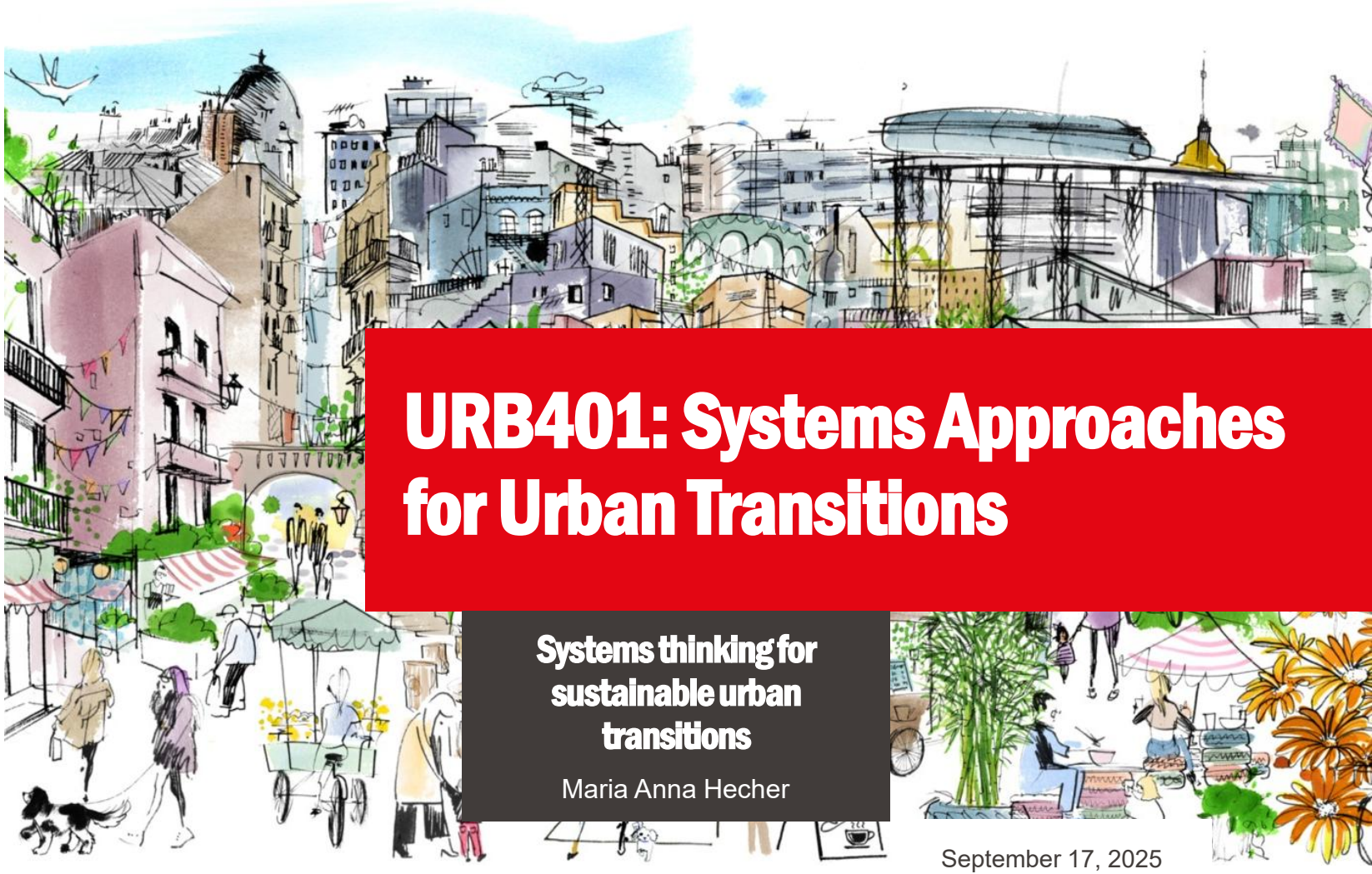

URB401: Systems Approaches for Urban Transitions

Systems thinking for sustainable urban transitions

Maria Anna Hecher

September 17, 2025

Courtesy of UN-Habitat and Global Utmaning

Course syllabus

Lectures 9:00-11:00
GC D0 386

Part	Week	Date	Teacher	Lecture
Part I: Urban transitions from a systems perspective	**1**	Sep 10	Hecher	Introduction to the course **Special guest:** Poetic transitions in the case of a historical architectural and urban design (Darius Karácsony)
	2	Sep 17	Hecher	Systems thinking for sustainable urban transitions
	3	Sep 24	Hecher	**Special guest:** Leverage points in the housing system (Anna Pagani)
	4	Oct 1	Binder	Transition research in urban systems
	5	Oct 8	Binder	Urban metaphors and urban metabolism
Part II: Social perspectives of urban transitions	**6**	Oct 15	Hecher	Social innovation and urban niches
	7	Oct 29	Hecher	Social acceptance in cities
Part III: Urban infrastructure and ecology in cities	**8**	Nov 5	Jessel	Multifunctional approaches through ecosystem services
	9	Nov 12	Jessel	Combining green-blue-grey infrastructures: Large-scale approaches (city level)
	10	Nov 19	Jessel	Combining green-blue-grey infrastructures: Small-scale approaches (building and neighborhood level)
Part IV: Policy and governance for urban transitions	**11**	Nov 26	Montfort	Multi-level embedding of cities: From global governance to scope for action in cities
	12	Dec 3	Montfort	Climate solutions in different types of cities
	13	Dec 10	All	**Special guest:** Urban transition processes in practice (Anton Sentic)
	14	Dec 17	All	Presentation City Lab projects

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Learning objectives

- To recognize the relevance of **systems thinking**
- To explore the core principles of a **system**
- To learn about the specialties of **sustainability science**
- To discover **concepts and tools** for systems thinking
- To learn about the principles for **applying a systems approach in urban practice**

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Why systems thinking?

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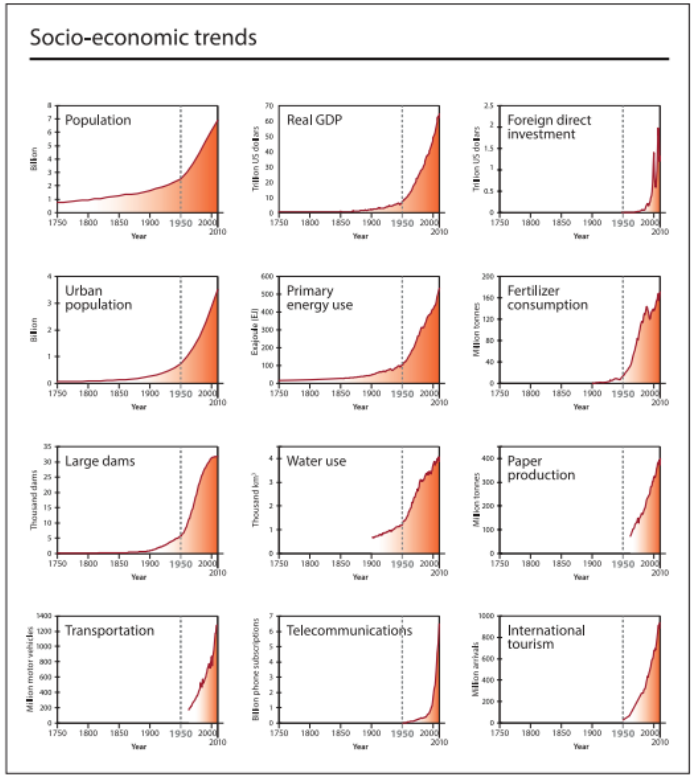
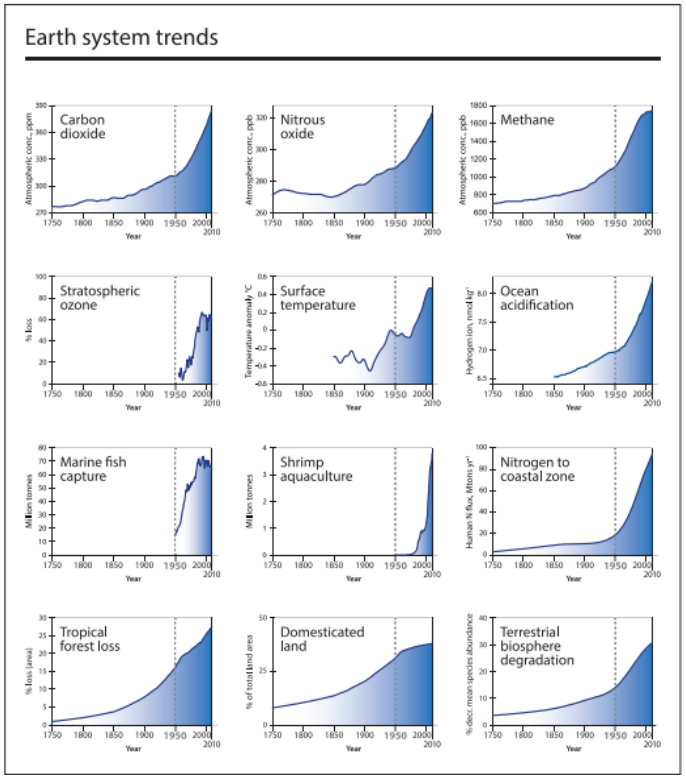
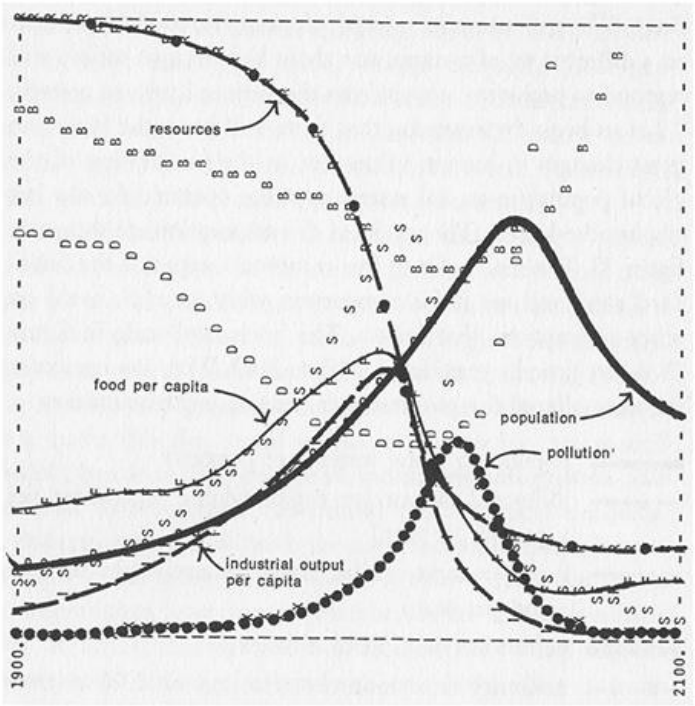
The 'Great Acceleration'

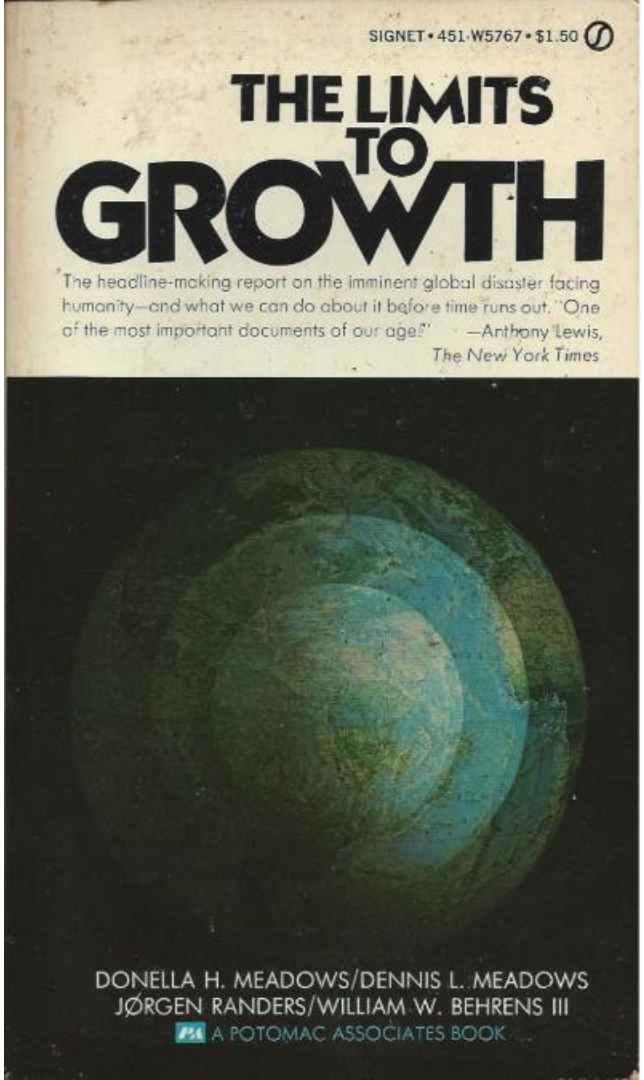




Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., & Ludwig, C. (2015). The trajectory of the Anthropocene: The Great Acceleration. The Anthropocene Review, 2(1), 81–98. https://doi.org/10.1177/2053019614564785

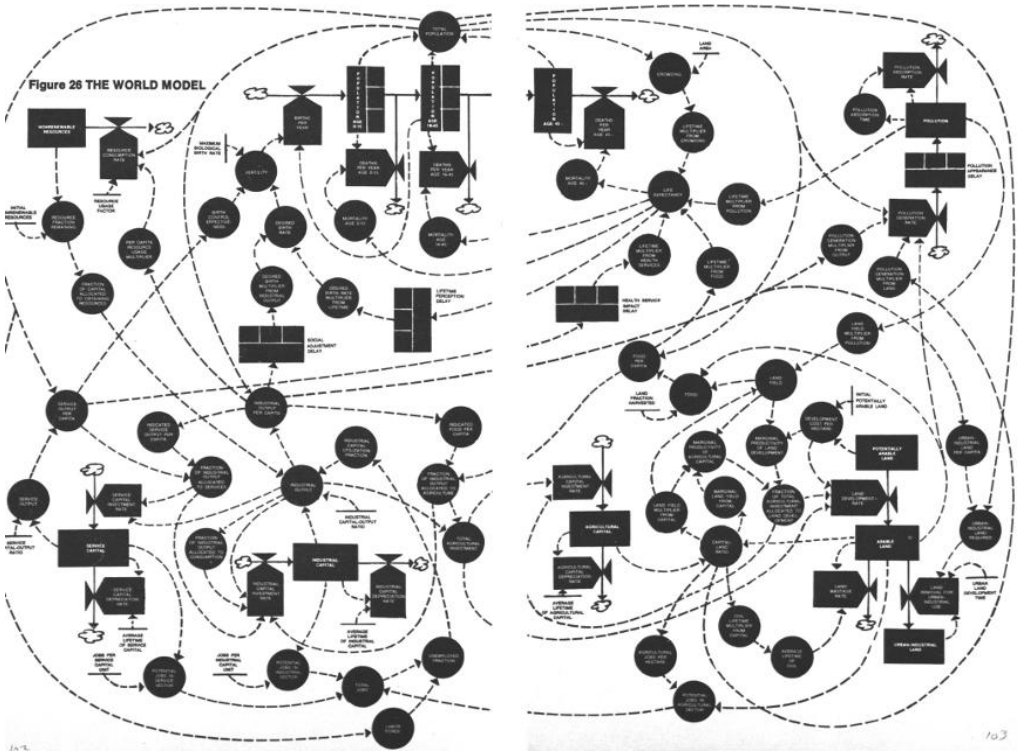
The 'Limits to Growth'





Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). The limits to growth: A report for the Club of Rome's project on the predicament of mankind. Universe Books.

The 'World Model' architecture



Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). The limits to growth: A report for the Club of Rome's project on the predicament of mankind. Universe Books.

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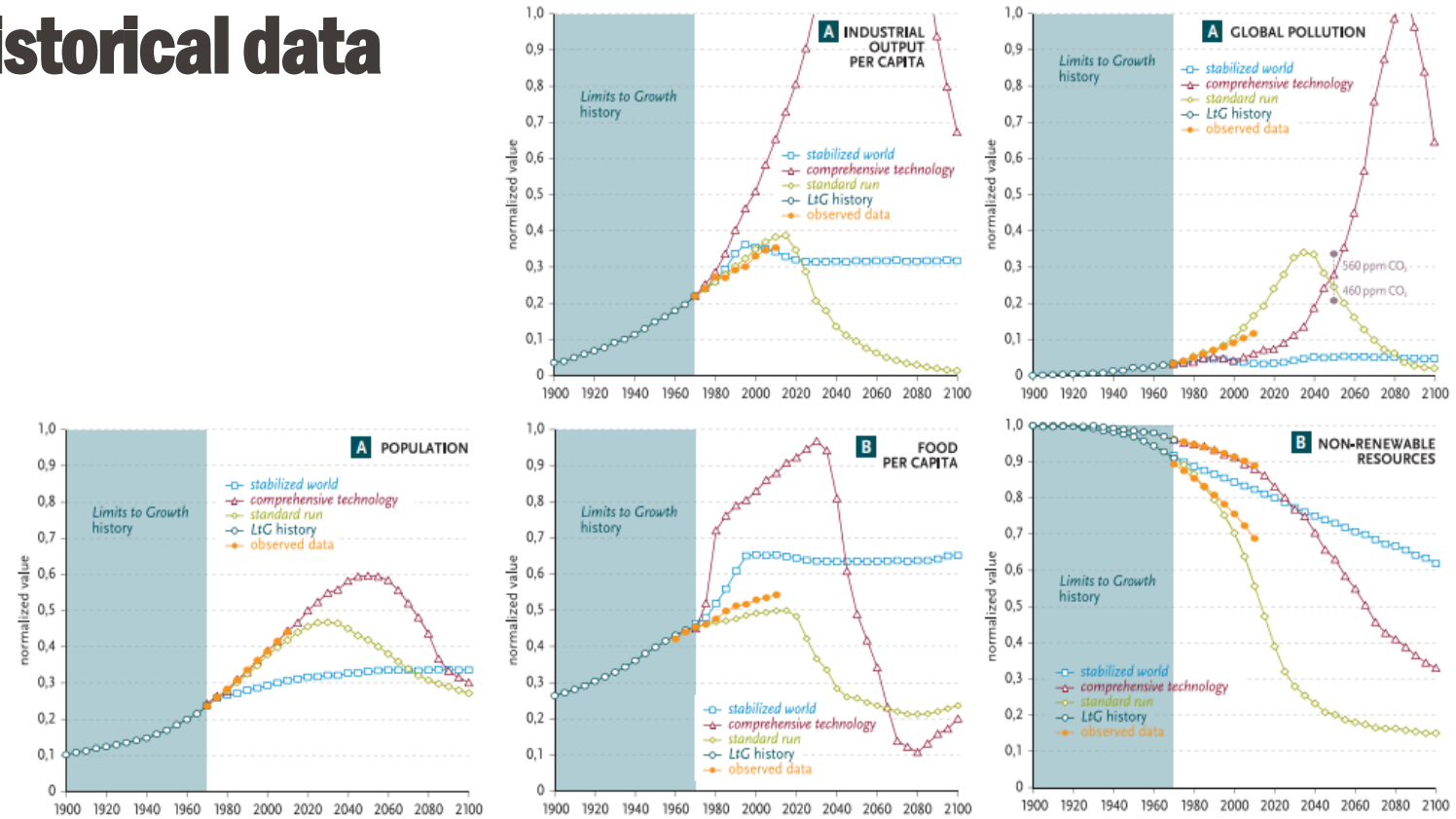
Club of Rome's mission

"To foster understanding of the varied but **interdependent components - economic, political, natural, and social** - that make up the global system in which we all live; to bring that new understanding to the **attention of policy-makers** and the public worldwide; and in this way to promote new policy initiatives and action."

Comparison with historical data



Turner, G. M. (2012). On the cusp of global collapse? Updated comparison of The Limits to Growth with historical data. GAIA: Ecological Perspectives for Science and Society, 21(2), 116–124. https://doi.org/10.14512/gaia.21.2.10

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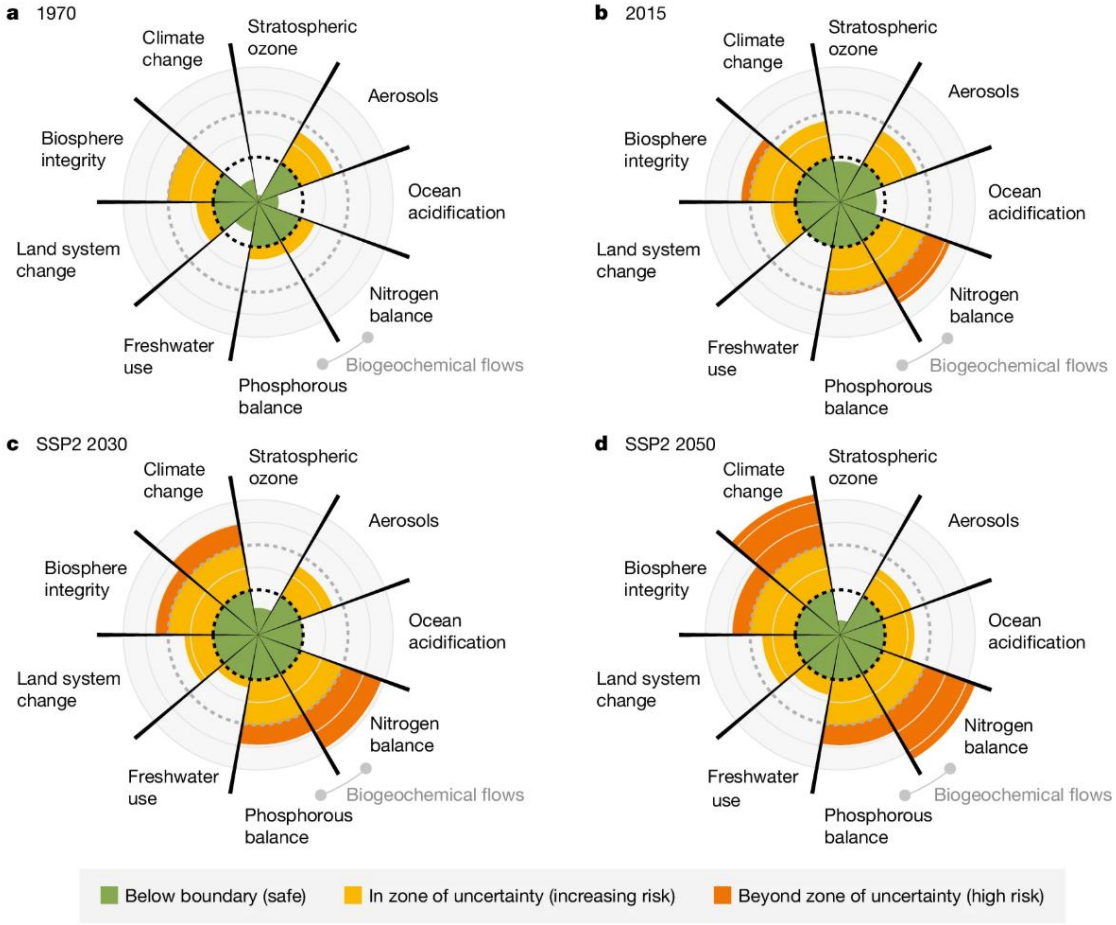
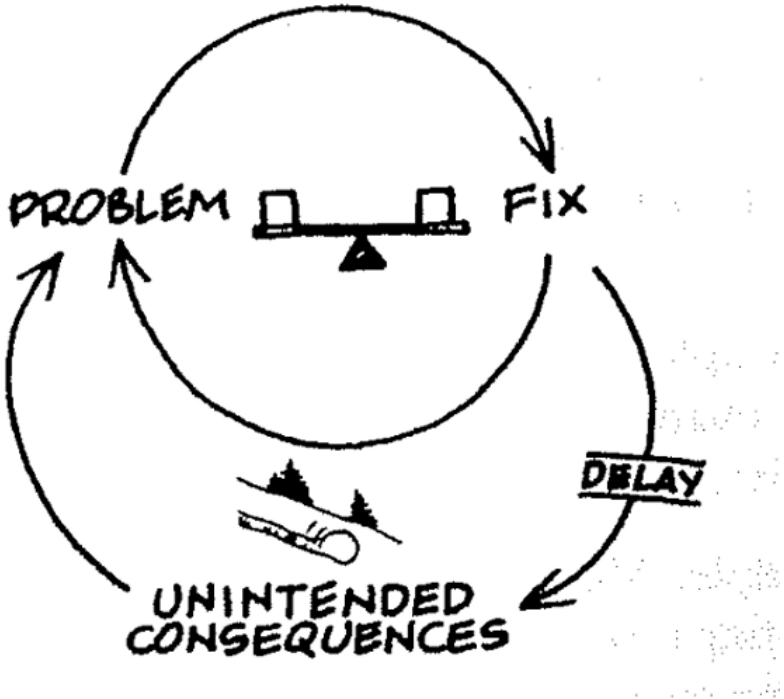
Planetary boundaries framework

With current trends and policies, the situation is projected to worsen to 2050 for all planetary boundaries, except for ozone depletion.



Van Vuuren et al. (2025). Exploring pathways for world development within planetary boundaries. *Nature, 641*, 910–916. https://doi.org/10.1038/s41586-025-08928-w

Today's problems come from yesterday's solutions



Senge, P. M. (1990). The fifth discipline: The art & practice of the learning organization. Doubleday/Currency.

A definition of system thinking

Barry Richmond, the originator of the systems thinking term

The art and science of making reliable inferences about behavior by developing an increasingly deep understanding of underlying structure.

Richmond, B. (1994). Systems Dynamics/Systems Thinking: Let's Just Get On With It. In International Systems Dynamics Conference. Sterling, Scotland.

Peter Senge, a leader in this field

Discipline for seeing wholes and a framework for seeing interrelationships rather than things, foreseeing patterns of change rather than static snapshots.

Senge, P. (1990). The Fifth Discipline: The Art and Practice of the Learning Organization. New York, NY: Doubleday/Currency.

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What is system?

A definition of systems

"A system is anything that is composed of **system elements** connected in a characteristic system structure.

This configuration of system elements allows it to perform specific **system functions** in its system environment. These functions can be interpreted as serving a distinct **system purpose**.

The **system boundary** is permeable for inputs from and outputs to the environment. It defines the system's identity and autonomy."

Bossel, H. (1999). Indicators for sustainable development: Theory, method, applications. A report to the Balaton Group, International Institute for Sustainable Development. Retrieved from http://www.ulb.ac.be/ceese/STAFF/Tom/bossel.pdf

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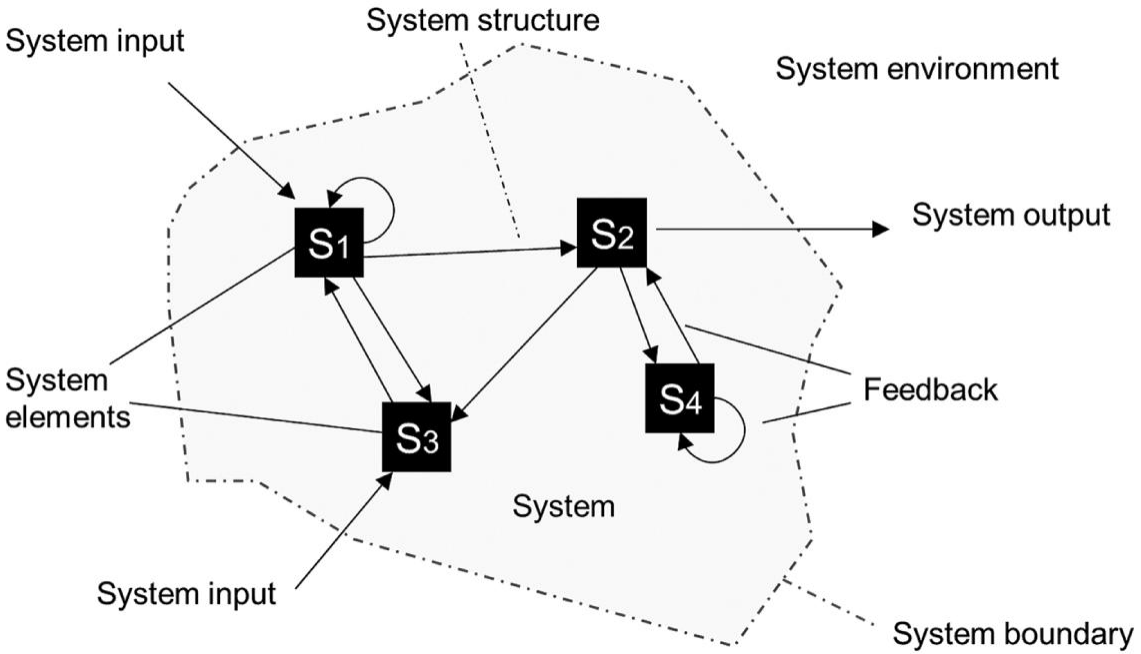
System characteristics



Bossel, H. (1999). Indicators for sustainable development: Theory, method, applications. A report to the Balaton Group, International Institute for Sustainable Development. Retrieved from http://www.ulb.ac.be/ceese/STAFF/Tom/bossel.pdf

Ossimitz, G., & Lapp, C. (2006). *Das Metanoia-Prinzip: Eine Einführung in systemisches Denken und Handeln*. Hildesheim: Franzbecker.

Different types of systems

Non-living systems
Human-made,
mechanical systems

Usually "hard-wired" and purpose does not change over time

Living systems
Natural-ecological systems
Social-economic systems

Evolving, adaptive and have the capacity to change their purpose over time

Kim, D. H. (1999). *Introduction to systems thinking*. Pegasus Communications. Retrieved from http://www.pegasuscom.com/

System boundaries

- Physical boundaries
- Functional boundaries
- Conceptual boundaries

Official city limits of Lausanne
Transportation system of Paris
The culture of consumerism in Milano

System boundaries

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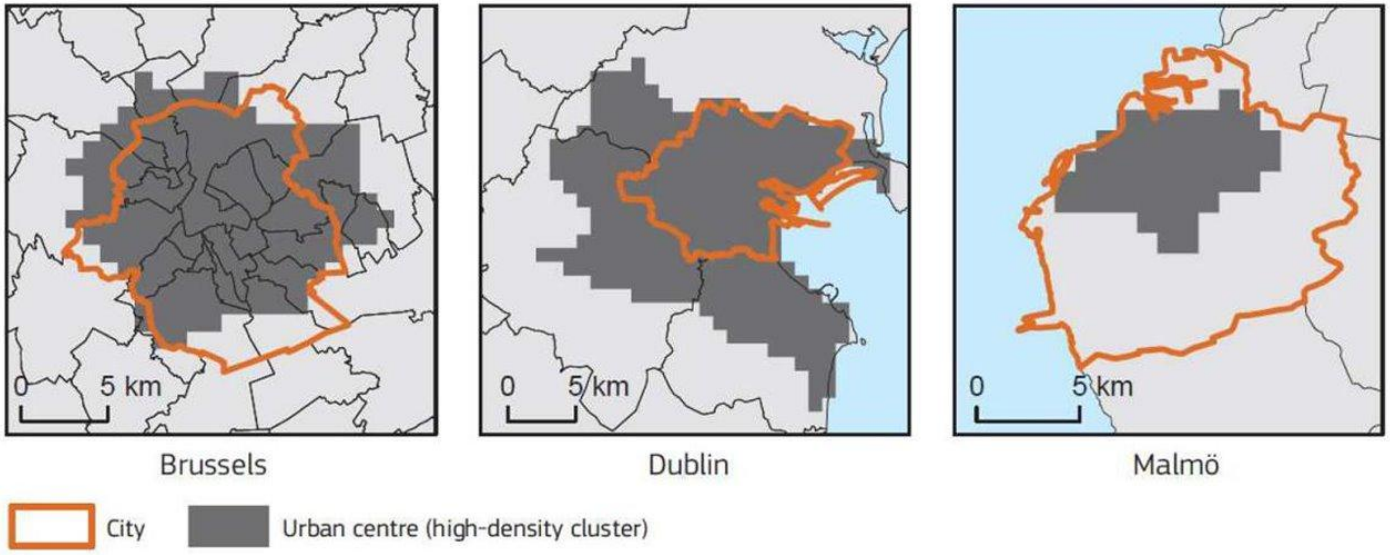
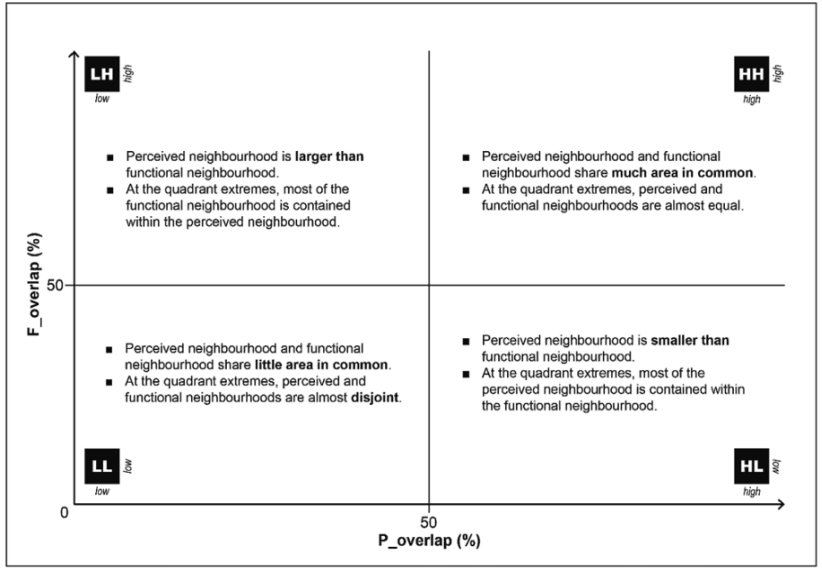
Which city would you predict to be best in terms of…

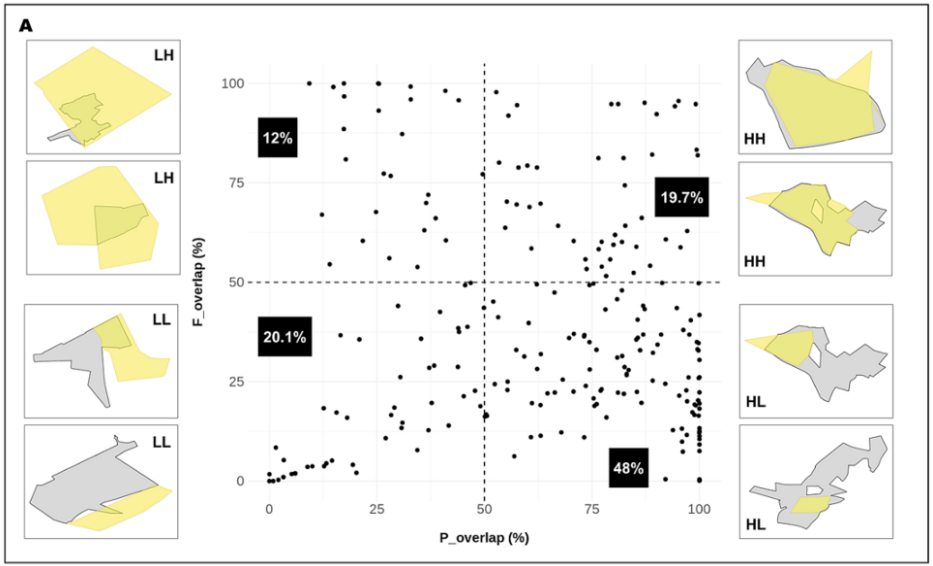
Green areas per capita?

Proximity to public transport stops?



Functional versus perceived neighborhoods





Pang, M., Binder, C. R., & Golay, F. (2024). An empirical comparative analysis of functional and perceived neighbourhood boundaries across Geneva, Switzerland. Cities, 146, 104786. https://doi.org/10.1016/j.cities.2023.104786

System boundaries

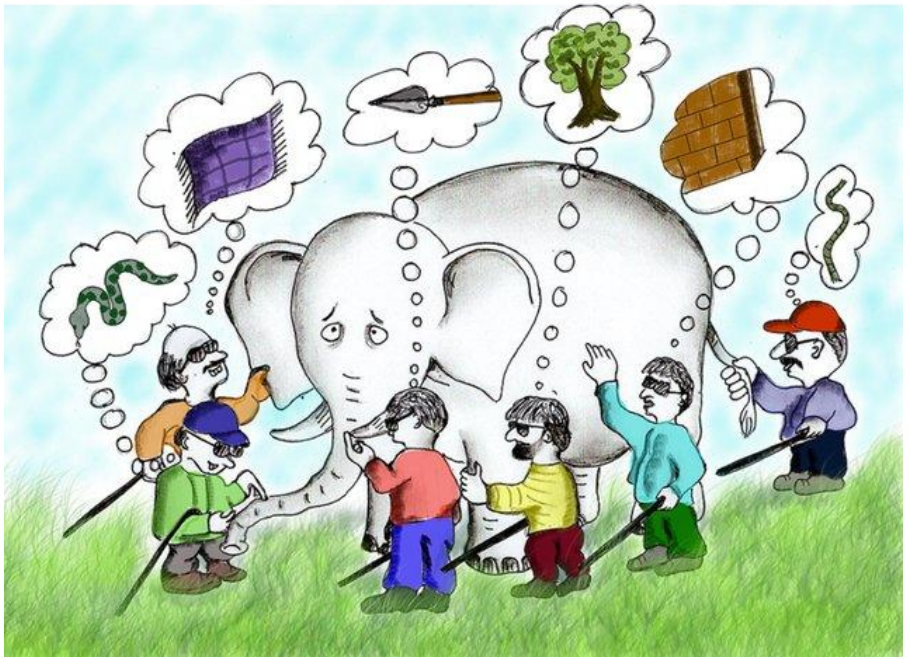
- The way boundaries are defined can significantly impact ...
  - … on **how a system is understood** and how its problems are addressed.
  - … **on measured outcomes** like sustainability or wellbeing, which in turn can have an impact on decision-making.

'The blind men and the elephant'

"A basic principle of a system is that it is something more than a collection of its parts."

Meadows, D. H. (2008). *Thinking in systems: A primer*. Chelsea Green Publishing.

"and so this men of Indostan
Disputed loud and long,
Each in his own opinion
Exceeding stiff and strong,
Though each was partly in the right
And all were in the wrong!"



The Blind Men and the Elephant by John Godfrey Saxe.

Swarm behavior

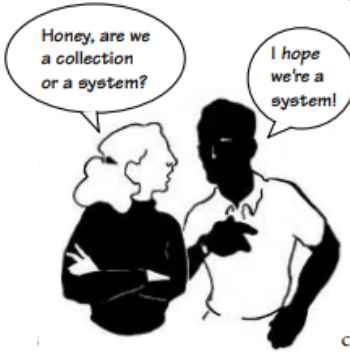
"A basic principle of a system is that it is something more than a collection of its parts."

Meadows, D. H. (2008). *Thinking in systems: A primer*. Chelsea Green Publishing.

Collections versus systems

What Is a System?

In the most basic sense, a system is any group of interacting, interrelated, or interdependent parts that form a complex and unified whole that has a specific purpose. The key thing to remember is that all the parts are interrelated and interdependent in some way. Without such interdependencies, we have just a collection of parts, not a system.



Marriage. For any of you who saw this one as a collection, please seek marriage counseling immediately! All kidding aside, the question of whether one has a healthy marriage has a lot to do with whether the relationship more resembles a collection or a system. Marriage is essentially a voluntarily chosen state of interdependence with another person (not codependence, which is something altogether different). This state actually characterizes any long-term relationship, including friendships. Is there anybody among us who has not been reminded by someone that our actions have an impact on him or her? Sometimes, that is how we first encounter systems, and how we learn (often painfully) that we are part of a larger system than we may have realized.

Kim, D. H. (1999). *Introduction to systems thinking*. Pegasus Communications. Retrieved from http://www.pegasuscom.com/

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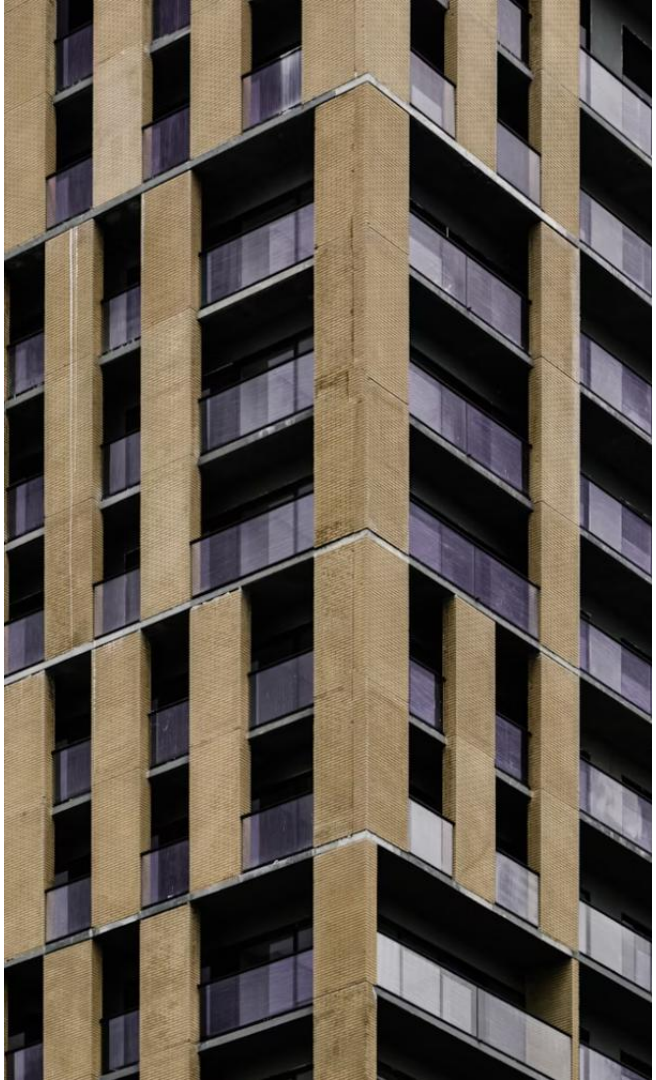
What is special about sustainability science?

Sustainability science

“The world has problems, but universities have departments.”



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Brewer, G.D. (1999). The challenges of interdisciplinarity. Policy Science. 32, 327-337.

Sustainability science

- Problem-driven, normative field of research, not a discipline with a single set of methods or objects
- Its purpose is to provide insights and solutions for sustainable development
- Unlike traditional "value-free" natural sciences, sustainability science is inherently tied to the normative goal of achieving sustainability

Spangenberg, J. H. (2011). Sustainability science: A review, an analysis and some empirical lessons. Environmental Conservation, 38(3), 275–287. https://doi.org/10.1017/S0376892911000270

Characteristics of sustainability science

- **Normative and action-oriented**

As sustainability is normative concept, sustainability science must be aimed at action.

- **Inter- & transdisciplinary**

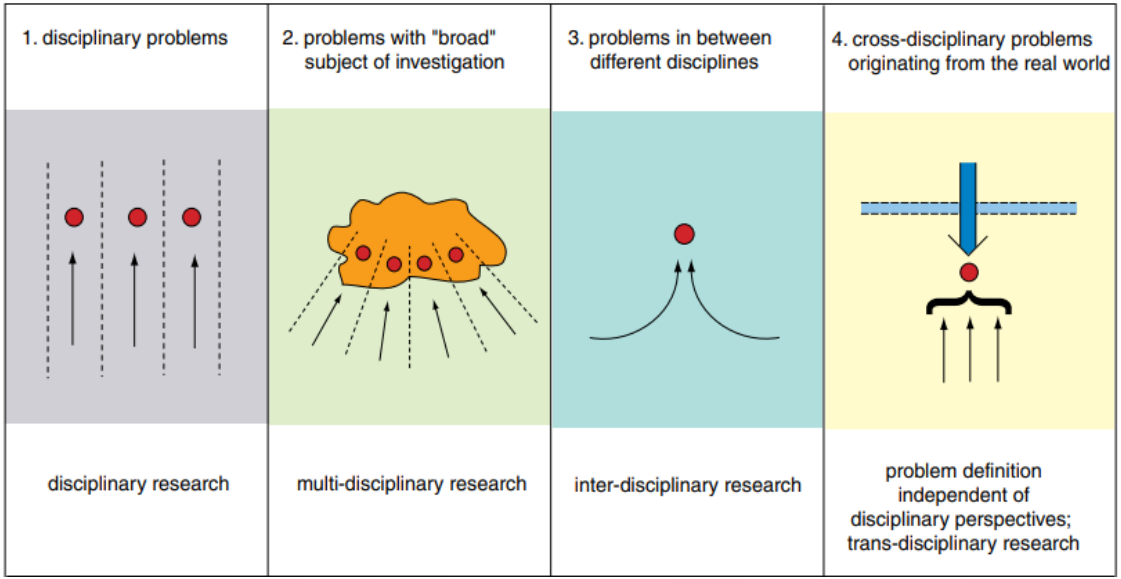
Sustainability science must be interdisciplinary bringing different disciplines together, and transdisciplinary integrating academic knowledge with the practical knowledge of stakeholders and society.

- **Integrated assessment**

It provides integrated analysis and assessments and offers useful information for decision makers.

Spangenberg, J. H. (2011). Sustainability science: A review, an analysis and some empirical lessons. Environmental Conservation, 38(3), 275–287. https://doi.org/10.1017/S0376892911000270

Multi-, Inter- & Transdisciplinarity



Disciplinarity is characterized by methods from individual disciplines by which certain problems are approached.

Multidisciplinarity approaches problems from the perceptions of different disciplines with little interaction among these disciplines.

Interdisciplinarity is established by the integration of methods from different disciplines.

Transdisciplinarity goes beyond science in the sense that it deals with complex societal problems that require knowledge from the scientific and the non-scientific world.

Jaeger, J., & Scheringer, M. (1998) Transdisziplinarität: Problemorientierung ohne Methodenzwang, GAIA, 7, 10–25, 1998.
https://www.env-science.ethz.ch/JaegerScheringer_TD.pdf

Two approaches to sustainability science

Solution-oriented

SCIENCE FOR SUSTAINABILITY

Science for sustainability is an attempt to strengthen the dialogue between society and science, and thus a service provided by science to society. It supports the search processes for sustainable solutions, helps assess the impacts of current decisions and identify the actions required for the future environment to reach a certain state. As it serves a purpose, the pursuit of sustainability, it is teleological, directed towards the goals of sustainable development. 'Although heterogeneous

Science for sustainability can be monodisciplinary or multidisciplinary, but it must be at least 'interdisciplinarity-ready', conducted with the broader picture of sustainability in mind, and therefore ready for integration with results from other disciplines.

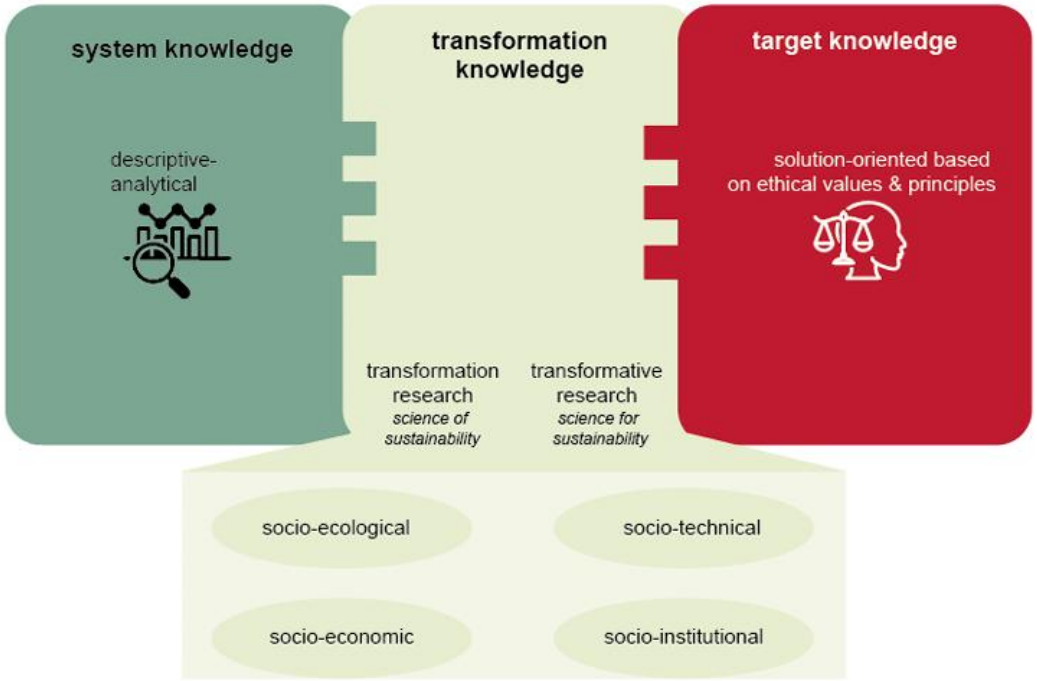
Descriptive-analytical

THE SCIENCE OF SUSTAINABILITY

The science of sustainability addresses what Clark (2007) has called the 'core sustainability science research program', namely 'understanding the complex dynamics that arise from interactions between human and environmental systems'. In the quest for applicable and problem solving solutions, it searches for a generalizable scientific understanding of sustainability, with research based on conceptual models and methods built at the interface of disciplines.

Spangenberg, J. H. (2011). Sustainability science: A review, an analysis and some empirical lessons. Environmental Conservation, 38(3), 275–287. https://doi.org/10.1017/S0376892911000270

Target-Systems-Transformation Knowledge



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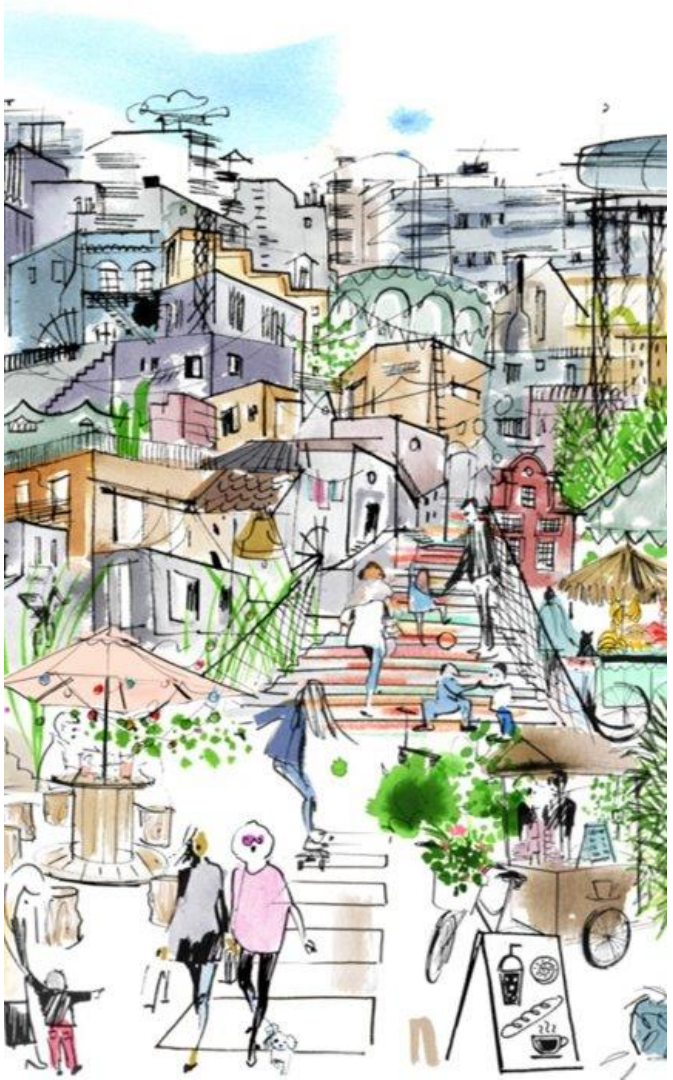
How to approach complex problems?

Systems thinking is important, but how do we apply it?



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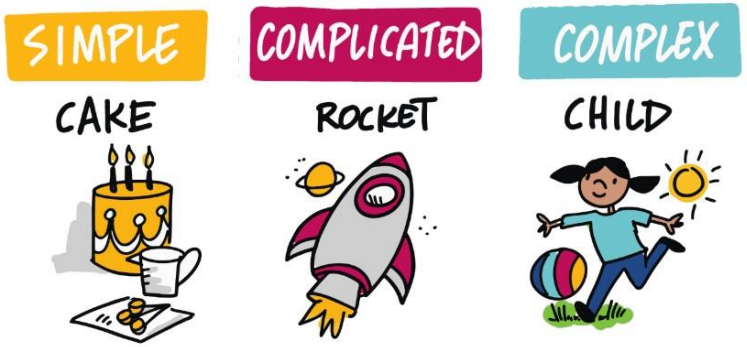
Understanding complexity



Problem	Clear	Some uncertainty	Lots of uncertainty
Outcomes	Standardized	Most rockets are similiar in important ways	Every child is unique
Rules/ Recipe	Same rules apply every time	Each effort allows you to improve the recipe for next time	Each child provides experience but adaptation to context is key
Expertise	Not required, but it increases the degree of success	High levels required in specific areas	Can be helpful, but it is neither necessary nor sufficient
Probability	Follow the recipe for the same product every time	Each test of the recipe improves the probability of success	Rules might help but they might also make things worse

Adapted from Glouberman & Zimmerman

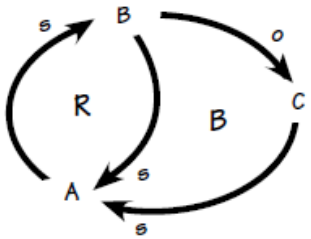
From linear thinking to systems thinking

LINEAR VS. SYSTEMS THINKING	
Linear Thinkers	**Systems Thinkers**
Break things into component pieces	Are concerned with the whole
Are concerned with content	Are concerned with process
Try to fix symptoms	Are concerned with the underlying dynamics
Are concerned with assigning blame	Try to identify patterns
Try to control chaos to create order	Try to find patterns amid the chaos
Care only about the content of communication	Care about content but are more attentive to interactions and patterns of communication
Believe organizations are predictable and orderly	Believe organizations are unpredictable in a chaotic environment

Ollhoff, J. & Walcheski, M. (unknown). The Systems Thinker. Making the jump to systems thinking. https://thesystemsthinker.com/making-the-jump-to-systems-thinking/

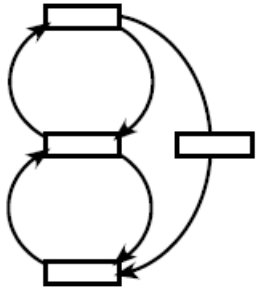
Understanding system dynamics

Causal Loop Diagram



Used in conjunction with behavior over time diagrams, can help you identify reinforcing (R) and balancing (B) processes.

Systems Archetype



Helps you recognize common system behavior patterns such as "Drifting Goals," "Shifting the Burden," "Limits to Growth," "Fixes That Fail," and so on—all the compelling, recurring "stories" of organizational dynamics.

Kim, D. H. (2000). Systems Thinking Tools: A Users' Reference Guide. Pegasus Communications, Inc.

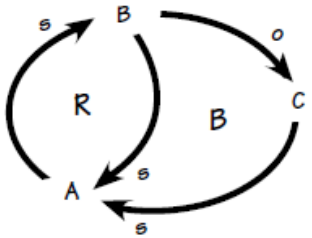
The language of links and loops

s → + → A causal link between two variables, where a change in X causes a change in Y in the same direction, or where X adds to Y.

o → − → A causal link between two variables, where a change in X causes a change in Y in the opposite direction, or where X subtracts from Y.

R A "reinforcing" feedback loop that amplifies change.

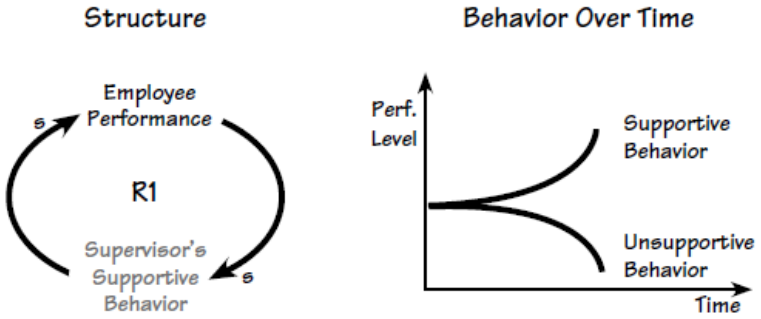
B A "balancing" feedback loop that seeks equilibrium.



Kim, D. H. (2000). Systems Thinking Tools: A Users' Reference Guide. Pegasus Communications, Inc.

Reinforcing loop: Engines of growth and decay

EMPLOYEE-SUPERVISOR REINFORCING LOOP

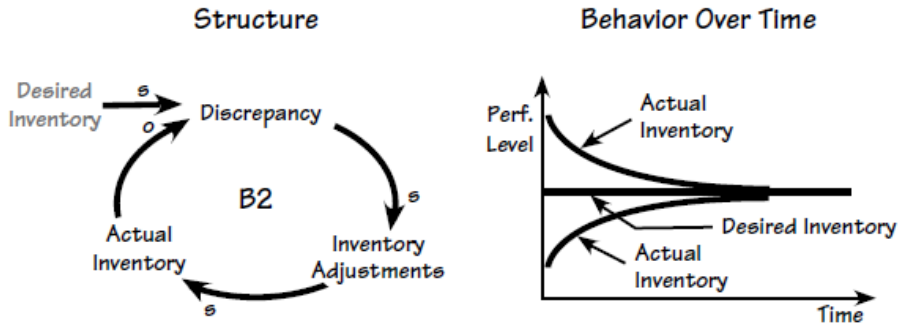


Reinforcing loops compound change in one direction with even more change. For example, encouragement can enhance an employee's performance, while critical or unsupportive behavior can lead to poor employee performance over time.

Kim, D. H. (2000). Systems Thinking Tools: A Users' Reference Guide. Pegasus Communications, Inc.

Balancing loops as goal-seeking process

INVENTORY CONTROL BALANCING LOOP

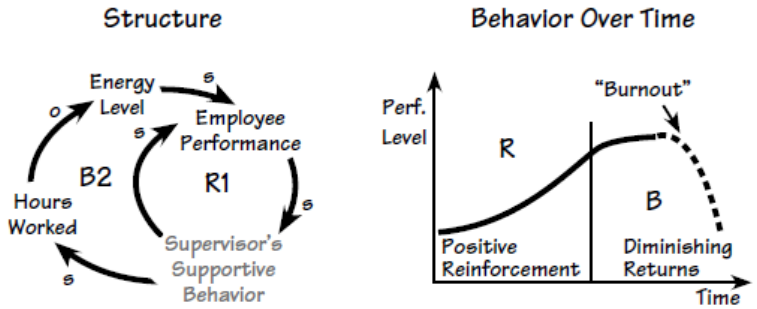


Balancing loops try to bring a system to a desired state and keep it there. In an inventory control system, the desired inventory is maintained by adjusting the actual inventory whenever there is too much or too little.

Kim, D. H. (2000). Systems Thinking Tools: A Users' Reference Guide. Pegasus Communications, Inc.

Reinforcing loop coupled with balancing loop

REINFORCING LOOP COUPLED WITH A BALANCING LOOP



Reinforcing and balancing loops can be combined to describe more complex behavior. For example, encouragement by the supervisor could lead the employee to work longer and longer hours in order to continue impressing the supervisor, eventually leading to burnout and a decrease in performance.

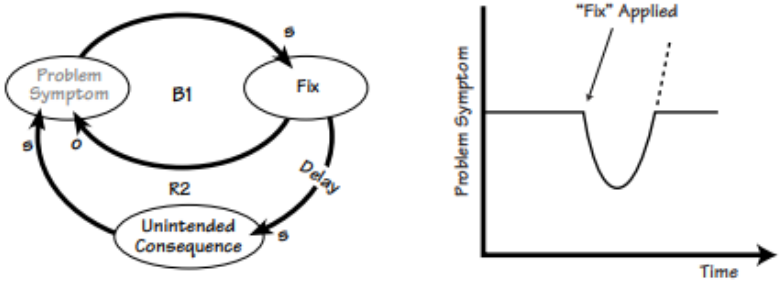
Kim, D. H. (2000). Systems Thinking Tools: A Users' Reference Guide. Pegasus Communications, Inc.

Archetypes

Fixes that fail in urban systems

To combat homelessness, a city builds new shelters. However, the shelters are located far from public transit and job centers, making it difficult for residents to find work. This dependence on the shelters perpetuates their poverty and homelessness, requiring more shelters to be built.

"FIXES THAT FAIL" TEMPLATE



In a typical "Fixes That Fail" situation, a problem symptom cries out for resolution. A solution is quickly implemented that alleviates the symptom (B1), but the unintended consequences of the "fix" exacerbate the problem (R2). Over time (right), the problem symptom returns to its previous level or becomes worse (dotted line).

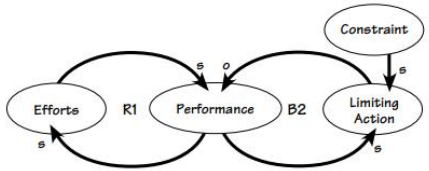
Kim, D. H. (2000). Systems Archetypes I. Pegasus Communications, Inc.

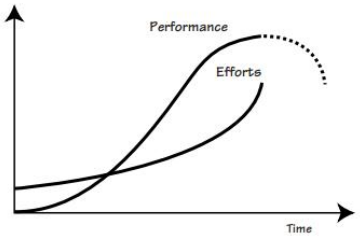
Archetypes

Limits to success in urban systems

A city's downtown area experiences a boom in new businesses and residents. However, the city fails to invest in expanding its water and sewer infrastructure at the same rate. The outdated infrastructure cannot support the growth, leading to water shortages and a halt in new construction.

"LIMITS TO SUCCESS" TEMPLATE





In a "Limits to Success" scenario, continued efforts initially lead to improved performance (R1). Over time, however, the system encounters a limit that causes the performance to slow down or even decline (B2). Once the system has hit a limit, performance begins to level off (or "crash"), even as efforts continue to rise (bottom).

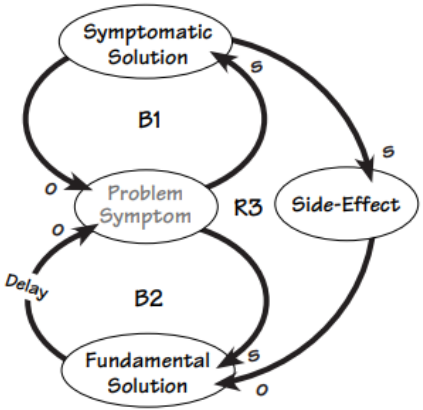
Kim, D. H. (2000). Systems Archetypes I. Pegasus Communications, Inc.

Archetypes

Shifting the burden in urban systems

To address a budget deficit, a city consistently defers maintenance on its public roads. The immediate problem is solved (the budget is balanced), but the underlying issue of structural financial inefficiency remains. Over time, the roads deteriorate to a point that requires a massive, more expensive capital project to fix.

"SHIFTING THE BURDEN" TEMPLATE



In the "Shifting the Burden" Template, a problem symptom is "solved" by applying a symptomatic solution, which diverts attention away from a more fundamental solution.

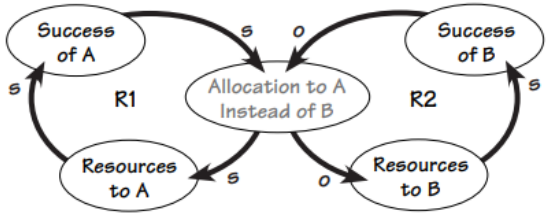
Kim, D. H. (2000). Systems Archetypes I. Pegasus Communications, Inc.

Archetypes

Success to the successful in urban systems

A city with multiple public schools allocates a greater share of its budget to the schools that have the highest test scores. These schools use the extra funding to improve their facilities and programs, which attracts more talented students and teachers, while schools with lower scores get fewer resources and fall further behind.

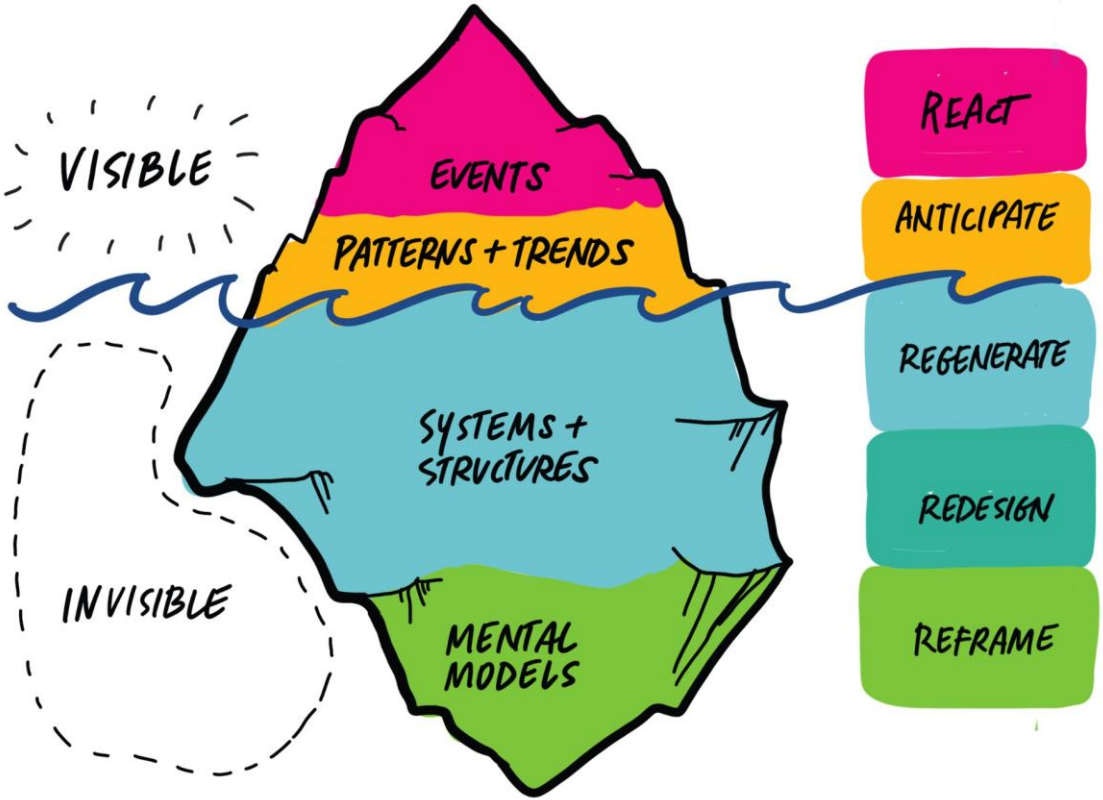
"SUCCESS TO THE SUCCESSFUL" TEMPLATE



The "Success to the Successful" archetype suggests that success may depend as much on structural forces as talent. If one person or group (A) is given more resources, it has a higher likelihood of succeeding than B (assuming they are equally capable). The initial success justifies devoting more resources to A than B (R1). As B gets fewer resources, its success diminishes, further justifying more resource allocations to A (R2).

Kim, D. H. (2000). Systems Archetypes I. Pegasus Communications, Inc.

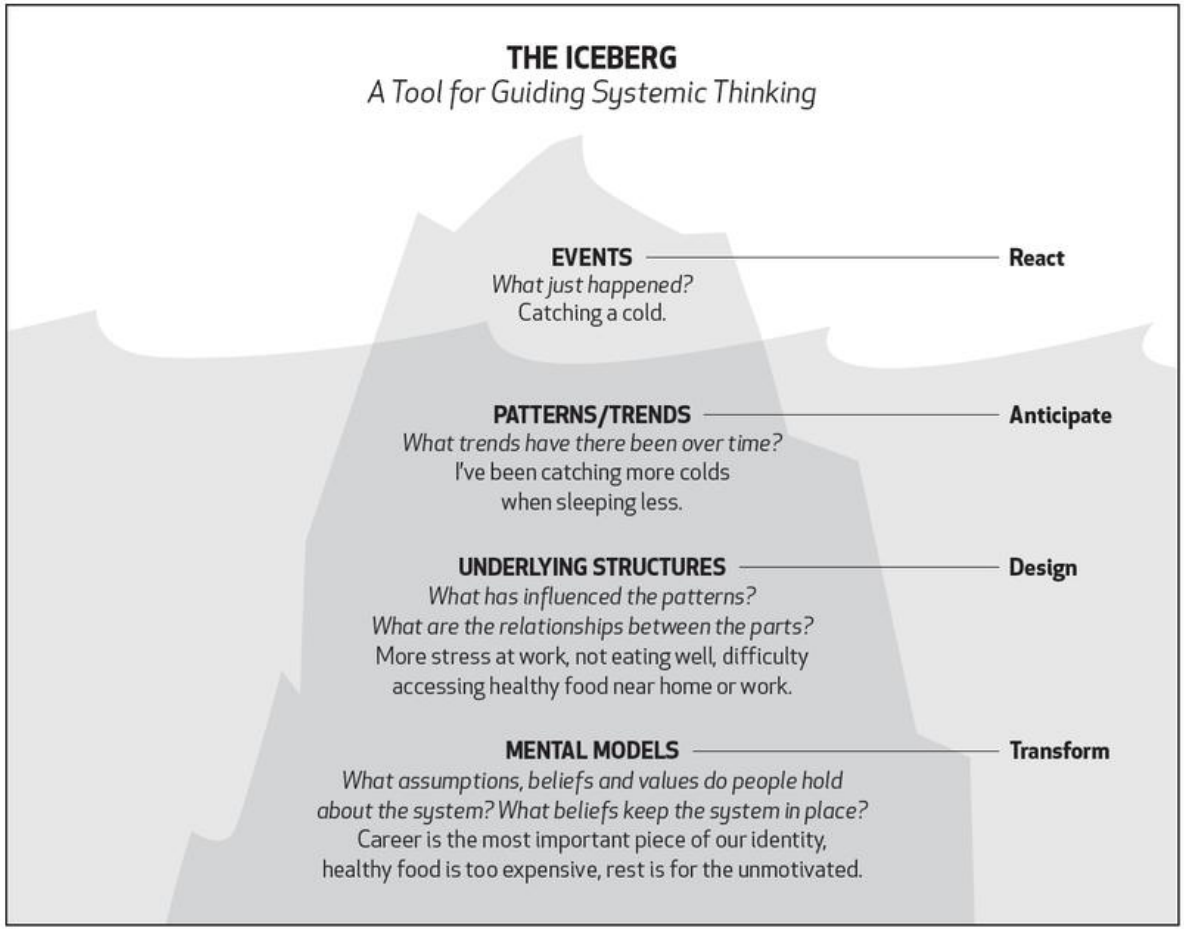
The Iceberg Model



Frameworks Collection by finegood@sfu.ca | Illustrated by sam@drawingchange.com | © CC BY-NC-ND

Hall, E. T. (1976). Beyond culture. Anchor Press.

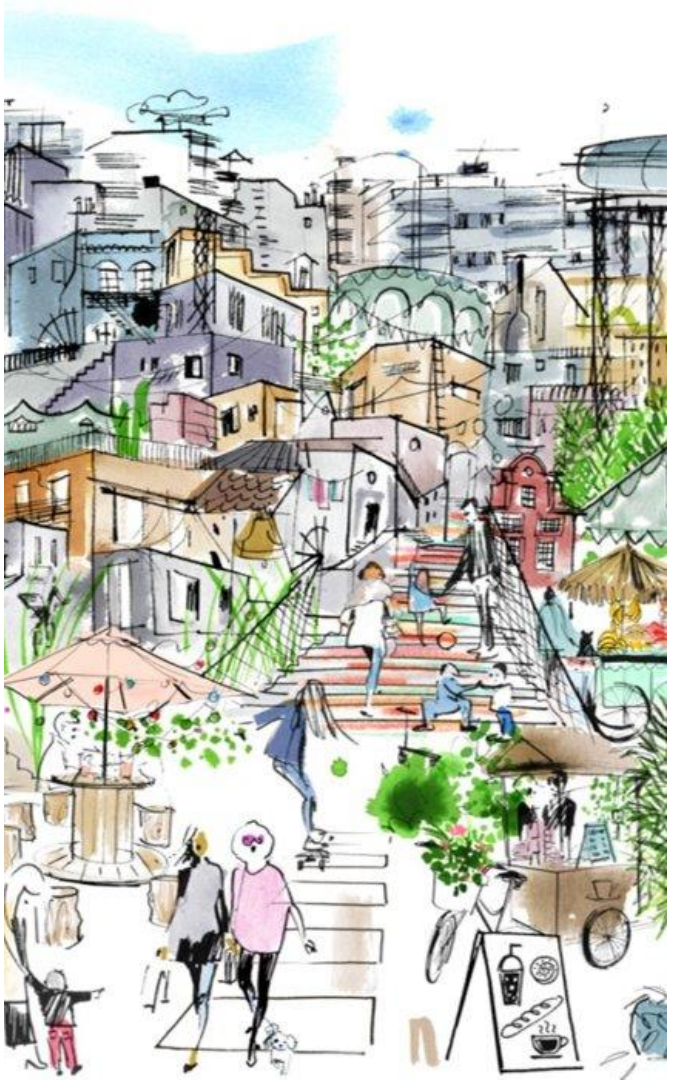
The Iceberg Model: A simple example



Northwest Earth Institute.
A systems thinking model:
The iceberg. ecochallenge.org.

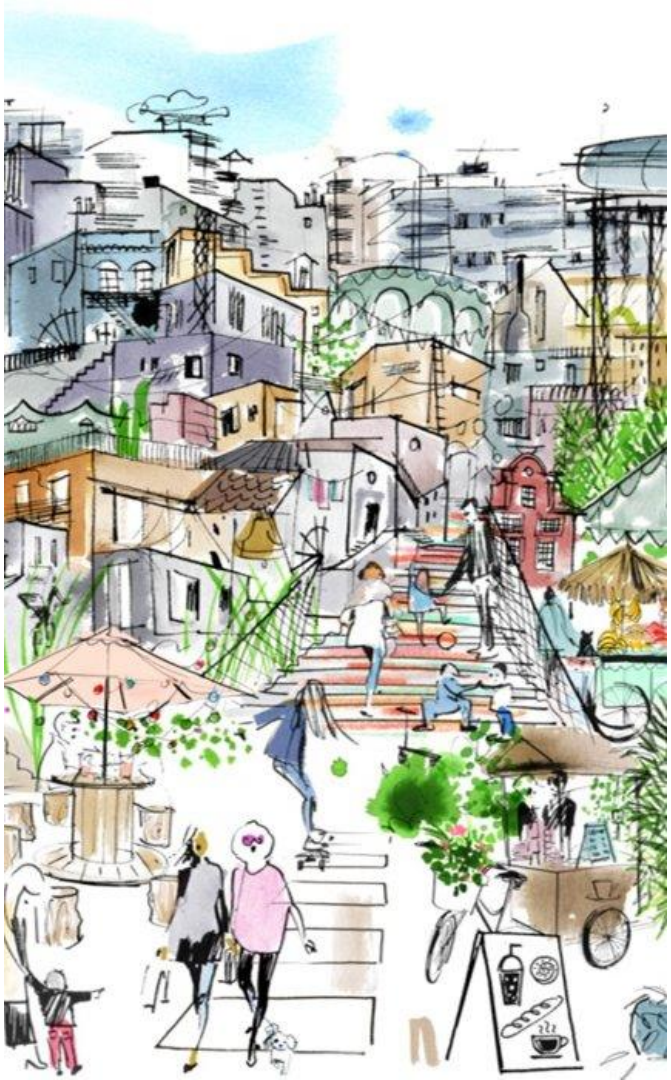
Systems thinking is important, but how do we apply it?

- Understanding the difference between simple, complicated and complex
- From linear thinking to systems thinking
- Unpacking complexity through understanding system dynamics
- Understanding the "invisible" - understanding deeper structures and mindsets



Maria Anna Hecher

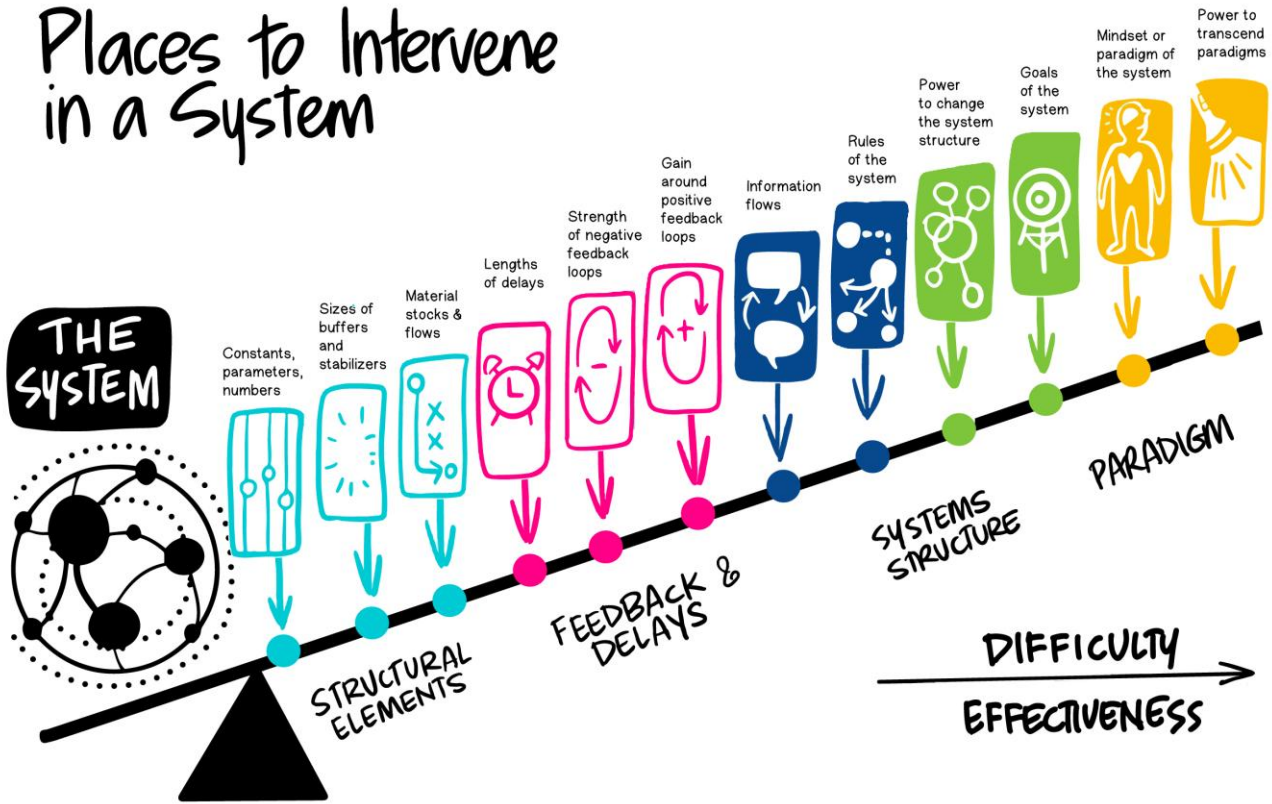
Understanding complex systems is important, but where should we intervene?



Maria Anna Hecher

If you wanted to change the world, where would you push?

Meadows, D. (1999). Leverage points: Places to intervene in a system. Hartland: The Sustainability Institute.



Adapted from Donella Meadows

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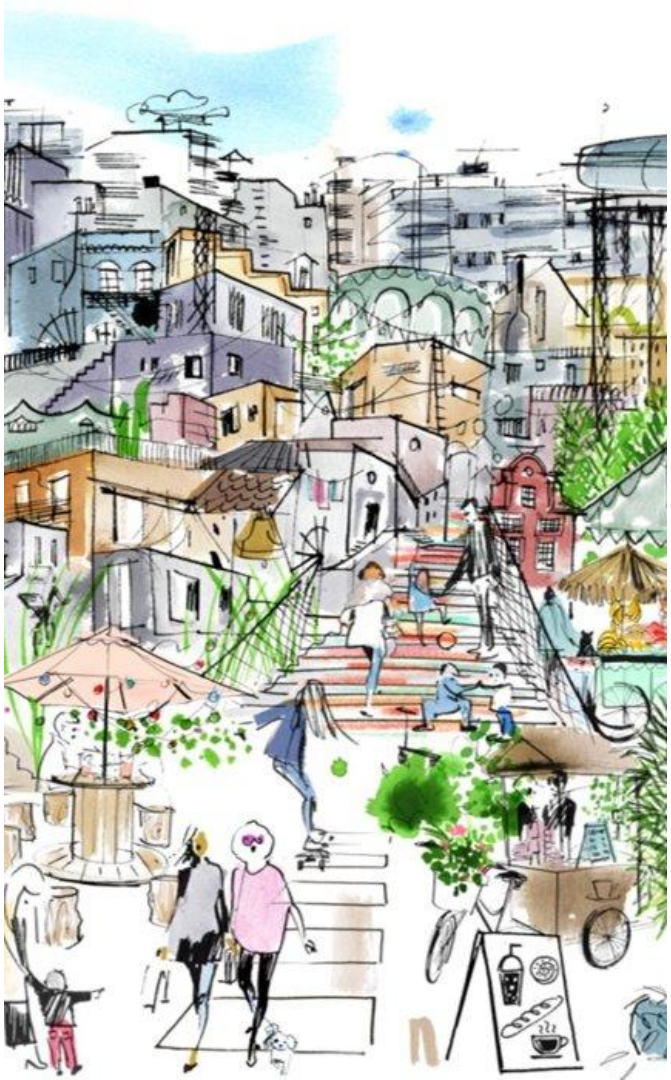
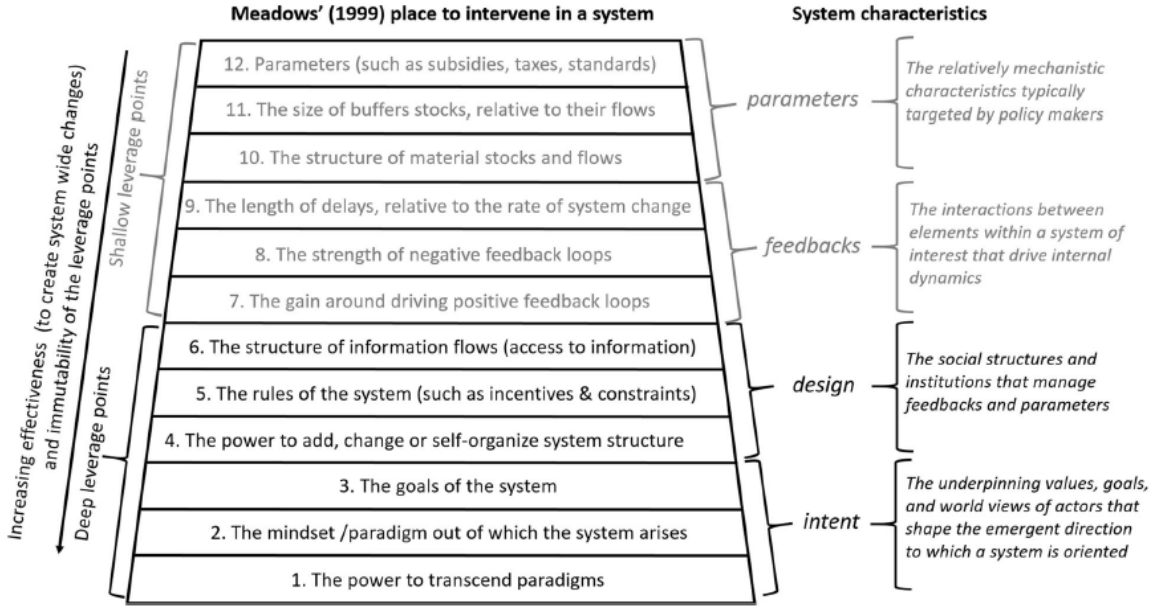
Leverage points in urban systems

Leverage Points	Urban Systems Example
12. Constants, Parameters, Numbers	Changing the speed limit on a city street from 30 mph to 25 mph.
11. The Size of Buffers	Increasing the number of police officers in a high-crime neighborhood.
10. The Structure of Material Stocks and Flows	Building more highways to relieve traffic congestion.
9. The Lengths of Delays	Shortening the time to approve a building permit.
8. The Strength of Negative Feedback Loops	Strengthening laws related to industrial pollution.
7. The Gain Around Positive Feedback Loops	Providing subsidies for electric vehicle purchases.
6. The Structure of Information Flows	Making neighborhood air quality data publicly accessible via a city app.
5. The Rules of the System	Introducing new zoning laws that require a percentage of affordable housing.
4. The Power to Self-Organize	Allowing neighborhoods to create and manage their own community gardens.
3. The Goals of the System	Changing the city's goal from "maximizing economic growth" to "improving resident well-being."
2. The Mindset or Paradigm	Shifting the mindset from urban nature as an aesthetic amenity to essential ecological infrastructure.
1. The Power to Transcend Paradigms	Moving from a "smart city" paradigm (technology as the sole solution) to a "responsive city" paradigm that empowers citizens and values adaptability.



Sustainability interventions target highly tangible, but essentially weak leverage points



Abson, D. J. et al. (2017). Leverage points for sustainability transformation. AMBIO A Journal of the Human Environment, 46, 30–39. https://doi.org/10.1007/s13280-016-0800-y

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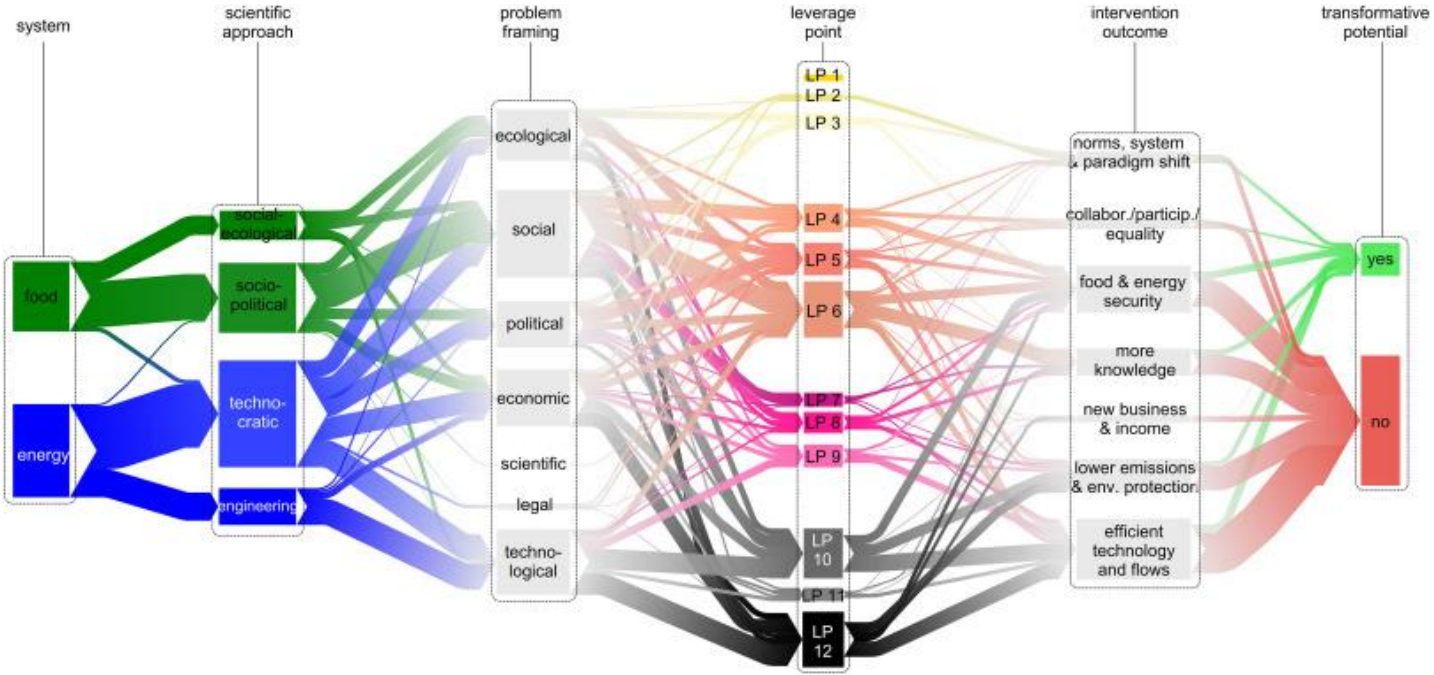
A review on interventions in food and energy systems



Dorninger et al. (2020). Leverage points for sustainability transformation: a review on interventions in food and energy systems. Ecological Economics, 171, 106570. https://doi.org/10.1016/j.ecolecon.2019.106570

Systems thinking tools

Curated collection of thinking tools

ALL | SYSTEMS THINKING | DECISION MAKING | PROBLEM SOLVING | COMMUNICATION

Iceberg Model

SYSTEMS THINKING

Uncover root causes of events by looking at hidden levels of abstractions.

Connection circles

SYSTEMS THINKING

Understand relationships and identify feedback loops within systems.

Concept map

SYSTEMS THINKING

Understand relationships between entities in a concept or system.

Balancing feedback loop

SYSTEMS THINKING

Mechanism that pushes back against a change to create stability.

Reinforcing feedback loop

SYSTEMS THINKING

Understand the force behind exponential changes.

Untools. Tools for better thinking.
https://untools.co/systems-thinking/#tools

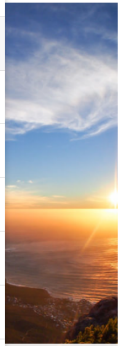
The Systems Thinker

SYSTEMS THINKER

SIGN IN SIGN UP

TOPICS SECTORS BROWSE BY SEARCH

- Archetypes
- Fundamentals
- Leadership
- Management
- Managing Conflict
- Organizational Learning
- Personal Mastery
- Public Policy
- Scenario Planning
- Strategy
- Sustainability
- System Dynamics



ughest

Articles

A Systemic View of the Israeli-Palestinian Conflict

Applying System Dynamics to Public Policy: The Legacy of Barry Richmond

Dancing with Systems

The Promise of Systems Thinking for Shifting Fundamental Dynamics

Acting and Thinking Systemically

Case Studies

Learning and Leading Through the Badlands

Operational Strategy Mapping: Learning and Executing at The Boeing Company

Minnesota Takes the Long View of Its Solid Waste System

Everyone's Problem to Solve: Systems Thinking Cross-Functionally

How-To Guides

Introduction to Systems Thinking

Fine-Tuning Your Causal Loop Diagrams—Part I

Systems Archetypes I: Diagnosing Systemic Issues and Designing Interventions

Applying Systems Archetypes

Pocket Guides

Pocket Guide: Systems Archetypes at a Glance

Pocket Guide: Guidelines for Daily Systems Thinking Practice

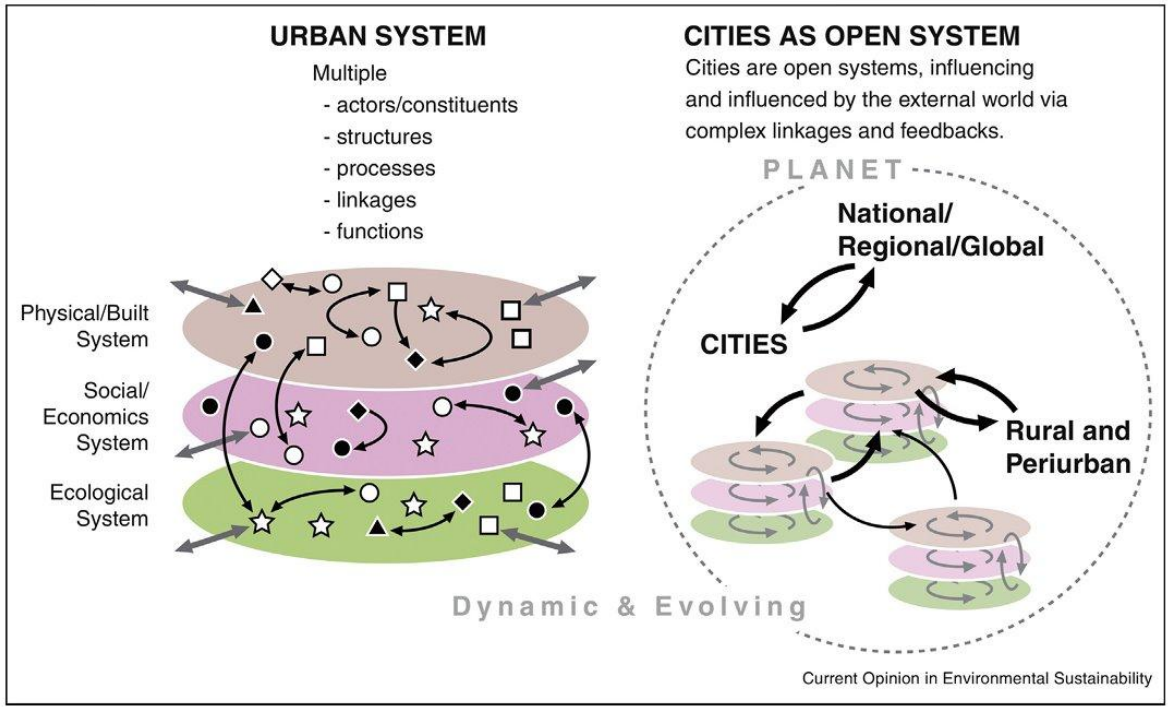
Pocket Guide: Moving from Blame to Accountability

Pocket Guide: Servant Leadership

Maria Anna Hecher

Systems approach for urban transitions

Cities are interconnected social–ecological–technological systems



Bai et al. (2016). Defining and advancing a systems approach for sustainable cities. Current Opinion in Environmental Sustainability, 23, 69–78. https://doi.org/10.1016/j.cosust.2016.11.010

Principles for applying a systems approach in urban practice

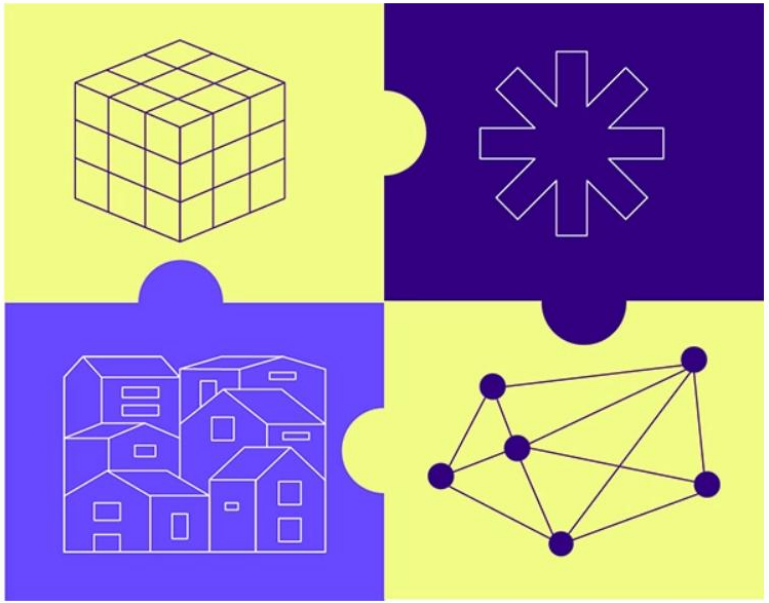
	A systems approach
Context	Begins with a sound understanding of the genesis and dynamics of the current system.
Vision	Should allow for the exploration of plausible and desirable visions of possible futures by a variety of stakeholders.
Goals	Should have a clear set of goals and priorities to avoid being overwhelmed by complexity or analysis paralysis.
Actors	Must engage a wide cross-section of urban decision-making agents and stakeholders.
Diversity & interdependencies	Should acknowledge that urban system functions derive from a diversity of constituents and address the systemic causes of inequity.
Flexibility & adaptability	Allows to derive solutions not fixed in time or space flexible to account for new challenges.

Bai et al. (2016). Defining and advancing a systems approach for sustainable cities. Current Opinion in Environmental Sustainability, 23, 69–78. https://doi.org/10.1016/j.cosust.2016.11.010

Maria Anna Hecher

Urban planning needs systems thinking

Four lessons from 15 cities in Eastern Europe and Central Asia on addressing interconnected civic challenges



1. Understanding root causes through community engagement

2. Building adaptive systems: Start small, learn fast

3. Transforming government roles: From regulator to facilitator

4. Smart investment: Spreading risk, building momentum

Key takeaways

- Systems thinking is crucial to tackle real-world complex problems.
- A system is composed of interconnected elements that interact to perform specific functions within a defined boundary serving a purpose.
- Sustainability science is a normative field of research with the purpose to provide solutions for sustainable development and therefore must be inter- and transdisciplinary.
- Systems thinking concepts and tools support us to unpack complexity and to identify the most effective interventions.
- Cities are interconnected social-ecological-technical systems and urban planning needs systems thinking.

Guest lecture: Dr. Anna Pagani

Leverage points in the housing system

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