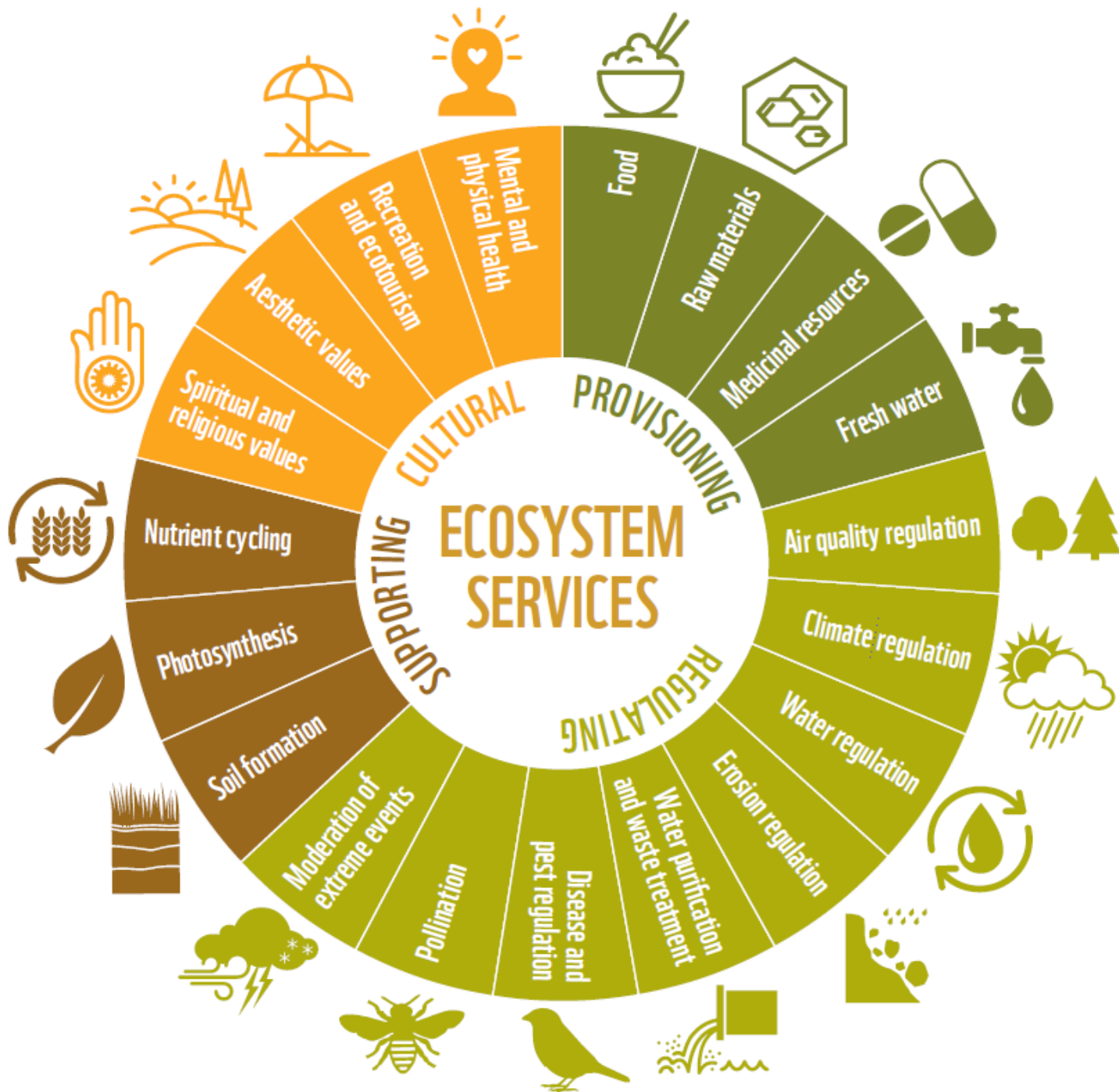


Environmental services and system approach

Environmental services

- Environmental services, or ecosystem services, refer to the benefits that humans derive from natural ecosystems.



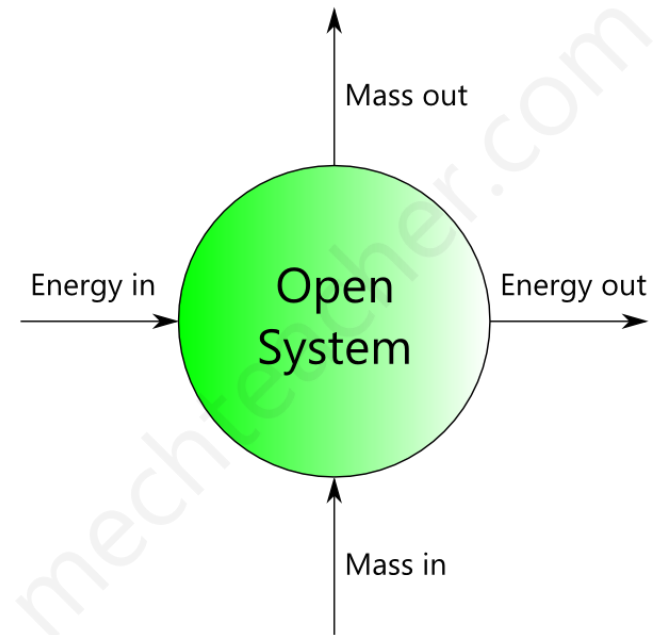


Systems theory

- An interdisciplinary and holistic framework for understanding complex systems in nature, society, and science.
- Explores how groups of components interact and function together to achieve specific goals.
- Provides a structured approach to analyzing inputs, outputs, and dynamic changes within systems under varying conditions.

Systems theory

- A system is a cohesive assembly of interrelated and interdependent parts, which can be natural or man-made.
- Defined by spatial and temporal boundaries, separating it from its environment.
- Matter and energy are exchanged between the system's components and the environment.
- A reservoir is where material is stored.
- The difference between inputs and outputs is called net flux.



Systems dynamics

- A system is in steady state when the net flux equals zero, meaning inputs and outputs are balanced.
- Resilience refers to a system's ability to maintain or return to steady state after disturbances.
- A tipping point is the threshold beyond which a system cannot revert to its original steady state.
- System types include natural or man-made systems, which can be either open (exchanging matter and energy with surroundings) or closed (only exchanging energy).
- Earth?

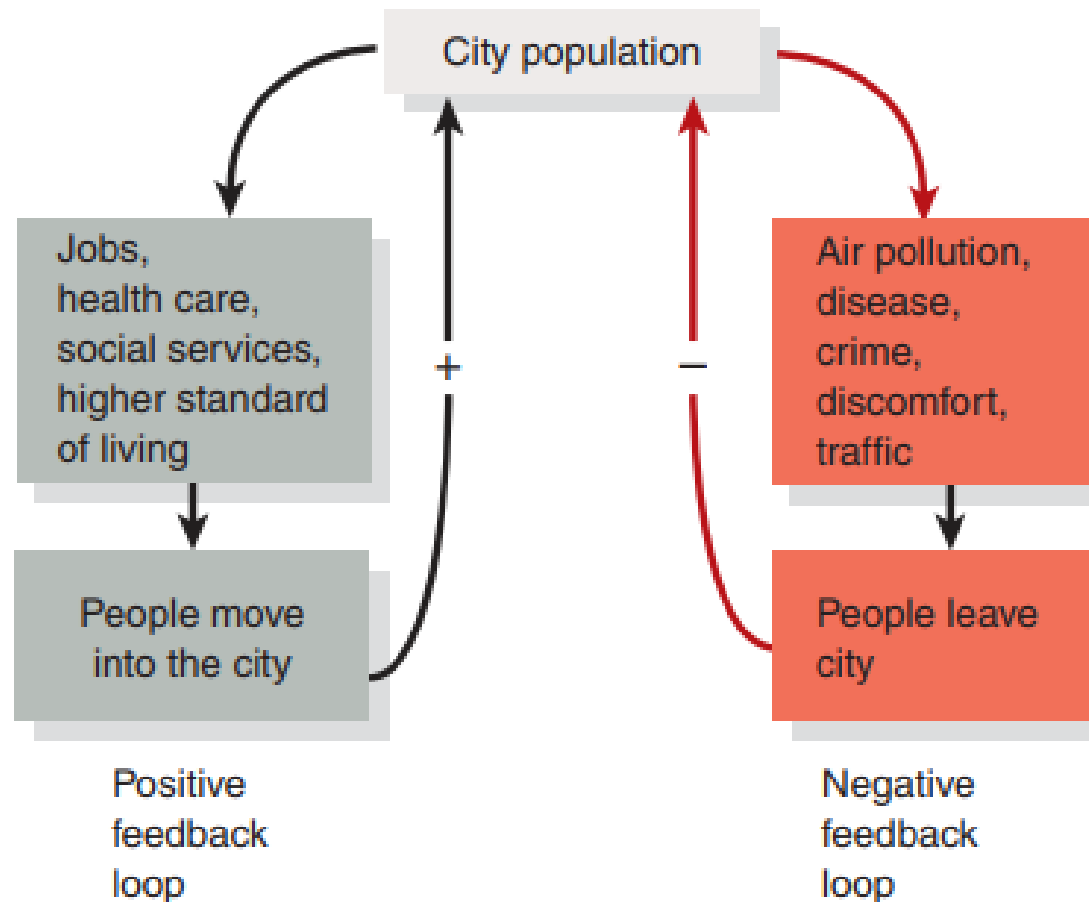
Interdependence in Systems theory

- Interdependence refers to the mutual reliance between different components of a system.
 - Changes in one part of the system affect the others.
 - Systems are maintained through a network of interactions.
 - Ex: Plants rely on pollinators for reproduction, while pollinators depend on plants for food.
 - A decline in pollinator populations can lead to reduced plant reproduction, affecting entire ecosystems and food supplies.
- = The survival and flourishing of both pollinators and plants are mutually dependent on each other.

Feedbacks in Systems theory

- Systems gravitate toward dynamic equilibrium, occasionally disrupted by natural or human disturbances → evolves over time.
- Feedback: Adjustments due to system changes.
- Positive: Amplifies change.
- Negative: Resists or slows change.

Human population in large cities



Feedback loops in climate science

Positive Feedback

- Warming increases atmospheric water vapor, trapping more heat.
- Thawing permafrost and methane hydrates in the Arctic release more carbon.
- Forest fires and desertification reduce rainforests.
- Melting ice and snow decrease albedo, increasing sunlight absorption.

Negative Feedback

- More water vapor forms clouds that reflect sunlight.
- Enhanced vegetation boosts photosynthesis and carbon uptake.

Emergences in Systems theory

- Emergence refers to new, complex behaviors or properties that arise from the interactions of components in a system.
- These properties are not found in individual parts but only in the system as a whole.
- Air purification emerges from the interaction of plants absorbing carbon dioxide and releasing oxygen, microbial decomposition of organic matter, and complex interactions between soil, water, and the atmosphere.

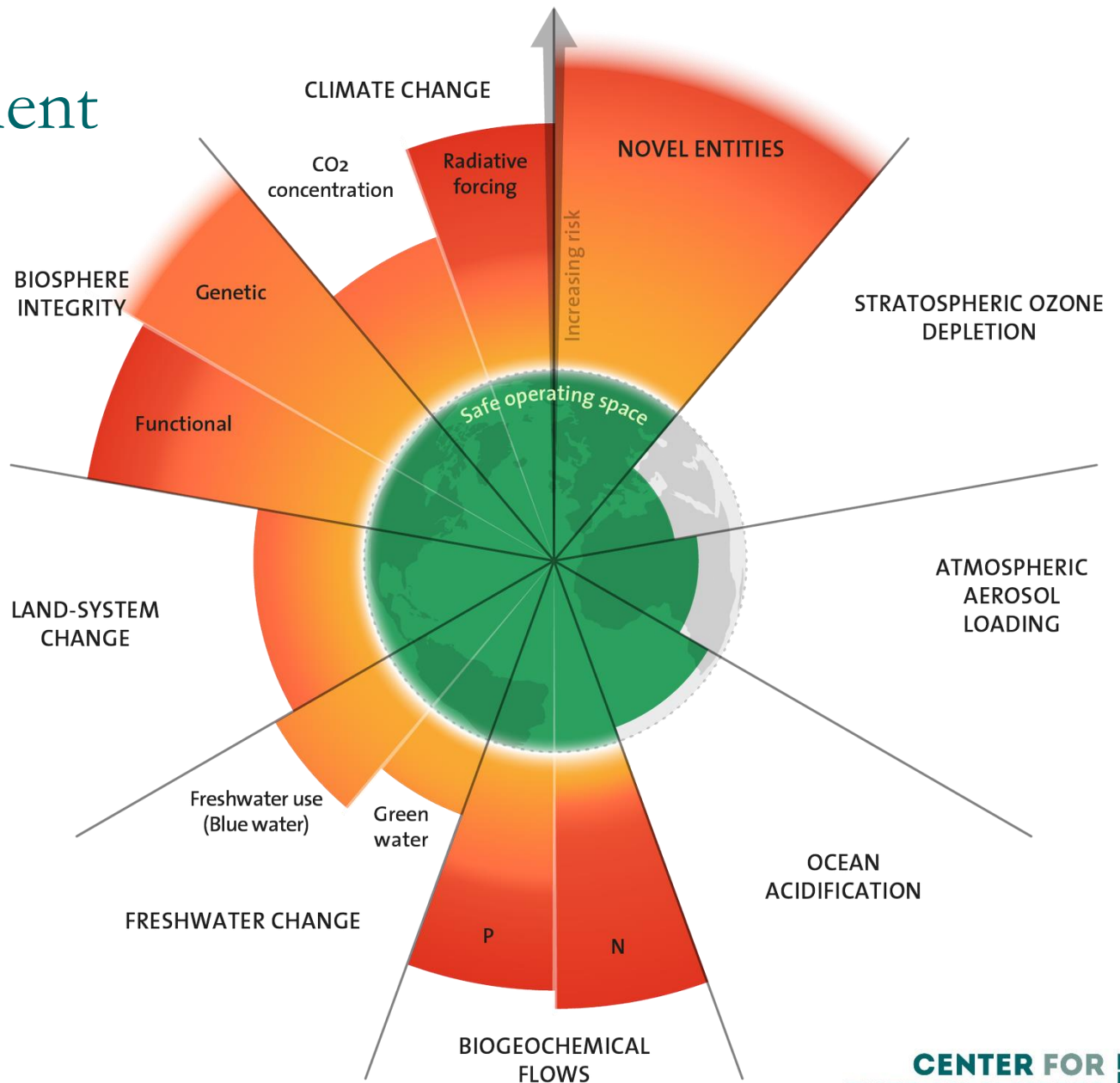
Systems theory, environment, and environmental services

- Ecosystems as complex systems; environmental services emerge from interactions within ecosystems.
- Components of ecosystems are interdependent, and disruptions can reduce the flow of services.
- Positive or negative feedback can enhance or degrade environmental services.
- Ecosystem resilience ensures the continued provision of services despite disturbances.

= Too much pressure on environmental services can lead to system collapse.

= The environment is not only of sentimental and moral but also of pragmatic importance.

Environment



Hologene as a reference state



Source: Česká
televize