure in low- and middle-income countries more resilient could yield net benefits of about $4.2 trillion, or about $4 in benefit for each $1 invested (Hallegatte et al., 2019). Infrastructure is an intersectional asset because power, water, transport and communications each depend on the others, so one failure travels.

Health and clean air. Air pollution accounts for about 7.9 million deaths a year, of which about 2.8 million come from household air pollution (HEI, 2025), much of it from cooking with polluting fuels. Clean cooking and clean power therefore connect health, climate, forests, gender equality and productivity.

Food and water. Diversified, water-efficient agriculture reduces exposure to drought, lowers pressure on freshwater and soils, and stabilizes farm incomes. It also reduces price shocks that trigger political instability.

Social protection and finance. Natural disasters push an estimated 26 million people into poverty each year (Hallegatte et al., 2017). Adaptive social protection that can scale up quickly after a shock protects households and accelerates recovery. Fiscal space is its enabling condition: when interest costs crowd out spending, the buffers are the first thing lost.

Digital public infrastructure and knowledge. Identity, payments and data exchange systems allow money and information to reach people at speed, support early warning and make cash transfers possible. They also create new dependencies, so they appear in the screen as strongly beneficial for economic resilience and as a source of cyber risk.

7.4 Risks inside solutions

Intersectional measures are not free of hazard. Concentrated supply chains for solar panels, batteries and critical minerals create new dependencies. Digital systems carry cyber and failure risks. Large-scale land use for energy or carbon removal can compete with food and nature. Heavy dependence on a technology that has a single point of failure can reintroduce the synchronization the framework is meant to reduce. The Polycrisis Resilience Test therefore asks not only how many vulnerabilities an action reduces, but whether it creates new ones. The best intersectional solutions also reduce their own coupling: diversified, modular and locally maintainable.

PART III · THE FRAMEWORK

8. The Economics of Polycrisis Resilience

IN BRIEF

- Disaster costs including cascading and ecosystem effects exceed $2.3 trillion a year, about eleven times the direct losses most statistics report.
- Prior evidence puts the return on adaptation and resilient infrastructure at between 2:1 and 10:1, with a headline estimate of $7.1 trillion of net benefits from $1.8 trillion invested over 2020–2030.
- Conventional benefit–cost accounting probably understates the return to intersectional measures, because it counts benefits within one system at a time (grade C).

8.1 The cost of cascades

The UN Office for Disaster Risk Reduction's 2025 Global Assessment Report estimates that direct disaster losses average about $202 billion a year, but that once cascading and ecosystem costs are included the total exceeds $2.3 trillion a year (UNDRR, 2025). The difference between the two figures is, in effect, the price of interaction: what falls outside conventional loss accounting because it moves through supply chains, health systems, public budgets and ecosystems. The report describes a cycle that links disasters, debt, uninsurability and humanitarian need, and it estimates that only about 2% of development aid goes to disaster-risk reduction. The loss is also heavily skewed: the report's illustration is that a storm costing 0.2% of GDP in North America could wipe out nearly half of the GDP of a Pacific island state.

8.2 The returns to resilience

The evidence on returns is consistent in direction. The Global Commission on Adaptation (2019) estimated that investing $1.8 trillion over 2020–2030 in five areas (early warning systems, resilient infrastructure, dryland agriculture, mangrove protection and water resource management) could generate $7.1 trillion in net benefits, with benefit–cost ratios between 2:1 and 10:1. The World Bank estimated about $4 of benefit for each $1 invested in more resilient infrastructure in low- and middle-income countries (Hallegatte et al., 2019). Tanner and colleagues (2015) distinguished a **triple dividend**: avoided losses, economic gains from reduced risk, and social and environmental co-benefits. Rodin (2014) argued that the dividend arrives in good times as well as bad. These estimates carry wide uncertainty and depend on assumptions about discount rates, hazard frequency and counterfactuals (grade B), but even conservative readings favor prevention.

8.3 Why standard accounting understates the case

Benefit–cost analysis normally evaluates a project against the hazards and benefits of its own system. Three features of the polycrisis suggest it will undercount.

- **Joint-tail blindness.** If losses in different domains are assessed independently, the probability of simultaneous severe outcomes is understated (Chapter 5). Measures that reduce coupling or add shared buffers provide insurance against exactly those outcomes, and the insurance has no line in the ledger.
- **Cross-domain benefits go uncounted.** A project is appraised for its primary purpose. Benefits to health, climate, education or fiscal stability fall outside the boundary. A conceptual statement of the problem is that the total benefit is the sum of within-domain benefits *plus* a term for avoided cross-domain cascades, and

standard appraisal captures only the first.

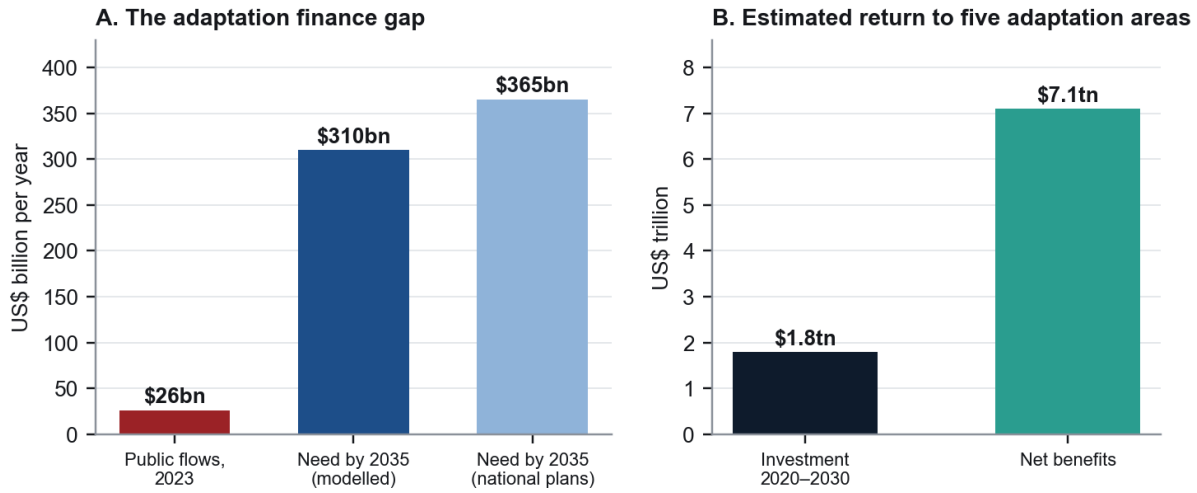
- **Time horizon.** Many resilience benefits arrive over decades, and standard discounting reduces them sharply. Where harm is potentially irreversible, a case exists for lower discount rates or for treating some thresholds as constraints rather than costs.

Whether the omitted terms are large is an empirical question and one of the research priorities in Chapter 13. The claim here is limited: the direction of the bias is predictable, and the mechanisms behind it are visible in the evidence (grade C).

8.4 The financing gap

Finance is where the economics meets the structure of the polycrisis. UNEP (2025) estimates that developing countries will need $310 billion a year for adaptation by 2035 on modelled costs, and $365 billion if extrapolated from the needs countries state in their own national plans. International public adaptation finance fell from $28 billion in 2022 to $26 billion in 2023, leaving a gap of 12 to 14 times current flows, and debt makes up 59% of those flows. UNEP warns of an *adaptation investment trap*, in which countries borrow to adapt and thereby worsen the debt burden that limits future adaptation. **Figure 7** sets the adaptation gap beside the estimated return on adaptation investment.

Figure 7. The adaptation finance gap and the estimated return to adaptation



Sources: UNEP (2025), Adaptation Gap Report 2025; Global Commission on Adaptation (2019). Panel B shows the Commission's estimate for five adaptation areas over 2020–2030.

The feedback structure is plain. Underinvestment in resilience raises future losses, which raise debt, which reduces the capacity to invest. Escaping it requires financing on terms that do not themselves create fragility: grants and concessional finance for the most vulnerable, contingent and shock-responsive instruments, and debt arrangements that preserve fiscal space for resilience.

PART III · THE FRAMEWORK

9. Resilience for Whom? The Distributive Imperative

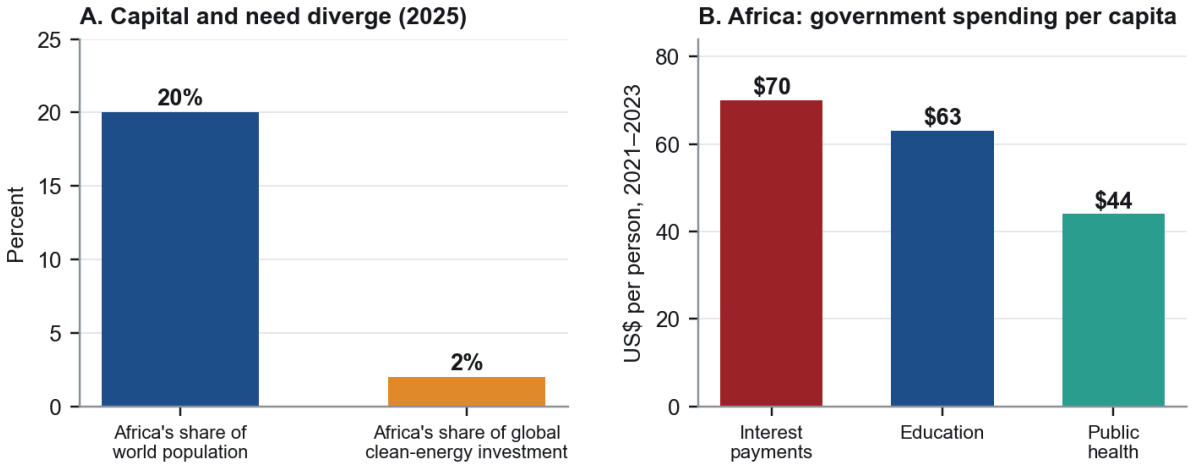
IN BRIEF

- Resilience is distributed very unequally: capital, fiscal space and protection are concentrated where the need is not greatest.
- Distribution is both an ethical requirement and a condition of effectiveness, because weak points propagate through trade, finance, migration, disease and conflict.
- Latecomer advantages in clean energy, digital infrastructure and finance offer a route to extend resilience quickly if finance and capacity are in place.

9.1 The resilience divide

Figure 8 shows two aspects of the divide. Africa has about one-fifth of the world's population but about 2% of global clean-energy investment (IEA, 2025). Over 2021–2023, African governments spent on average about $70 per person on interest payments, more than the $63 spent on education and the $44 on public health (UNCTAD, 2025). Across the developing world, 3.4 billion people live in countries that spend more on interest than on health or education, and 61 developing countries spend at least a tenth of government revenue on interest.

Figure 8. Two measures of the resilience divide



Sources: IEA (2025), World Energy Investment 2025; UNCTAD (2025), A World of Debt 2025. Panel A uses rounded shares reported by the IEA; panel B uses average per-capita spending reported by UNCTAD for Africa, 2021–2023.

The poor bear a disproportionate share of disaster losses in welfare terms. Because low-income households have little savings and few assets that can be insured, a given physical loss translates into a larger loss of wellbeing (Hallegatte et al., 2017). About 808 million people are estimated to be living below $3.00 a day in 2025, and each additional shock makes it harder for them to escape.

9.2 Why distribution is a property of the system

The distributive property is often defended on grounds of fairness, and rightly. It also follows from the structure of interacting systems. A pandemic that spreads unchecked in one region reaches others. Failed harvests and price spikes raise food insecurity and unrest across borders. Financial distress in a group of indebted countries affects lenders, trading partners and global financial conditions. Displacement caused by climate and conflict is not contained by borders. In a networked system, the weakest nodes set the level of the whole (Centeno et al., 2015). Resilience confined to wealthy countries is, in this sense, incomplete by construction.

9.3 Latecomer opportunities

Where infrastructure has not yet been built, countries can adopt newer and cheaper systems instead of retrofitting older ones. Mobile payments and digital public infrastructure have extended financial access without a branch network. Distributed solar with storage can reach people without waiting for grid extension. Early-warning systems built on satellites and mobile networks reach populations without costly ground infrastructure. The same cost declines that make clean technology attractive in rich countries make it affordable in poorer ones, provided finance is available at reasonable cost. The constraint is rarely technology and more often capital, capacity and institutions.

9.4 Design implications

- **Finance on resilient terms:** grants and concessional finance for the poorest and most exposed countries, contingent instruments such as climate-resilient debt clauses, and tackling the cost of capital that makes clean investment several times costlier in developing countries.
- **Local ownership:** programs designed with communities and local institutions are more likely to be maintained and adapted, and local knowledge is itself a capability.
- **Capacity before and alongside capital:** data, skills, procurement and project-preparation capacity determine whether finance can be absorbed.
- **Adaptive social protection:** mechanisms that scale up automatically with shocks protect households and reduce the need for emergency appeals.
- **Inclusion in measurement:** indicators and data systems must cover the places and people who are least visible in current statistics.

PART III · THE FRAMEWORK

10. The Long-Term Horizon

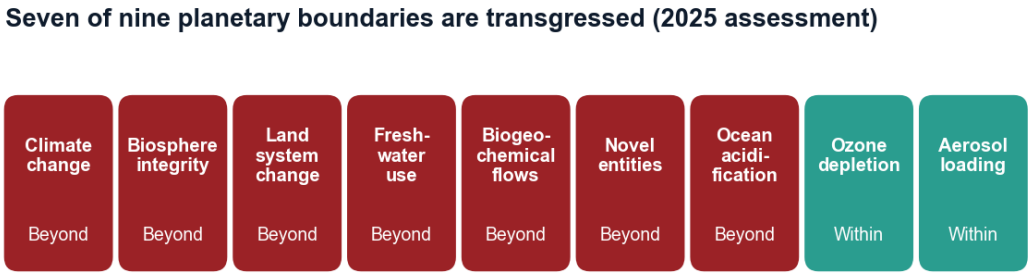
IN BRIEF

- Seven of nine planetary boundaries are transgressed, and several climate tipping elements may be approached within the warming range now in view.
- The long-term property directs attention to cumulative risk, irreversibility and intergenerational consequences.
- Practical implications: preserve options, avoid lock-in, build adaptive pathways and treat potentially irreversible harms as constraints.

10.1 Cumulative and irreversible risk

Some of the stresses in the polycrisis behave like flows that can be corrected quickly; others behave like stocks that accumulate. Atmospheric carbon dioxide, biodiversity loss, chemical pollution, aquifer depletion and public debt are the second kind. The 2025 Planetary Health Check found that seven of the nine planetary boundaries had been transgressed, with ocean acidification crossing the line for the first time and all seven trending in the wrong direction (Steinert et al., 2025). **Figure 9** summarizes the picture. Only ozone depletion, where international action worked, and aerosol loading remain within bounds.

Figure 9. The state of the planetary boundaries, 2025



Ocean acidification was assessed as transgressed for the first time in 2025. Source: Planetary Health Check 2025 (Steinert et al.).

Source: Steinert et al. (2025), Planetary Health Check 2025, Potsdam Institute for Climate Impact Research.

The ozone case is worth noting: it shows that coordinated action can restore a boundary. On climate, 2025 was about 1.43 °C above the 1850–1900 baseline, and 2015–2025 was the warmest eleven-year period on record (WMO, 2026). Research on tipping points concludes that several elements of the climate system, among them ice sheets, coral reefs and permafrost, could be triggered at warming in the range of 1.5 to 2 °C (Armstrong McKay et al., 2022; Lenton et al., 2019). These are uncertain and contested at the level of individual thresholds (grade B for the existence of risk, C for specific timing).

10.2 Intergenerational consequences

Choices made now fix the capital stock, institutions and ecological conditions of people not yet born. Two features matter for resilience. First, lock-in: infrastructure and energy systems built today shape emissions and vulnerability for decades. Second, option value: keeping alternatives open has value when the future is uncertain, and irreversible choices foreclose them. The long-term property asks that costs and risks transferred to future generations be counted and justified rather than simply discounted away.

10.3 Severe tail risks

A body of work argues that low-probability, high-severity outcomes, including catastrophic climate scenarios, deserve systematic assessment (Kemp et al., 2022; Ord, 2020). Polycrisis Resilience takes these risks seriously without making them the center of the framework. Its focus is the whole distribution of outcomes: reducing everyday suffering, raising survivability in severe events and lowering the probability of the worst ones. In practice the same measures serve each aim, such as reducing emissions, building robust infrastructure and strengthening health and food systems. This is a strength: it means the framework does not depend on resolving contested probabilities of extreme outcomes in order to justify action.

10.4 Design principles for the long term

- **Preserve options.** Prefer reversible and modular choices where uncertainty is high.
- **Avoid lock-in.** Screen long-lived assets for compatibility with plausible future conditions.
- **Use adaptive pathways.** Define decision triggers in advance so that strategies change when evidence changes.
- **Treat thresholds as constraints.** Where harm may be irreversible, avoid crossing the line rather than pricing it.
- **Invest in slow variables.** Education, institutions, ecosystems and fiscal health decay and recover slowly, and so need early and sustained attention.

PART IV · APPLICATION

11. Measuring Polycrisis Resilience

IN BRIEF

- A framework that cannot be measured cannot guide allocation or be held accountable. A Polycrisis Resilience Profile is proposed, based on the five capacities.
- The most important design choice is the aggregation rule: a weakest-link approach exposes imbalances that an average conceals.
- The proposal is at the design stage (grade D). No country ranking is offered in this report.

11.1 Design principles

- **Cross-domain.** Indicators must cover multiple stress domains and the links between them.
- **Capacity-based.** The core structure follows the five capacities: anticipate, withstand, adapt, recover and reduce.
- **Weakest-link sensitive.** The aggregation must not allow strength in one area to hide serious weakness in another.
- **Nested across scales.** Indicators should be computable for households, localities, nations and systems where data allow.
- **Outcome-oriented.** Indicators of results (time to recovery, deaths averted) are preferred to indicators of effort (plans written).
- **Transparent and equitable.** Methods are open, and distributional breakdowns are reported alongside averages.

11.2 Candidate indicators

Table 10. Candidate indicators for a Polycrisis Resilience Profile

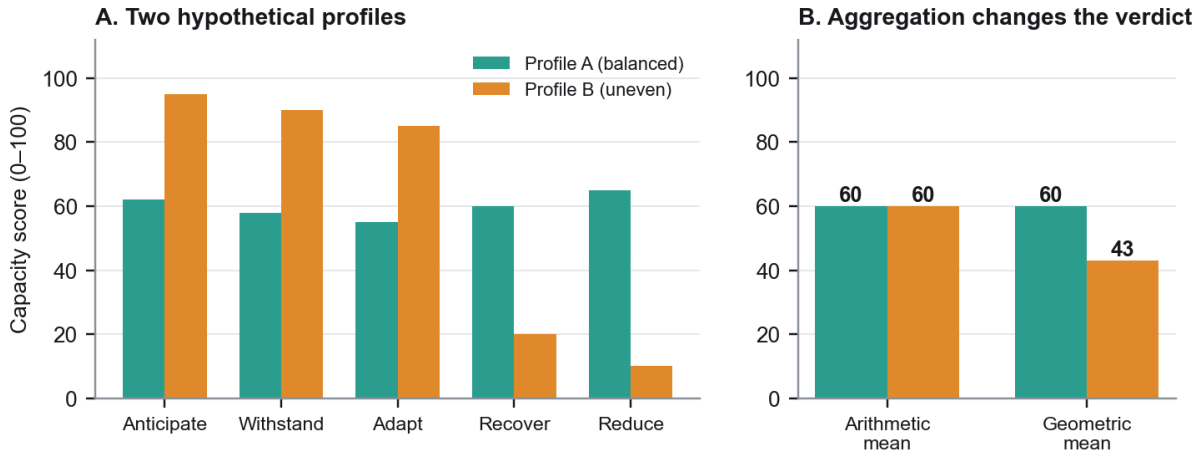
Capacity	Candidate indicators	Possible sources
Anticipate	Population covered by multi-hazard early warning; availability of cross-domain risk assessments; forecast skill	WMO; UNDRR; national meteorological and statistical agencies
Withstand	Reliability of power and water; share of population with social protection; food and fuel reserve days; bank and fiscal buffers	World Bank enterprise and household surveys; ILO; IEA; IMF
Adapt	Education and skills attainment; implementation of national adaptation plans; technology adoption; diversification of income sources	UNESCO; UNFCCC; UNEP; household surveys
Recover	Time to restore services after shocks; insurance and contingent finance coverage; fiscal space after interest costs	Post-disaster needs assessments; insurers; UNCTAD; IMF
Reduce	Greenhouse-gas and pollutant intensity; ecosystem condition; debt trajectory; inequality; incidence of violent conflict	Global Carbon Project; HEI; Living Planet; World Bank; UCDP

Source: H Heuristics. Candidate indicators for evaluation; not a finalized set.

11.3 The aggregation problem

Composite indices usually average their components, which allows high scores in some dimensions to offset low scores in others. For resilience that is the wrong behavior. A country with excellent forecasting and no capacity to recover is not half-resilient; it is exposed to the failure of the weaker link. A geometric mean, or a minimum-based rule, penalizes imbalance. **Figure 10** shows the effect with two hypothetical profiles.

Figure 10. Aggregation rules can reverse a ranking (hypothetical profiles)



Source: H Heuristics illustration with hypothetical scores (evidence grade D). Profiles A and B have the same arithmetic average (60) but different geometric means (60 and 43).

Profile A is balanced across capacities; Profile B is excellent on three and very weak on two. Under an arithmetic mean they are indistinguishable (both score 60). Under a geometric mean A keeps its score (60) and B falls to 43, which better reflects its exposure to a failure of recovery or reduction. The profiles are hypothetical and no country data are implied.

11.4 Pitfalls

- **Goodhart effects.** Indicators that become targets stop being good indicators. Profiles should be diagnostic dashboards, not league tables.
- **Data gaps.** The countries most in need often have the weakest statistics. Indices that omit them reinforce invisibility.
- **False precision.** Composite scores can imply an exactness that the evidence does not have. Uncertainty ranges should be reported.
- **Context dependence.** A good score on a given indicator means different things in different settings, so profiles should be read with qualitative context.

11.5 Next steps

The proposed route is staged: assemble data for a small number of pilot countries or regions; test whether the profile identifies weaknesses that single-domain indices miss; examine sensitivity to aggregation choices; and publish methods openly for scrutiny. Until such tests are completed, claims that a composite index can usefully rank countries remain speculative (grade D).

PART IV · APPLICATION

12. Strategic Pathways: What To Do

IN BRIEF

- Different actors hold different levers: governments, development finance institutions, businesses and investors, researchers, and civil society and educators.
- Five no-regret priorities follow from the screening and economics: education, distributed clean energy, resilient infrastructure, adaptive social protection with health systems, and fiscal space.
- Sequencing matters: early actions should build the capabilities that later actions depend on.

12.1 Priorities by actor

Table 11. Priority actions by actor

Actor	Priority actions
National and local governments	Appraise major investments with the Polycrisis Resilience Test; create cross-sector risk units with shared budgets; build fiscal buffers; integrate climate, health, energy, education and social-protection planning; publish cross-domain risk assessments.
Multilateral and development finance institutions	Scale concessional and grant finance for the most vulnerable; adopt contingent and shock-responsive instruments; fund capacity and data alongside capital; report co-benefits across domains.
Businesses and investors	Map dependencies on interacting systems in risk disclosure; diversify supply chains and energy; invest in resilient and modular assets; price cross-domain risk in capital allocation.
Researchers	Measure coupling empirically; test the intersectional hypothesis; develop and validate indicators; study maladaptation and trade-offs; work with practitioners on design.
Civil society, educators and media	Explain interacting risks in plain language; support community-level resilience; hold institutions to account on distribution; build public understanding that solutions exist.

Source: H Heuristics.

12.2 Five no-regret priorities

Combining the screening in Chapter 7 with the economic evidence in Chapter 8, five priorities score well across domains and have a favorable evidence base. None is a complete strategy; they are a place to start.

- **Education, especially for girls, and foundational learning.** It builds adaptive capacity in every domain and is a slow variable that cannot be improvised.
- **Distributed clean energy and resilient grids.** It reduces emissions, pollution and import dependence while powering health, water, cooling and digital services.
- **Resilient infrastructure.** It protects the shared systems through which cascades travel, with strong evidence of returns.
- **Adaptive social protection and primary health care.** They protect people directly and shorten recovery times.
- **Fiscal space and resilient finance.** They are the enabling condition for everything else, and the point where cascades turn into long-term damage.

12.3 Sequencing across three horizons

Table 12. A three-horizon view of sequencing

Horizon	Focus	Examples
Now to 2030	Close the largest protection gaps and build foundations	Early warning coverage; clean cooking; school completion; resilient reconstruction standards; debt-relief and contingent finance mechanisms; cross-domain risk assessment
2030 to 2040	Scale and integrate systems	Distributed clean-energy and storage at scale; adaptive social protection widely in place; resilient infrastructure replacing high-risk assets; common measurement across countries
2040 to 2050	Consolidate and adapt pathways	Reduction of the drivers of coupling; reviews of adaptive pathways against evidence; restored buffers; transfer of lessons

Source: H Heuristics. The horizons are indicative, not forecasts.

PART IV · APPLICATION

13. Critiques, Limits and the Research Agenda

IN BRIEF

- A new concept should be tested against its strongest objections. Six are considered here.
- Ten research questions would move the framework from a proposal to a tested theory.
- Section 13.3 states what evidence would lead H Heuristics to revise or abandon parts of the framework.

13.1 Objections and responses

Table 13. Six objections to Polycrisis Resilience and responses

Objection	Response
The concept is too elastic. If everything interacts, nothing is excluded, and the term becomes a buzzword.	The definition is bounded by eight named domains and six tests. The test and the matrix generate specific, falsifiable statements about what to prioritize. Elasticity is a risk to be managed by operational discipline, not a reason to avoid a concept.
Resilience shifts responsibility to the vulnerable. It can become a way of asking people to cope with failures that institutions should prevent (Béné et al., 2012).	The distributive and preventative properties are written to prevent this reading: the capacity to be built is institutional and systemic as well as individual, and reduction of risk sources is a core capacity.
Adaptation is not enough; transformation is needed.	Agreed. The framework includes *reduce* as a capacity and treats transformation of drivers (energy, land, finance) as part of resilience, in line with Kates et al. (2012) and Pelling (2011).
The framework is techno-optimist. It risks underweighting politics, power and values.	The developmental property is a hypothesis about means, not a claim that technology suffices. Politics enters through the distributive property and the test question on who gains and who pays. Technologies are screened for the risks they create.
Efficiency and resilience conflict. Buffers and redundancy are costly in normal times.	True, and the framework treats this as a trade-off to be priced and chosen. The economic case rests on the cost of cascades and the evidence on returns, but local conditions will change the balance.
It cannot be measured without false precision.	The report proposes a profile, not a ranking, uses weakest-link aggregation, reports uncertainty, and labels the measurement program as speculative until tested (grade D).

Source: H Heuristics.

13.2 A research agenda

Table 14. Ten research questions

Theme	Question	Approach
Coupling	How strong are the couplings between the eight domains, and how do they vary by place and period?	Time-series and network analysis; historical case studies
Coupling	Which links are most responsible for cascades, and which can be cut at the lowest cost?	Network models; counterfactual analysis
Interventions	Does the intersectional ranking in Chapter 7 hold up under evidence?	Systematic reviews; expert elicitation; cross-domain evaluation
Interventions	Where do intersectional measures create new vulnerabilities, and how large are these?	Case studies of maladaptation; supply-chain and cyber analysis
Economics	How large are the omitted cross-domain benefits in standard appraisal?	Extended benefit–cost studies; integrated assessment
Economics	What financing structures break the debt–disaster feedback loop?	Comparative studies of contingent and concessional instruments
Distribution	How do weakest-link effects transmit from low-resilience to high-resilience regions?	Trade, migration and epidemiological network models
Measurement	Does a capacity-based profile identify weaknesses that single-domain indices miss?	Pilot profiles; sensitivity and validation studies
Long-term	Which long-lived decisions create the greatest lock-in, and how can pathways be made adaptive?	Scenario analysis; decision-making under deep uncertainty
Governance	Which institutional designs allow cross-sector action to be sustained?	Comparative case studies; evaluation of cross-sector units

Source: H Heuristics.

13.3 What would change our mind

A concept that cannot be wrong is not useful. H Heuristics would revise the framework if evidence showed any of the following: that the couplings between domains are weak or unstable enough that domain-specific resilience captures most of the risk; that the intersectional ranking is not borne out by evaluations; that cross-domain measures systematically create offsetting vulnerabilities; that a weakest-link profile performs no better than existing indices at identifying vulnerability; or that the concept does not change decisions in practice. Each is testable and each belongs on the research agenda.

PART IV · APPLICATION

14. The H Heuristics Program and Conclusion

IN BRIEF

- H Heuristics proposes to develop Polycrisis Resilience through three connected pillars: framework, research and public education.
- The first year concentrates on establishing the definition and tools; later work tests, measures and disseminates.
- The concept succeeds if it changes how risks are described, how investments are appraised and who is protected.

14.1 Three pillars

Table 15. A proposed program in three pillars

Pillar	Purpose	Proposed outputs
1. Framework	Establish and refine the definition, vocabulary and tools	This report; a glossary and one-page definition; the Polycrisis Resilience Test as a usable worksheet; a public comment and revision process
2. Research	Test and extend the framework empirically	Papers on coupling, intersectional value and economics; pilot Polycrisis Resilience Profiles; an open data repository; partnerships with academic and policy institutions
3. Public education	Build understanding of interacting risks and solutions	Plain-language explainers and visual guides; teaching materials; briefings for policymakers and journalists; case studies of intersectional projects

Source: H Heuristics. The program is a proposal; timing and resourcing are to be determined.

14.2 Conclusion

The major risks of this century interact. That is the finding that unites the climate scientist, the debt economist, the public-health researcher and the security analyst, and it is why a response organized only by discipline will miss much of what matters. The task is to build capacity that works across the interactions: capacity to anticipate, withstand, adapt to, recover from and reduce the compounding effects of multiple crises.

Polycrisis Resilience is H Heuristics' proposal for how to describe that capacity and how to build it. It is defined by six properties: multidimensional, preventative, developmental, intersectional, distributive and long-term. It is organized around five capacities, five classes of capability and five scales of action. It points toward actions that reduce several vulnerabilities at once, and it insists that the protection must reach those who are most exposed.

Much remains to be tested. Several of the analytical exhibits in this report are illustrative, the intersectional ranking is a hypothesis, and the measurement proposal is at the design stage. The report's claim is not that the framework is finished but that the problem it addresses is real and that a shared concept is a precondition for shared work. The ambition stated at the outset still stands: not simply to describe the polycrisis, but to develop a framework for responding to it.

Glossary

Adaptive capacity	The ability of people, institutions and systems to adjust to changing conditions, take advantage of opportunities and cope with consequences.
Cascade	The propagation of failure or stress from one system to others through dependencies.
Common driver	A single stress that affects several systems at the same time (Lawrence et al., 2024).
Coupling	The degree to which stress or failure in one domain is transmitted to another.
Domino effect	A cascade in which failure in one system triggers failure in the next along a chain of dependencies.
Feedback loop	A circular causal path in which an effect returns to influence its own cause, either reinforcing or dampening it.
Intersectional (in this report)	Addressing several vulnerabilities or crisis domains at once.
Maladaptation	Action intended to reduce vulnerability that increases it elsewhere or later.
Planetary boundaries	A framework of nine Earth-system processes with limits within which humanity can operate safely (Rockström et al., 2009).
Polycrisis	A condition in which crises in multiple systems become causally entangled in ways that worsen overall prospects.
Polycrisis Resilience	The capacity of individuals, communities, economies, institutions and interconnected systems to anticipate, withstand, adapt to, recover from and reduce the cascading and compounding effects of multiple interconnected crises (H Heuristics).
Resilience dividend	The benefit that resilience investment yields in non-crisis periods as well as in crises (Rodin, 2014).
Systemic risk	The risk that failure in one part of a connected system spreads to cause widespread failure.
Tipping element	A component of the Earth system that can shift abruptly and often irreversibly once a threshold is crossed.
Weakest-link aggregation	A way of combining scores that penalizes low values, such as a geometric mean or a minimum.

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